HOMELAND SECURITY
EMERGENCY MANAGEMENT
NEW HAMPSHIRE DEPARTMENT OF SAFETY

New Hampshire
State Hazard Mitigation Plan
2023 Update

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i. ADMINISTRATIVE HANDLING INSTRUCTIONS

The following State of New Hampshire Hazard Mitigation Plan is an Unclassified compilation of open source and publicly available information on the threats and hazards that have the potential to impact the State of New Hampshire, information relating to disasters and emergencies that the State has experienced, and a strategy for reducing or eliminating the long-term risks posed by the threats and hazards. This document is authorized for public release.

For questions or additional information, please contact New Hampshire Homeland Security and Emergency Management at 603-271-2231 or by email at NH.HM@dos.nh.gov.

HOMELAND SECURITY
EMERGENCY MANAGEMENT
NEW HAMPSHIRE DEPARTMENT OF SAFETY

ii. Certificate of Adoption

A Resolution Adopting the New Hampshire State Hazard Mitigation Plan 2023 Update

WHEREAS, the State of New Hampshire has historically experienced damages from hazard events and continues to be vulnerable to natural hazards profiled in this Plan, which could result in the loss of life, damage to property and the environment, economic hardship, and threats to public health and safety; and

WHEREAS, the State of New Hampshire has developed and received approval pending adoption from the Federal Emergency Management Agency ("FEMA") for the New Hampshire State Hazard Mitigation Plan 2023 ("Plan") under the requirements of 44 CFR 201.4; and

WHEREAS, meetings were held between February 2021 and March 2023, including the solicitation of stakeholder input, regarding the development, maintenance, and review of the Plan; and

WHEREAS, a Hazard Identification and Risk Assessment ("HIRA"), as well as a capability assessment, have been conducted to review the potential threats and hazards and their impacts to the State; and

WHEREAS, the Plan specifically addresses hazard mitigation strategies, as well as Plan implementation and maintenance procedures for the State of New Hampshire. The Plan recommends several hazard mitigation actions/projects that will provide mitigation for hazards identified in the HIRA in order to protect people, property, and the environment from loss associated with those hazards; and

WHEREAS, adoption of this Plan will make the State of New Hampshire eligible for funding to alleviate the impacts of future hazards;

NOW, THEREFORE, I, CHRISTOPHER T. SUNUNU, GOVERNOR OF THE STATE OF NEW HAMPSHIRE, do hereby declare the adoption of the New Hampshire State Hazard Mitigation Plan 2023 as developed by the New Hampshire Department of Safety, Division of Homeland Security and Emergency Management.

IT IS HEREBY ORDERED, the respective agencies and officials identified within the Plan are directed to pursue the actions assigned to them to protect lives, property, the environment, limit economic impact, and lessen the likelihood and/or impacts of the hazards identified within the Plan. An annual consultation between the State of New Hampshire and FEMA will occur in accordance with Federal Requirements.

ADOPTED and SIGNED this 25th day of Sep 2023.

Christopher T. Sununu

Christopher T. Sununu, Governor
State of New Hampshire

Robert L. Quinn, Commissioner
NH Department of Safety

Robert M. Buxton, Director
NH Division of Homeland Security and Emergency Management

iii. Record of Changes

Submit comments and recommendations regarding the 2023 NH State Hazard Mitigation Plan to NH HSEM via email at HSEMplanning@dos.nh.gov .

Description of Change	FEMA Approval Date	Changes Completed by
Original Natural Hazards Mitigation Plan	October 1999	Shaunussey
Multi-Hazard Update per DMA 2000	October 22, 2004	M. Poirier / R. Verville
3 Year Update	October 19, 2007	M. Poirier / R. Verville
3 Year Update	November 1, 2010	M. Poirier / R. Verville / L. Harbour
3 Year Update	October 29, 2013	Cheney / B. Peck / P. Moore
5 Year Update (New 2018 FEMA Requirements)	September 2018	W. Welch / V. Urango / K. Henderson
5 Year Update (New 2023 FEMA Requirements)	September 2023	P. Crooker/ M. Hoskins

iv. Record of Distribution/Availability

The adopted NH State Hazard Mitigation Plans are available online in the NH HSEM Resource Center. The direct link to the NH State Mitigation Plan page in the Resource Center is https://prd.blogs.nh.gov/dos/hsem/?page_id=1506.

Plan Title	Distribution	Availability
1999 Natural Hazards Mitigation Plan	Hard Copies	Not on File
2004 Multi-Hazard Mitigation Plan	Hard Copies	On File at NH HSEM
2007 Multi-Hazard Mitigation Plan	Hard Copies	On File at NH HSEM
2010 State Multi-Hazard Mitigation Plan	Hard Copies / Online	On File at NH HSEM
2013 State of NH Multi-Hazard Mitigation Plan	Hard Copies / Online	On File at NH HSEM
2018 State of NH Hazard Mitigation Plan	Hard Copies / Online	Online/ On File at NH HSEM
2023 NH State Hazard Mitigation Plan Update	Hard Copies / Online	Online Link/On File at NH HSEM

v. ACKNOWLEDGEMENTS

The development of the 2023 New Hampshire State Hazard Mitigation Plan (2023 NH SHMP) was conducted and led by the NH HSEM Internal SHMP Working Group (Internal SHMP Working Group). The SHMP Working Group consists of the following HSEM staff:

- Robert Buxton, Director
- Megan Hoskins, Assistant Director
- Austin Brown, Chief of Mitigation and Recovery
- Deborah Yeager, Chief of Community Services
- Natasha Cole, Assistant Chief of Hazard Mitigation/State Hazard Mitigation Officer (fmr)
- Virginia Clasby, Assistant Chief of Hazard Mitigation/State Hazard Mitigation Officer
- Neil Cantin, Assistant Chief of Community Services
- Patty Crooker, Emergency Management Planning Specialist
- Rachel Armbricht, Online Training Specialist, Community Services Section
- Sheila Dupere, EMPG Coordinator, Finance Section
- Lynne Doyle, Hazard Mitigation Planner, Mitigation Section
- Lauren Morgan, Hazard Mitigation Coordinator, Mitigation Section

Special appreciation is extended to the many individuals from federal, state, and local levels of government, as well as those from our non-governmental partner organizations, who participated in this update by contributing their valuable time, energy, and subject matter expertise. Your dedication, guidance, and assistance resulted in a comprehensive, all-hazards focused state mitigation plan that will be used to inform and provide direction for other state, regional, and local emergency planning, and mitigation efforts over the coming years. Individuals and organizations participating in the 2023 NH SHMP process are listed within the Planning Methodology Section of this Plan.

Special appreciation to Assistant Commissioner of the NH Department of Environmental Services Mark Sanborn for his guidance and support.

vi. EXECUTIVE SUMMARY

Hazard Mitigation is defined as reducing the loss of life and property during a disaster situation. Millions of dollars are spent nationwide to assist in the recovery as a result of repeat disasters. In an effort to prevent future loss from repeat disaster, states are allocated funding for mitigation projects through Federal Grants. The 2023 NH SHMP seeks to identify hazards that impact communities, across the state, to help reduce recovery costs, loss of infrastructure, and most importantly, loss of life.

The 2023 NH SHMP is an update. This Plan is an update of the 2017 previous plans and follows the planning requirements as found in *FEMA's State Mitigation Planning Policy Guide (FP 302-094-2)*[1] and pursuant to 44 CFR 201.4. Standard State Hazard Mitigation Plans must contain the following information:

- Description of the Planning Process
- Hazard Identification and Risk Assessment
- State Mitigation Capabilities
- Mitigation Strategy
- Local Planning Coordination and Capability Building
- Review, Evaluation, and Implementation
- Adoption and Assurances

The purpose of this Plan is to reduce or eliminate the long-term risk to human life and property from the hazards identified within the Hazard Identification and Risk Assessment (HIRA) before, during, and after an incident or disaster. The Plan was developed by The New Hampshire Department of Safety (DOS) Division of Homeland Security and Emergency Management (NH HSEM) Planning Section with assistance from federal, other State, and local agencies, input from Regional Planning Commissions (RPCs), private and non-governmental entities, as well as the public. New Hampshire HSEM is the lead agency for the hazard mitigation program in the State. The 2023 NH SHMP is the foundation and the key element for the State's comprehensive hazard mitigation program.

In 1953, New Hampshire experienced a forest fire which resulted in its first disaster declaration, DR-11. Since then, New Hampshire has received 52 major disaster declarations, including Presidential Declarations (DR), Emergency Declarations (EM), and Fire Management Declarations (FM).

In the 2023 SHMP, three new areas of focus were introduced: inclusive planning for equitable outcomes, the impacts of climate change, and community lifelines. While these topics are not new, this is the first time that the New Hampshire State Hazard Mitigation Plan addresses them in depth, not only relative to each hazard, but also by incorporating them throughout the Plan into over-arching goals and mitigation actions. The inclusion of this information will emphasize New Hampshire's commitment to Whole Community planning, establish a good foundation in these new areas, provide a framework for individual communities to incorporate this information into their own hazard mitigation plans and keep the focus on life-safety.

The New Hampshire State Hazard Mitigation Planning Committee developed six overarching goals to help align the plan with new focuses on equity and the impacts of climate change.

1. Minimize loss and disruption of human life, property, the environment, and the economy due to natural hazards through a coordinated and collaborative effort between federal, State, and local authorities to implement appropriate and cost-effective hazard mitigation measures.
2. Enhance protection of the general population, citizens, and guests of the State of New Hampshire 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 State.
3. Promote comprehensive hazard mitigation planning at the state and local levels to encourage data integration, alignment of plans, and identification of funding and other resources.
4. Identify how climate change impacts natural hazards, as well as mitigation strategies.
5. Strengthen Continuity of Operations and Continuity of Government across the State and local levels to ensure continuation of essential services through training, outreach, and education.
6. Promote equity by challenging state agencies and municipalities to incorporate Whole Community concepts during the planning and execution of mitigation projects, encouraging the identification and inclusion of vulnerable populations in the planning process.

For 2023, the State Hazard Mitigation Plan focused on the Natural Hazards that impact the state. Past iterations of this plan have taken an All-Hazards approach, which sought to encompass human and technological hazards. An All-Hazards approach is an efficient method for planning, but for this to be a true Hazard Mitigation plan, the state needed to center its approach on hazards that can truly be prevented by identification of risk and areas prone to hazard.

2023 New Hampshire SHMP Natural Hazards		
Avalanche	Extreme Temperatures	Lightning
Coastal Flooding	High Wind Events	Severe Winter Weather
Dam Failure	Infectious Disease	Solar Storms & Space Weather
Drought	Inland Flooding	Tropical/Post Tropical Cyclones
Earthquake	Landslides	Wildfire

ENDNOTES – EXECUTIVE SUMMARY

[1] https://www.fema.gov/sites/default/files/documents/fema_state-mitigation-planning-policy-guide_042022.pdf

1. INTRODUCTION

The 2023 New Hampshire State Hazard Mitigation Plan (SHMP) was developed by the New Hampshire Department of Safety (DOS), Division of Homeland Security and Emergency Management (HSEM) to establish a comprehensive plan to prevent the loss of life and property and reduce damage to the natural environment. Once we identified the natural hazards that pose the most risk to our State, we developed mitigation strategies and carried out activities intended to lessen the risk associated with these events and protect our most vulnerable people, communities, and facilities. Hazard Mitigation plans are the key to breaking the cycle of disaster damage, reconstruction, and repeated damage.

Developing a hazard mitigation plan allows for the following:

- Increased education and awareness around threats, hazards, and vulnerabilities.
- Building partnerships for risk reduction which include government, organizations, businesses, and the public.
- Identify long-term, broadly supported strategies for risk reduction.
- Develop state mitigation efforts that support local mitigation efforts.
- Identify strategies and activities that focus resources on the greatest risks and vulnerabilities; and,
- Communicate priorities to potential sources of funding.

A FEMA-approved hazard mitigation plan is a requirement for receiving certain types of non-emergency disaster assistance including funding for mitigation projects including:

- Public Assistance (Categories C-G)
- Fire Management Assistance Grants (FMAG)
- Hazard Mitigation Grant Program (HMGP)
- Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)
- High Hazard Potential Dam (HHPD)
- Building Resilient Infrastructure & Communities (BRIC)

1.1 THREATS AND HAZARDS TO NEW HAMPSHIRE

Natural hazards are defined by FEMA as environmental phenomena that have the potential to impact societies and the human environment.

A hazard is a source of risk in a harmless state (such as a river) and the threat is an event or condition with the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, environmental damage, business interruption, or other losses (such as when the river floods).

Hazards are classified as follows:

Natural Hazard – These events are emergencies caused by forces extraneous to man in elements of the natural environment. (e.g., earthquake, flood, hazardous weather, public health emergency).

Technological Hazard – These incidents involve materials created by man and that pose a unique hazard to the public and environment. The jurisdiction needs to consider incidents that are caused by accident (e.g., mechanical failure, human mistake), that are the result of another hazard, and that are the result of an intentional act (e.g., infrastructure destruction, utility disruption, radiological, or hazardous material release).

Human-Caused Hazard – These are disasters created by man, either intentionally or unintentionally (e.g., criminal/violent behavior, intruder, civil unrest, active shooter, terrorism).

In the 2023 SHMP, human-caused and technological hazards have been moved to an annex so that we can maintain information on the hazards traditionally classified as threats, recognizing the difference between preparedness activities and mitigation activities. Mitigation activities are long-term strategies that can be used to prevent further occurrences of loss of life and property. Communities identify areas that suffer from repeated effects of natural hazards and develop mitigation strategies to prevent further occurrences. All communities in NH are susceptible to technological and human-caused hazards at any time, and therefore, a mitigation strategy is ineffective. Rather, communities prepare for technological and human-caused hazards through training and exercise, as well as, the creation of Hazard Annexes in Local Emergency Operations Plans, the State's Threat Hazard Identification and Risk Analysis, and the Integrated Preparedness Plan (IPP).

Evaluating technological and human-caused hazards are not a requirement for State or local Hazard Mitigation Plans; however, information on these hazards can be extremely helpful to state and local agencies. New Hampshire is committed to maintaining these elements of the plan as a resource for communities and will retain information on these threats to provide statewide threat information with those who desire to use it to inform preparedness activities.

1.2 WHAT IS HAZARD MITIGATION?

Hazard mitigation is defined as "any sustained action taken to reduce or eliminate the long-term risk to human life and property from hazards." (44 Code of Federal Regulations (CFR) § 201.2 Definitions)

Mitigation planning enables state, local and tribal governments to identify natural hazards affecting them, identify actions and activities to lessen the impact and/or reduce losses from those hazards, and establish a coordinated process to implement the plan using a wide range of resources. (44 CFR § 201.1(b) Purpose)

To better understand the SHMP, it is important to understand what hazard mitigation is. Hazard mitigation is defined as the effort to reduce loss of life and property by lessening the impacts of disasters. This involves actions or projects which reduce or eliminate long-term risk to hazards. Hazard mitigation aims to make communities safer and more resilient.

Examples of hazard mitigation actions and projects include, but are not limited to:

- Acquisition or relocation of flood prone properties
- Erosion control
- Flood risk reduction
- Generators
- Hazard mitigation planning
- Structural retrofitting
- Controlled burns to prevent wildfires.

1.3 Background and Authority

The 2023 New Hampshire State Hazard Mitigation Plan builds upon the previous versions of New Hampshire's Mitigation Plans dating back to 1999. The first SHMP was based upon a hazard assessment following the July 1998 disaster declaration for severe storms and flooding (DR-1231). This assessment, conducted by NH HSEM (then the Office of Emergency Management) and the Federal Emergency Management Agency (FEMA) Region I Mitigation Staff, determined that there was not a viable plan in place that would satisfy the requirements of Section 409 of the Robert T. Stafford Disaster Relief Act (Stafford Act). At the time, Section 409 required that states maintain and update a mitigation plan following a major presidentially declared disaster. The first NH SHMP was developed, presented to FEMA on April 1, 1999, and approved in October of 1999.

On April 19, 2022, FEMA released updated guidance in the *State Mitigation Planning Policy Guide* (*The Guide*) which becomes effective on April 19, 2023. *The Guide* provides FEMA's official policies on and interpretation of state hazard mitigation planning requirements and regulations. It is also a tool for consistent evaluation and approval of state hazard mitigation plans. For state planning teams, *The Guide* provides clear information on the regulatory and policy requirements for SHMP approval, as well as information on how FEMA will be evaluating and approving plans.

Authority for the development of this Plan by New Hampshire Homeland Security and Emergency Management (NH HSEM) is contained in the New Hampshire Revised Statutes Annotated (RSA), Chapter 21-P Section 37.

It is NH HSEM's goal to have all incorporated communities within the State obtain and maintain a FEMA-approved local hazard mitigation plan to reduce future losses from hazard events. State and local hazard mitigation planning guidance references requirements for only natural hazards to be assessed; however, NH HSEM recognizes the importance of incorporating all-hazards into this document so that it may work in cooperation with the State Emergency Operations Plan

(SEOP), the State Recovery Annex, as well as, other State, county, and local emergency plans.

1.4 PURPOSE

The purpose of the NH State Hazard Mitigation Plan is to identify the natural hazards that occur in NH, assess the impact of those hazards on the state and its residents, and determine, through risk-informed decision making, strategies and activities that will reduce the long-term risk the hazards pose to life and property.

The SHMP ensures compliance with federal regulations, as outlined in the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act), and Title 44 Code of Federal Regulations (CFR) Part 201 Mitigation Planning.

The SHMP details how the State will address planning for future hazards and to reduce the impact of future hazards that can't be eliminated.

The SHMP identifies, analyzes, and assesses the risk of the hazards that affect the State of New Hampshire; therefore, the Plan has been incorporated, as an annex to, the State of New Hampshire Emergency Operations Plan (SEOP) and will continue to be an annex with each update.

1.5 SCOPE AND JURISDICTION

This 2023 Plan addresses the entire State of New Hampshire. The concept of a State Hazard Mitigation Plan is undeniably broad. This plan will address the entire State by first reviewing threats and hazard risk at the State level and then identifying which counties are most vulnerable to the hazards (for example, while the State may be impacted by coastal flooding, only coastal communities would experience this hazard; conversely, some of the more mountainous regions of the State may experience avalanches, whereas the flatter coastal communities would not be susceptible to avalanches.)

1.6 ASSURANCES

The State of New Hampshire, Department of Safety, Division of Homeland Security and Emergency Management assures that the State will comply with all applicable Federal Statutes and regulations at all times during which it receives grant funding. Pursuant to 44 CFR §13.11(c), NH HSEM will amend this plan whenever necessary to reflect changes in State or Federal Laws and Statutes. NH HSEM will also ensure the provisions of 2 CFR §200 and its subsections are appropriately followed. The State Hazard Mitigation Officer (SHMO) will be responsible for ensuring grant compliance with FEMA and leading the review and update of the State Hazard Mitigation Plan.

1.7 IMPLEMENTATION AND MAINTENANCE

Pursuant to 44 CFR §13.11(c), the State of New Hampshire complies with, and will continue to comply with, all applicable federal statutes and regulations in effect with respect to the periods for which it receives grant funding, including 2 CFR parts 200 and 3002.

Upon the adoption of the 2023 NH SHMP and continuing throughout its implementation, NH HSEM will maintain a record of actions taken (to include actions identified in the plan as well as other actions accomplishing the same mitigation results) toward achieving the goals and strategies outlined in the Plan. HSEM will also maintain a record of improvements and revisions to the 2023 SHMP this plan that are identified during implementation. This information will be reviewed by the SHMPC and other stakeholders for inclusion in the 2028 NH SHMP Update.

Further details regarding the maintenance and implementation of the 2023 NH SHMP can be found in ***Section 11: Plan Implementation and Maintenance*** of this Plan.

ENDNOTES – INTRODUCTION

[1] National Risk Index, Natural Hazards, FEMA. https://hazards.fema.gov/nri/natural-hazards

2. Planning Methodology

2.1 NH State Hazard Mitigation Planning Committee

Many of the stakeholders participating in the 2023 New Hampshire State Hazard Mitigation Plan, both internal and external to NH Homeland Security and Emergency management, were new to their departments, roles, All Hazard and/or Hazard Mitigation planning at the beginning of the process. This provided not only an opportunity to begin to develop new strategic collaborations between community sectors and organizations, but also a chance for us to work through the hazard mitigation planning process used by the State of NH and consider innovative strategies that can be implemented to improve New Hampshire’s mitigation policies, protocols, programs, and capabilities over the coming years, including how hazard mitigation processes are conducted and kept current.

2023 NH State Hazard Mitigation Planning Committee			
Name	**Title**	**Agency**	**Community Sector/NRF**
Megan Hoskins	Assistant Director	HSEM	Emergency management
Vanesa Urango	Chief, Mitigation and Recovery (fmr)	HSEM	Emergency management
Natasha Cole	Asst. Chief of Mitigation/ State Hazard Mitigation Officer (fmr)	HSEM	Emergency management
Patty Crooker	Emergency Management Planning Specialist	HSEM	Emergency management
Lynne Doyle	Hazard Mitigation Planner	HSEM	Emergency management
Sheila Dupere	EMPG Coordinator	HSEM	Emergency management
Virginia Clasby	Asst. Chief of Mitigation/ State Hazard Mitigation Officer	HSEM	Emergency management
Dr. Stephen Crawford	State Veterinarian, Dept. Agriculture, Markets, and Food	DAMF	Natural and cultural resources
Dr. Nate Harvey	Asst. State Veterinarian, Dept. Agriculture, Markets, and Food	DAMF	Natural and cultural resources
Theodore Kupper	Administrator – Department of Administrative Services, Division of Public Works Design and Construction	DPW	Infrastructure
Amy Bassett	Deputy Director, Dept. of Business and Econ Affairs, Division of Travel and Tourism Development	DTTD	Economic development
Jim Gallagher	Chief Environmental Engineer, NH Department of Environmental Services	DES	Infrastructure
Johanna McKenna	Supervisor, Drinking Water, NH Department of Environmental Services	DES	Infrastructure
Kirsten Howard	Resilience Program Coordinator, Coastal Program, Watershed Management Bureau, Water Division,	DES	Infrastructure

	NH Department of Environmental Services		
Nathalie DiGeronimo	Coastal Resilience Specialist, Watershed Management Bureau, Water Division, NH Department of Environmental Services	DES	Natural and cultural resources
Steve Couture	Coastal Program Administrator, Water Pollution Division, NH Department of Environmental Services	DES	Natural and cultural resources
Jim Martin	Public Information Officer	DES	Infrastructure
Rick Skarinka	Civil Engineer, Water Pollution Division, NH Department of Environmental Services	DES	Land use and development
Shane Csiki	State Geologist and Director, New Hampshire Geological Survey, NH Department of Environmental Services	DES	Land use and development
Steve Doyon	Chief Dam Safety Officer, NH Department of Environmental Services	DES	Infrastructure
Sherry Godlewski	Resilience and Adaptation Manager (fmr), NH Department of Environmental Services	DES	Land use and development
Jason Domke	Waste Management Division, NH Department of Environmental Services	DES	Infrastructure
Lucio Barinelli	Lab Manager, Bureau of Laboratory Services	DPHS	Health and social services
Maureen Collopy	Microbiologist, Emergency Preparedness, Response, and Recovery	DPHS	Health and social services
Carole Totzkay	Program Planner, Emergency Preparedness, Response, and Recovery	DPHS	Health and social services
Stephanie Locke	Bureau Chief, Emergency Preparedness, Response, and Recovery	DPHS	Health and social services
Ryan Tannian	Bureau Chief, Infectious Disease Control	DPHS	Health and social services
Ian Watt	Deputy Director, Division of Public Health Services	DPHS	Health and social services
Paula Holigan	Public Health Program Manager NH Immunization Section	DHHS	Health and social services
David Trubey	Archaeologist, Review and Compliance Coordinator	DNCR	Natural and cultural resources
Steve Sherman	Chief, Forest Protection Bureau	DNCR	Natural and cultural resources
Tracey Boisvert	Administrator, Land Management Bureau	DNCR	Natural and cultural resources

Sabrina Stanwood	Administrator, Natural Heritage Bureau	DNCR	Natural and cultural resources
William Guinn	Administrator, Forest Management Bureau	DNCR	Natural and cultural resources
Lee Baronas	Principal Engineer, OPS Division Highway	DOT	Infrastructure
Mark Kirouac	Senior Engineer, OPS Division Highway	DOT	Infrastructure
Roger Appleton	Civil Engineer, OPS Division Highway	DOT	Infrastructure
Steve Johnson	Principal Engineer (ret)	DOT	Infrastructure
Anne Marie Mercuri	Administrator, Infectious Disease Control	DPHS	Health and social services
Katrina Hansen	Administrator, Infectious Disease Control	DPHS	Health and social services
Megan Heddy	Administrator, Infectious Disease Control	DPHS	Health and social services
Patricia Tilley	Director, Division of Public Health Services	DPHS	Health and social services
Paul Kasper	Director, Enforcement and Compliance, Department of Energy	Energy	Infrastructure
Jason List	Utility Analyst, Department of Energy	Energy	Infrastructure
Major David Walsh	Conservation Officer, Law Enforcement Program	NHFG	Infrastructure
Josiah (Jay) Neiderbach	Mitigation Planner, Risk Analysis Branch, Mitigation Division	FEMA	Emergency Management
Marie-Annette (Nan) Johnson	Senior Community Planner, Risk Analysis Branch, Mitigation Division	FEMA	Emergency Management
Sean Toomey	State Fire Marshall, Building Code Regulation	FMO	Infrastructure
Bill Wood	Preparedness Coordinator, EMS Regional Coordinator, Fire Standards and EMS	FSTEMS	Emergency management
Vanessa Palange	Public Information Officer, Communications	HSEM	Emergency management
Austin Brown	Chief of Mitigation and Recovery	HSEM	Emergency management
Dave Vaillancourt	Chief of Field Services, Radiological	HSEM	Emergency management
Kim Castle	Asst. Chief of Field Services (fmr)	HSEM	Emergency management
Joshua Mann	Communications Chief, Division of Emergency Services and Communications	DESC	Infrastructure
Marilyn Burkowski	Deputy Director, NH Information and Analysis Center, Communications	NHIAC	Emergency management

Donald Dumont	Warning Coordination Meteorologist, Incident Meteorologist (IMET), National Weather Service, Gray, ME	NWS	Natural and cultural resources
Jennifer Gilbert	Director, State Floodplain Management Program Administrator, NH Office of Strategic Initiatives	OSI	Land use and development
Kathryn Nelson	Principal Planner (fmr)	OSI	Land use and development
Mary Stampone	State Climatologist, Associate Professor of Geography, University of New Hampshire	UNH	Natural and cultural resources
John Duclos	Director, NH Department of Environmental Services	DES	Infrastructure
Ken Weeks	State Cyber Security Officer, Department of Information Technology, Communications	DoIT	Infrastructure
Grant Nichols	Assistant Director, Division of Ports and Harbors, NH Port Authority	DPH	Emergency management

2.2 FEDERAL AGENCY PARTICIPATION/COORDINATION

Throughout the SHMP update process, NH HSEM coordinated and shared information with the Federal Emergency Management Agency (FEMA) Region I Office Risk Analysis Branch and Hazard Mitigation Branches. The Risk Analysis Branch provided information, guidance, resources, and suggestions on the development, review, and approval of the SHMP. The Hazard Mitigation Branch provided information, guidance, and resources related to the Hazard Mitigation Assistance Grants which NH HSEM administers. Representatives of Region I were consulted and provided an opportunity to serve on New Hampshire's SHMP update committee.

2.3 STATE AGENCY COORDINATION

As the lead State agency for updating the SHMP, NH HSEM coordinated the mitigation planning process, developed the mitigation planning committee, and authored the Plan update. NH HSEM coordinated with numerous other State agencies with expertise in mitigation or mitigation related activities.

Members of the following State agencies were invited to participate on the Committee:

- NH Department of Transportation
- NH Department of Health and Human Services
- Division of Public Health Services
- EPR
- NH Department of Environmental Services
- NH Department of Safety
- Division of Homeland Security and Emergency Management
- Division of Fire Standards and Training and Emergency Medical Services
- Division of Fire Safety
- Information and Analysis Center
- NH Department of Business and Economic Affairs
- Office of Planning and Development (formerly the NH Office of Strategic Initiatives)
- NH Department of Natural and Cultural Resources
- Division of Forests and Lands
- NH Department of Information Technology
- Cyber Integration Center
- NH Department of Agriculture, Markets and Food
- New Hampshire Silver Jackets

2.4 LOCAL, REGIONAL, AND COMMUNITY ENGAGEMENT

Opportunities for statewide partners, stakeholders, and the public to provide input, review, and

comment on the plan was provided throughout the planning process.
Involvement was solicited and publicized through the following methods:

- NH HSEM Twitter; approximately 9,000 followers
- NH HSEM Instagram; approximately 1,300 followers
- NH HSEM Facebook account; approximately 22,000 followers
- NH HSEM website and resource center
- In person meetings
- Via email

2.5 PRIVATE ENTITY, NON-GOVERNMENTAL ORGANIZATIONS, ACADEMIC, BUSINESS AND INDUSTRY, AND OTHER SECTOR PARTICIPATION

In addition to utilizing the same methodology to notify private entities, Non-Governmental Organizations (NGOs), academia, business and industry, and other sectors for participation and input related to the update of this Plan, NH HSEM utilized its listservs to email information to these partners. NH HSEM maintains two main listservs:

- Emergency Support Function Listserv: Contains approximately 400 e-mail addresses.
- Emergency Management Director Listservs: Includes 30 listservs with a total with 750 e-mail addresses.

Sectors Underrepresented or Unrepresented

In order to ensure that we are considering a wide range of perspectives and areas of expertise, HSEM makes every effort to ensure that planning committees include representatives from a broad range of stakeholder sectors. In planning for the 2023 SHMP, HSEM determined that several sectors, identified below, were underrepresented or unrepresented. The primary reasons for these sectors not participating include the shortened planning period, the transition of a number of HSEM and other state staff that play key roles in SHMP implementation and development, and the availability of other state and external partners during the planning process.

Housing: It is imperative that we broaden our engagement with housing focused organizations. Action has been taken to reach out to the New Hampshire Housing Authority, transitional/homeless sheltering organizations to discuss the importance of whole community planning and invite them to designate a representative of their agency to participate on the SHMPC in the future.

Behavioral Health (including substance use): In Spring 2023, HSEM approached NH Recovery Friendly Workplaces to discuss them becoming involved in our stakeholder committee. They were happy to be included and will be designating a representative to the SHMPC.

Diversity, Equity, Inclusion, and Accessibility (focus on vulnerable communities): Although many of the SHMP members have expertise in DEIA, we did not have anyone on the committee for the 2023 update that represented an organization focused on this area. In Spring 2023, HSEM identified potential stakeholders to fill this gap, including the University of New Hampshire's Office of Community, Equity and Diversity, Southern New Hampshire University's Office of Diversity and Inclusion, the NH DHHS Office of Health Equity, Ascentria Care Alliance, and the New Hampshire Fiscal Policy Institute. As we move forward, HSEM will work towards engaging one or more of these entities in planning and implementation.

Climate Change: The HSEM Planning Specialist met with a representative of the New Hampshire Healthcare Workers for Climate Action in March 2023 to discuss the SHMP process. As we move forward, a representative from this group will participate on the SHMPC alongside the NH State Climatologist, representatives from the National Weather Service - Grey, Maine), NH Department of Environmental Services, and other stakeholders that have provided extensive subject matter expertise to the SHMP process.

Colleges/Universities: The SHMP process has included research and publications from colleges and universities as well as staff from various colleges and universities; however, there has not been participation from anyone representing secondary education as a sector. In May 2023 HSEM has begun engaging representatives from this sector, including the NH Community College System, the University System of NH, and their affiliate member colleges/universities. This effort will continue and expand as we move forward in planning and implementation.

2.6 PLAN AND PROGRAM INTEGRATION

While this Plan provides an opportunity for agencies and organizations to collaborate on issues of hazard mitigation; coordination among agencies on planning and other initiatives across all mission areas is constant. Planning and programmatic efforts that could integrate information from this Plan or provide information to be integrated into this Plan are as follows:

State Emergency Operations Plan (SEOP)

While this Plan is included as a supporting annex to the SEOP, the information contained within the HIRA of this plan plays an important role in the SEOP. The SEOP identifies roles, responsibilities, and actions of the State during incidents, emergencies, and disasters. The SEOP addresses the ability to direct, control, coordinate, and manage emergency operations and follows the Emergency Support Function (ESF) format.

State Recovery Annex

The State Recovery Annex is another supporting annex to the SEOP which details the roles, responsibilities, and actions of the State and its partners to recover from an incident,
emergency, or disaster. The Recovery Annex follows the guidelines set forth in the National Disaster Recovery Framework (NDRF) and recovery responsibilities are divided into 6 different Recovery Support Functions (RSFs). As the recovery process extends into the later phases, hazard mitigation becomes a central element in the recovery process to ensure that communities

continue to build resiliency, lessen the likelihood of hazards, and lessen the impacts of future hazards.

Public Assistance Program

FEMA's Public Assistance (PA) grant program is authorized through the Stafford Act to provide federal assistance to government organizations and certain Private Nonprofit (PNP) organizations following a Presidential Disaster Declaration. This funding is provided at a 75%/25% cost share to allow government and certain PNP entities to respond and recover from major disasters or emergencies. The Public Assistance program returns damages to their pre-disaster condition.

Through the PA program, FEMA provides supplemental assistance in the following Categories:

- Emergency Work
    - Debris Removal
    - Emergency Protective Measures
- Permanent Work
- Roads and Bridges
- Water Control Facilities
- Public Buildings and Contents
- Public Utilities
- Parks, Recreational, and other facilities

Section 406 of the *Stafford Act* provides FEMA with the authority to fund cost-effective mitigation measures to repair, restore, or replace eligible damaged facilities, and allows for those structures to be rebuilt or repaired to better than pre-disaster conditions to make them less vulnerable to future hazards. Unlike other hazard mitigation grant programs, Section 406 mitigation is only available in the counties declared in the presidential declaration and only for eligible damaged facilities.

Additional State Plans Referenced

Numerous state plans were referenced in the 2023 NH SHMP and mitigation activities were aligned with the related plans. No other state plans were being updated or written during the period of time in which the 2023 NH SHMP was being developed. The majority of the departments and entities responsible for writing these state-level plans did actively participate in SHMP update process. While HSEM staff have participated in the development of many state-level plans driven by other agencies, many of these plans listed did not include collaboration from sectors outside of the plans primary topic area(s).

The table below identifies some of the NH State-level plans developed by HSEM stakeholders and SHMPC members, including NH State agencies and non-governmental organizations. HSEM staff participated in the development of many of these plans; however, the plans span a wide range of time, and most do not identify the agencies or individuals involved with writing them.

2.7 NH State-Level Plans

Agency/Organization: State of New Hampshire	
Dept/ Division: **Department of Safety, Homeland Security and Emergency Management**	
Plan/Topic	*Year Updated*
NH State Hazard Mitigation Plan	2023
State Emergency Operations Plan	2019
State Recovery Plan	2015
Integrated Preparedness Plan	2023

Agency/Organization: State of New Hampshire	
Dept/ Division: **Department of Environmental Services**	
Plan/Topic	*Year Updated*
Drought Management Plan	2016
Solid Waste Management Plan	2022
2018 – 2028 New Hampshire Regional Haze Plan Periodic Comprehensive Revision	2022
2017-2023 New Hampshire Wetland Program Plan	2017
2022 DWSRF Intended Use Plan	2022

Agency/Organization: State of New Hampshire	
Dept/ Division: **NH Fish and Game**	
Plan/Topic	*Year Updated*
New Hampshire Wildlife Action Plan 2015 Revised Edition	2015

Agency/Organization: State of New Hampshire	
Dept/ Division: **DHHS, Division of Public Health Services**	
Plan/Topic	*Year Updated*
Crisis Standards of Care Guidance	2022

Agency/Organization: State of New Hampshire	
Dept/Division: **Department of Transportation**	
Plan/Topic	*Year Updated*
Critical Needs Transportation Plan (Motor Coach)	2013
Debris Management	2013
New Hampshire Statewide Freight Plan	2019
2022 – 2026 New Hampshire Strategic Highway Safety Plan	2022

Agency/Organization: State of New Hampshire	
Dept/Division: **Department of Information Technology**	
Plan/Topic	*Year Updated*
New Hampshire Statewide Information Security Manual (SISM)	Updated 3/2023

Agency/Organization:	State of New Hampshire
Dept/Division:	**Department of Safety, Fire Marshall's Office**
Plan/Topic	*Year Updated*
Statewide Fire Mobilization	2017

Agency/Organization:	**State of New Hampshire**
Dept/Division:	**Department of Natural and Cultural Resources, Division of Forests and Land**
Plan/Topic	*Year Updated*
Forest Management Plan	2020

Agency/Organization:	**State of New Hampshire**
Dept/Division:	**Department of Energy**
Plan/Topic	*Year Updated*
NH Energy Strategy Plan	2018

Agency/Organization: Granite State Healthcare Coalition	
Plan/Topic	*Year Updated*
GSHCC Coordination Plan	2022
GSHCC Infectious Disease Surge Annex	2023
GSHCC Hazard Vulnerability Analysis (HVA)	2023
GSHCC Pediatric Surge Annex	2023
GSHCC Burn Surge Annex	2023

Agency/Organization: American Red Cross	
Plan/Topic	Year Updated
Hurricane Planning	In process 2023
Points of Distribution/Commodities Distribution/CPODs	In process 2023

2.8 BASIC METHODOLOGY

FEMA's 2023 Local Mitigation Planning Policy Guide sets forth a nine-task planning process to be undertaken to update a Local Hazard Mitigation Plan. The State Hazard Mitigation Plan update generally follows these same nine tasks:

1. Determine the Planning Area and Resources
2. Build the Planning Team
3. Create an Outreach Strategy
4. Review [State] Capabilities
5. Conduct a Risk Assessment
6. Develop a Mitigation Strategy
7. Keep the Plan Current
8. Review and Adopt the Plan
9. Create a Safe and Resilient [State]

Several of these tasks were accomplished independently while other tasks were completed sequentially. While the 2018 update of the SHMP was a complete overhaul and revision to meet the updated FEMA requirements for states, much of the historical information came from the 2013 Plan and associated previous editions of the State of New Hampshire Multi-Hazard Mitigation Plan.

During the planning process, careful consideration was given to the 2023 State Hazard Mitigation Plan Review Tool to ensure the plan and planning process met the State specific requirements. Reference to FEMA's Comprehensive Guides 101 and 201 were given in addition to ensuring plan alignment across all related plans (SEOP, COOP, Recovery Annex, etc.).

2023 New Hampshire SHMP Schedule and Activities		
Meeting	**Date**	**Activities**
Initial	3/21/2022	SHMPC met to establish timeline, discuss logistics, and begin SHMP update.
Kickoff Meeting	7/9/2022	Hosted kick-off meeting held virtually participants, reviewed planning process, provided background information, and highlighted changes and updates required.
SHMPC Meeting – Strategy & SMEs	11/9/2022	Starting on November 9, 2022, the SHMPC began holding weekly 2-hour meetings dedicated to SHMP development. The Committee reviewed the SME/Workgroup list, which had been updated including members who were no longer available, potential new members, and who to contact to get a new representative assigned from various agencies.

SHMPC Meeting – Timeline, Project Management, Strategy, Hazards & Narratives	11/16/2022	The SHMPC reviewed the SHMP development timeline, discussed the process we would be using to track progress, determine allocation of tasks and priorities, and plan remaining meetings with stakeholders. The Committee reviewed hazards included in the 2018 SHMP, then discussed and finalized details of the small group process that was going to be used to update Hazard Narratives. Also discussed FEMA TA needed and next steps.
Capabilities Tables	11/17/2022	Capability Tables were broken down into Natural, Human-Caused, and Technological Hazards, each including capabilities identified as All Hazard. For each Hazard Narrative update assigned to an SME Workgroup, the corresponding Capability Table was provided. SME Workgroups were asked to update the Capability Tables by adding and removing information as appropriate.
Hazard Narrative Updates	11/22/2022	Hazard Narratives were provided to SME Workgroups via email. The email also included the corresponding Capability Table and instructions for the update, including formatting protocols, due date (12/16/2022), and contact information if they had questions. They were also encouraged to invite other SMEs to participate in assisting with updates if we had inadvertently left someone out or they knew of SMEs we were not aware of.
SHMPC/FEMA Meeting	12/13/2022	The SHMPC met with FEMA Region 1 Planner to discuss 2023 Plan requirements.
Regional Mitigation Monthly Planning Meeting	12/14/2022	Region 1 met with FEMA Planners to discuss SHMP 2023 requirements and submission dates.
NH Ports and Partners Meeting	01/23/2023	HSEM met with NH Ports and Harbors, US Coast Guard and Department of Environmental Services. Discussions ranged from Port Security, climate change impacts, and the overall mission of NH Ports as a part of the state's critical infrastructure.
Regional Planning Committee Meeting	01/26/2023	HSEM and RPC staff discussed ongoing challenges with LHMPs and how to provide better coordination between state and local plans. Information and data exchange was discussed to encourage more comprehensive plans. Also discussed was the 2023 Hazard Mitigation Plan guidance from FEMA.
SHMPC Meeting – Mitigation Strategy, & Activities	02/17/2023	Mitigation Strategies, Activities and Prioritization were discussed with the SME Workgroup. Background information on equity and vulnerable populations was discussed, along with information on the health impacts of climate change. Overarching goals were developed, Mitigation Activities were updated and removed from 2018 list as needed.

SHMPC Meeting – Final Draft NH SHMP 2023 Update Compilation	03/15/2023	The NH HSEM SHMP Internal Working Group met to compile the elements of the final draft for stakeholder review.
Final Draft NH SHMP 2023 Update Submitted	3/17/2023	Plan was submitted to FEMA for initial review.
SHMPC Meeting	03/29/2023	SHMPC met. Members of the team had reviewed the submitted plan and identified sections of plan that were likely to not meet FEMA SHMP Guidance. Team discussed how these sections could be improved to meet guidance. A plan of action was outlined.
Internal Team Completed 2023 State Mitigation Plan Review Tool	5/5/2023	Initial FEMA 2023 NH SHMP Review Report and Required Revisions received.
Internal SHMPC Meeting	5/10/2023	SHMPC met to strategize next steps in addressing recommendations from FEMA Review Report dated 5/5/2023
Virtual SHMPC/ FEMA Meeting	5/18/2023	A virtual meeting was held with the FEMA Mitigation Division to discuss the recommendations of the review report dated 5/5/2023
SHMPC Meeting	6/8/2023	SHMPC held a virtual meeting with the FEMA Mitigation Division to review revised information that was submitted specifically to address the HHPD requirements of the State Hazard Mitigation Plan and discuss revisions and improvements.
SHMPC Meetings	6/12/2023 6/21/2023 6/23/2023 6/26/2023 6/27/2023 6/28/2023 6/29/2023 7/5/2023 7/6/2023	The SHMPC met multiple 11 additional times between June 12th and July 6th to review progress on the FEMA Required Revisions to the NH SHMP including development of new materials, potential sources of additional data, information gathered from SMEs, legislative research results, and discuss strategy for submission of Revision #2. In addition, numerous virtual meetings/calls were held with FEMA Mitigation Division.
NH SHMP 2023 Update Revision #1 Submitted	7/6/2023	
FEMA NH SHMP 2023 Update Revision #1 Review Report Received	8/2/2023	
SHMP Plan Revisions	8/3 - 9/2023	SHMPC and other staff worked, as a group, on the SHMP Required Revisions from the SEOC.
NH SHMP 2023 Update Revision #2 Submission	8/10/2023	

NH SHMP 2023 Update APA Notice received.	8/16/2023	Received NH 2023 SHMP Approvable Pending Adoption (APA) plan status of the State of New Hampshire Hazard Mitigation Plan 2023 Update.
Leadership Meetings	September 2023	Virtual and in-person meetings, as well as calls, focusing on the approval of the NH SHMP 2023 Update took place and included leadership from the NH Governor's Office, HSEM Leadership, and the FEMA Mitigation Division.
FEMA Formal Approval for NH SHMP 2023 Update	9/27/2023	Received FEMA formal Approval Letter and final Plan Review Tool for the New Hampshire State Hazard Mitigation Plan 2023 Update.
Certificate of Adoption signed	9/28/2023	Certificate of Adoption signed by the Governor of NH
Adopted NH SHMP 2023 Update posted online	10/7/2023	The Adopted NH SHMP 2023 Update Posted to HSEM Resource web page.

2.9 NARRATIVE DESCRIPTION OF THE SHMP DEVELOPMENT PROCESS

April 1, 2022, Initial NH HSEM Meeting

The planning process for the 2023 update of the SHMP began in April 2022 with an initial planning meeting with Robert Christensen (Preparedness and Response Chief), Megan Hoskins (Preparedness and Response Assistant Chief), Vanesa Urango (Mitigation and Recovery Chief), Brian Eaton (Assistant Chief of Mitigation/ State Hazard Mitigation Officer), Dakota Hayes (All Hazards Planner), John Marcel (Hazard Mitigation Planner), Francis Tarasiewicz (Hazard Mitigation Coordinator) at NH HSEM in Concord, New Hampshire. At this meeting, a timeframe for the update was created, the previous list of State Hazard Mitigation Plan Committee members was reviewed, and a new list of potential members began to be generated, a public and private outreach strategy was discussed. In between meetings, NH HSEM staff worked on logistics for future meetings, information gathering, and preparing the 2023 plan.

April 22, 2022, SME Update Meeting

The NH HSEM Internal SHMP Working Group, met to discuss Subject Matter Expert participants and needed updates. Identified SMEs will be contacted regarding their participation in the larger State Hazard Mitigation Plan 2023 Update Working Group in order to identify 2023 threats/ hazards, goals, and objectives, and will assist in updating information.

July 8, 2022 – Kickoff Meeting

The kickoff meeting for the 2023 Update of the State Hazard Mitigation Plan was held at NHDES with the full State Hazard Mitigation Plan Update Committee. After participant and facilitator introductions were completed, the purpose of the State Hazard Mitigation Plan and update process were reviewed. The Hazard Identification and Risk Assessment (HIRA) process was reviewed and deemed appropriate to remain in its current form. At the conclusion of the meeting, expectations were identified for moving forward with the update to include outreach methodologies, future meetings, and how NH HSEM was going to work with individual Stakeholders.

3. STATE PROFILE

This section of the Plan provides an overview of the State of New Hampshire, including its government, geography, industry, economy, development, and the people who live, work, and play in the Granite State.

New Hampshire was one of the original 13 colonies. In 1766, it was the first state to develop its own constitution. In 1788, NH was the 9th state to ratify the U.S. Constitution and the final state needed to put the document into effect.

Throughout history, New Hampshire frequently has demonstrated its pioneer spirit –

- NH was the first state of the original 13 to have its own state constitution.
- In 1775, New Hampshire became the first state to declare its independence from England.
- Samuel Shelburne of Portsmouth was the first Attorney General of the United States. He was named to the post in 1789.
- The first American in space, Alan Shepard, was born in Derry, New Hampshire. His historic flight was made in 1961.
- The first private citizen in the history of space flight was Christa McAuliffe, a Concord school teacher. After her death in the Challenger Space Shuttle disaster, a planetarium was built in her honor in Concord.
- The first-in-the-nation Presidential Primary election has been held in the Granite State every four years. Until the 1992 elections, no candidate had ever won the Presidency without first winning in New Hampshire.

Nicknames

- Granite State: Granite is the official rock of the state of New Hampshire, as much of the State's bedrock is Granite.
- Mother of Rivers: Many of New Hampshire's largest rivers originate in the White Mountains
- White Mountain State: for the White Mountain Range
- Switzerland of America: for our beautiful mountain scenery

The State Capital
Concord is the seat of New Hampshire government. It is centrally located in the state on the Merrimack River.

State Motto
"Live free or die; death is not the worst of evils."

- General John Stark, Revolutionary General John Stark, hero of the Battle of Bennington. Written 136 years before it became New Hampshire's official state motto.

State Seal, Flag and Symbols
New Hampshire has adopted many symbols over the past 200 years, beginning with the first state seal in 1775 and continuing to the most recent symbol, the State Tartan in 1995.

The flag, seal and various symbols are all ways the state identifies itself. They had been adopted by the legislature as symbolic of the state in one way or another.

3.1 State Government

"New Hampshire has three branches of government. The Legislative Branch, known as the General Court, is composed of the state senators and representatives; the Executive Branch includes the Governor, Executive Council, and State Agencies; and the Judicial Branch is made up of the courts. Each branch of government is separate from the others yet has some control over and is controlled by the other two. This is known as a system of checks and balances. All three branches derived their powers from the State's Constitution and the Constitution is controlled by the people of the state. – *State Government Overview, New Hampshire Almanac*, NH.Gov. https://www.nh.gov/almanac/government.htm

The State's executive branch is headed by a governor and five administrative officers called Executive Councilors. The Governor is elected for a two-year term. The New Hampshire bicameral legislature (General Court) consists of 24 senators and 400 representatives, all elected for two years. The State elects two senators and two representatives to the US Congress and has four electoral votes.

New Hampshire, like other New England States, has a tradition of local town meetings. In many towns, residents vote directly on municipal and school budgets and can propose and amend warrant articles. New Hampshire, like Vermont, is among the few states in the Nation that utilizes a strong, local government rather than a predominately county government structure.

3.2 NH Counties, Cities, Towns, and Unincorporated Places

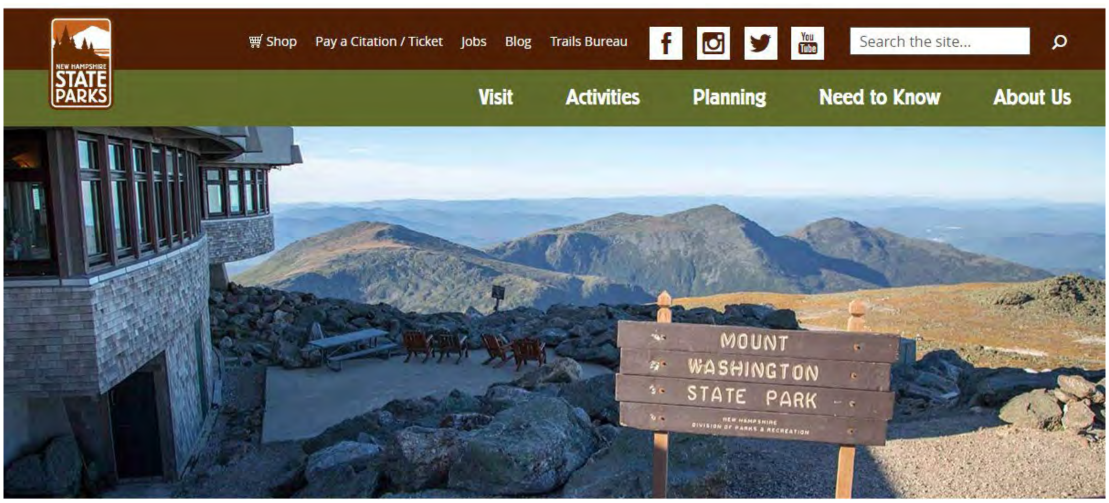
The State of New Hampshire consists of 10 counties, 13 cities, 221 towns and 25 unincorporated places.

3.3 GEOGRAPHY

New Hampshire is one of the six New England states that make up FEMA Region 1, the others being Maine, Massachusetts, Vermont, Rhode Island, and Connecticut. It is the 5th smallest state in the United States, with a total area of 9,304 sq miles (24,097 sq km), including of 9,027 sq miles (23,380 sq km) of land and 277 sq miles (717 sq km) of inland water. New Hampshire is bordered on the north by the Canadian province of Quebec, on the east by Maine and the Atlantic Ocean, on the south by Massachusetts, and the on the west by Vermont.

Elevation

The highest point in New Hampshire is the summit of Mount Washington at 6,288 feet (1,918m). The lowest point is sea level, with an approximate mean elevation is 1,000 feet (305m).



Climate

New Hampshire has a humid continental climate (Dfb under the Köppen climate classification). The winters are long, cold, and heavy snow is common (most locations in this region receive 60 to 120 inches or 1.52 to 3.05 meters of snow annually).

The state's northerly latitude and location in the Northeast expose the state to both the moderating and moistening influence of the Atlantic Ocean and the effects of hot and cold air masses from the interior of the continent. Its climate is characterized by cold, snowy winters and mild summers.[1] From late fall through spring, the jet stream is regularly situated near the state, which results in variable weather patterns. Precipitation is frequent because several preferred storm tracks associated with the jet stream cross the state. The extreme northern and western portions of the state are the least influenced by the moderating effects of the Gulf of Maine and thus experience more extreme cold temperatures. The southeast, with its lower elevations and proximity to the Atlantic Ocean, is somewhat warmer. Average minimum temperatures in January are colder in the north (Lancaster: 2°F to 7°F) and at higher elevations (Mount Washington: −5°F to −1°F) than in the south (Concord: 12°F to 15°F). Seacoast communities are warmer, with average minimum temperatures ranging from 15°F to 18°F. Average maximum temperatures in July range from 75°F to 80°F in the north and from 80°F to 85°F in the south. The statewide annual average (1991–2020 normals period) precipitation is 48.8 inches, with higher amounts occurring in the south and along the eastern border of the state and lower amounts in the west and north.

New Hampshire has a changeable climate, with wide variations in daily and seasonal temperatures. The variations are affected by proximity to the ocean, mountains, lakes, or rivers. The state enjoys all four seasons. Summers are short and cool. Winters are long and cold. Fall is glorious with foliage. The weather station on Mount Washington has recorded the coldest wind chill on record in the United States, and the highest windspeed ever recorded in the world.

New Hampshire is divided roughly into two climate zones, north and south, that are delineated by the White Mountains. Contained within the Appalachian Highlands, the three primary physiographic regions of New Hampshire are the Coastal Lowlands, the Eastern New England Upland, and the White Mountain Region. The State experiences four seasons, including moderately warm summers and cold, wet winters.

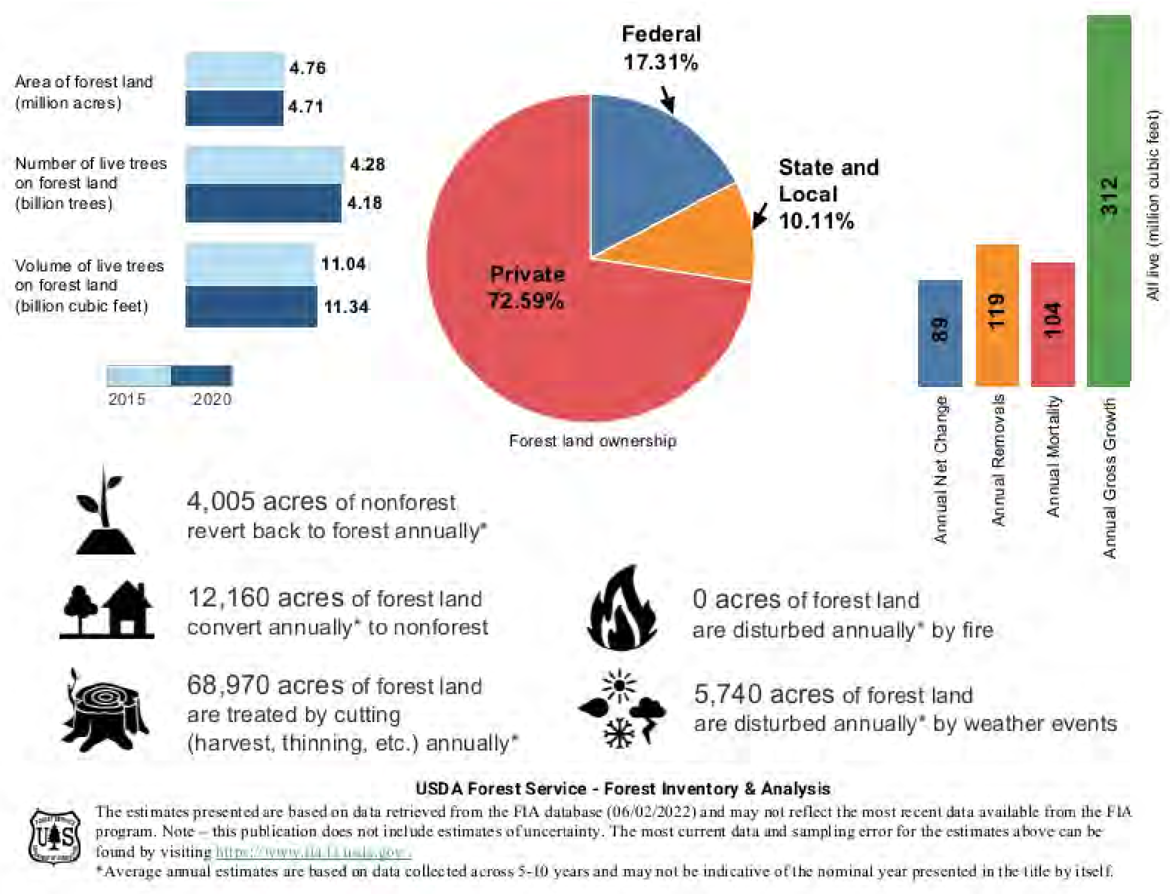
The climate of New Hampshire is influenced greatly by the presence of the Atlantic Ocean, which acts to moderate the temperature along the coast throughout the year and provide ample moisture for low pressure systems. Additionally, there are portions of the State within the White Mountains, such as Franconia Notch, where the steep terrain amplifies the severity of local weather, namely precipitation, year-round.

Temperature varies greatly depending on the season, with below freezing temperatures during winter months and high temperatures above 90°F during warm spells in the summer. Average annual temperatures in New Hampshire vary significantly based on location but tend to be between 37°F in the north and 46°F in the central part of the State. It is important to note, however, that these average annual temperatures do not provide an accurate representation of the temperature at any given time during the year.

Precipitation is brought to the State in the form of extratropical cyclones throughout most of the year, with convective precipitation more common in the warmer summer months. The distribution of precipitation is fairly even across the State, with increased values recorded at higher elevations and along the coast; but these distributions of increased precipitation values can vary based on storm track. An example of this can be seen with coastal storms, often referred to as Nor'easters, which bring heavy precipitation in the form of snow, freezing rain, sleet, rain, or a combination of all of these, to coastal portions of the State. These storms may also bring heavy precipitation inland if the storm track is favorable. New Hampshire receives approximately 42-43 inches of precipitation annually, but local average annual precipitation values will vary based on elevation.

Forests

New Hampshire has an estimated 4,708,302 acres of forest land and is the second most forested state in the United States (trailing Maine). Forests make up 82% of the state (after excluding total area covered by water). The area of forest land has declined by 35,000 acres since 1983 but has increased from 1997 and 2007 levels.



Lakes in NH

New Hampshire is home to nearly 1,000 lakes. Lakes are an important part of the quality of life, economy, and heritage in the state.

Lakes are also major attraction for visitors and residents. During the warmer months, popular lake activities include swimming, boating, and fishing. Some lakes are used for public water supply purposes and have restrictions on recreational activities. Lakes in New Hampshire typically freeze during the winter. Popular winter lake activities include ice-fishing, ice- skating, and cross-country skiing.

New Hampshire is home to some of the cleanest and healthiest lakes in the country. However, the health of our lakes is threatened by impacts of climate change, including polluted runoff water, and invasive species.

3.4 ECONOMY

Tourism is the leading industry in New Hampshire. Each year, millions of visitors and residents enjoy the beaches, mountains, and lakes. The state's largest lake, Lake Winnipesaukee, is dotted with 274 inhabitable islands, provides ample opportunity for fishing and water recreation sports. Along the Atlantic shore, 18 mi (29 km) of curving coastline boasts white sand beaches (many State-owned) which attract vacationers. In the winter, skiers flock northward to take advantage of the numerous ski areas, which the State has responded by greatly expanding its facilities. When the snow melts, the skiers are replaced with hikers, rafters, cyclists, and climbers.

The New Hampshire Motor Speedway (NHMS) is the largest sports facility in New Hampshire based upon seating capacity of approximately 50,000 people. The venue hosts a NASCAR Cup Series race mid-July. The Speedway also co-hosts (with Laconia) New Hampshire Motorcycle Week, which is held annually in June with over 380,000 in attendance each year.

3.5 HIGHER EDUCATION

Among the State's institutions of higher learning are the University System of New Hampshire (five Colleges/Universities), the Community College System of New Hampshire (seven Colleges/Institutes), and over a dozen additional private colleges, universities, and institutes of higher education. All of the colleges and universities in NH are self-insured.

3.6 TRANSPORTATION SYSTEMS

Air Service

Located in Manchester, New Hampshire the Manchester-Boston Regional Airport (MHT[2]) is the State's largest commercial aviation airport and New England's third largest airport. Less than 50 miles north of Logan Airport in Boston, MHT is situated on 1,500 acres and houses a 308,000 ft^2 terminal.[3] The airport has two hard surfaced runways, a 24-hour FAA Air Traffic Control Tower, and an extensive system of taxiways.

MHT offers service to 13 destinations through an average of 25 departures daily, with five airlines (American, Delta, Southwest, United, and Avelo Airlines). The airport hosts 8 rental car companies, 14 food/news concession stands, and an airport business center as well as commercial, cargo, and general aviation services. The airport offers both short and long- term parking with a parking capacity of over 11,000 vehicles.

In 2022, Manchester-Boston Regional Airport serviced 1,296,314 commercial passengers and processed 200,887,351 pounds of cargo. In fact, MHT processes more air cargo each year than all other regional New England airports combined.

The State also has two other primary airports offering commercial service:

- Lebanon Municipal Airport located in Lebanon, New Hampshire offering service with Cape Air.
- Portsmouth International Airport at Pease in Portsmouth, New Hampshire offering service with Allegiant.

The State has about a dozen other General Aviation Airports located throughout the State with the larger General Aviation Airports being located in Concord, Keene, Laconia, and Nashua (Boire Airfield).

Rail Service

There are 459 miles of active railroad in New Hampshire. The State is the largest railroad owner with over 200 miles of active line, that was purchased to preserve freight service to industry and promote tourism and economic development. Nine freight railroads operate in the State. Passenger rail service in New Hampshire is provided by the Amtrak Downeaster and services routes between Brunswick, ME and Haverhill, MA, with stops in Dover, Durham, and Exeter. The Vermonter rail service has a stop at the Claremont Junction as well as Vermont communities in the Connecticut Valley.

Bus Service

There are numerous bus companies serving the citizens and guests of the State with regularly scheduled trips across the State, into Boston, as well as other long-distance fares.

Road System

The State maintains 4,814 miles (7,747 km) of roads, of which 2,567 miles (4,131 km) are numbered routes and 1,465 miles (2,358 km) are unnumbered roadways. The State has 557 miles (896 km) of primary highways, which it defines as highways that "connect population centers, other National Highway Systems (NHS) routes within the State, and other NHS routes in the surrounding states: Vermont, Maine, and Massachusetts." The remaining 12,215 miles (19,658 km) of roads are maintained typically by the towns and cities traversed by these roads. Many minor State highways do not have assigned numbers, only local names.

A total of 224.2 miles (360.8 km) of roadway in New Hampshire are part of the Interstate Highway System. Three primary Interstates and two secondary Interstates pass through New Hampshire:

Interstate highways

- Interstate 89 (I-89)
- Interstate 93 (I-93)
    - I-293
    - I-393
- Interstate 95 (I-95)

Turnpike System

- The Frederick E. Everett Turnpike
- The Eastern Turnpike, composed of the following two connecting turnpikes:
    - The Blue Star Turnpike (also known as the New Hampshire Turnpike)
    - The Spaulding Turnpike

3.7 POWER GENERATION

Fifty-seven power generation facilities within the State of New Hampshire produce more than one megawatt (MW) of power. These facilities provide electric power to residential and commercial users across the State. New Hampshire also directly receives power from two facilities in the State of Vermont. The following is a fuel type break down of the 57 >1MW power generating facilities:

- 2 Biogas
- 2 Coal
- 1 Fuel Oil #2
- 33 Hydro
- 2 Natural Gas
- 1 Nuclear
- 2 Solid Waste
- 5 Wind
- 9 Wood

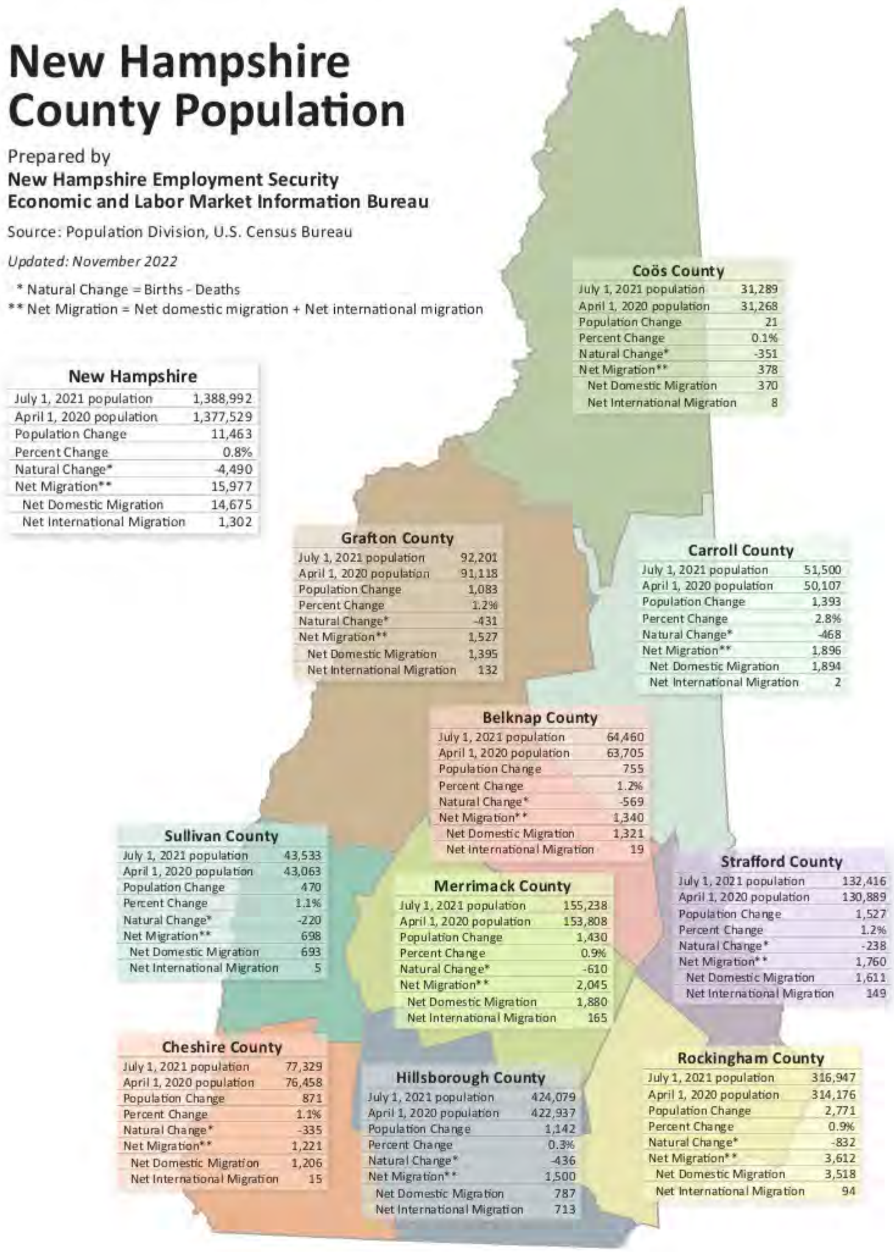
The State's sole Nuclear Power Facility, NextEra Energy Seabrook Station (SS), located in Seabrook, New Hampshire is positioned on 900 acres; it is a pressurized water reactor (PWR) that generates 1,250 MW of electricity. The plant began construction in 1976 and began operations in 1990.

3.8 POPULATION CHANGES AND ESTIMATIONS

According to 2020 Census New Hampshire had a total population of 1,377,529. Between 2010 and 2020, New Hampshire's population saw an increase of slightly more than 61,000 (4.6 percent) approximately 19,600 less than the increase seen in 2010 (6.5 percent). This represents the smallest population gain in New Hampshire's history since roughly 1950.[4] During the past decade, migration was the most important source of the state's population increase (net migration gain of 54,500), accounting for 89 percent of the population gain. In addition, there were only 6,500 more births than deaths during the past decade, which is also a significant decrease. As of 2020, an estimated 59% or residents were not born in the state.

Between July of 2021 and July of 2022, the population of New Hampshire grew by 7,700 (0.55 percent) to 1,395,000, according to 2021 Census Bureau estimates. The population gain was entirely due to migration. In all, 10,200 more people moved into New Hampshire than left between July of 2021 and July of 2022. Approximately 62 percent of this migration gain was due to more people moving to NH from other states then the number of residents that left, but the state also gained from immigration. This migration gain was large enough to offset a natural loss of 2,000 people when deaths exceeded births in New Hampshire in the past year.[5]

The influx of people to the state of NH isn't a new phenomenon. Migration has continually provided most of the state's population gain and depends upon migration for future growth. This underscores the importance of cultivating and maintaining communities that welcome and value all people. In addition, state leaders need to be motivated to ensure that NH's political climate is supportive of and equitable to diverse populations to keep current residents here and encourage new migrants to come to New Hampshire.



Population estimate data is provided by the New Hampshire Office of Planning and Development (NH OPD) for each town, county, and the state on a yearly basis. The most recent data is based on the 2021 Census Population Estimates. Between 2020 and 2021, it was estimated that the population within the state of New Hampshire grew by 11,463 people. Rockingham County showed the largest numeric growth with a population increase of approximately 5,313 people. Some counties showed population loss between 2020 and 2021, but these were most likely due to a reflection of COVID closures on group quarters such as nursing homes and college housing and are not expected to continue.

NH OPD, in partnership with the state's Regional Planning Commissions (RPCs), also provides state and county population projections based on age. These reports utilize census data, migration data, fertility data, special populations data (such as colleges, military, and prisons), and birth and death records from the New Hampshire Department of State, Division of Vital Records Administration, among other data sources. The most recent report was completed in 2022 and offers the following probable population trends which extend out to 2050[6]:

- The total New Hampshire state population is projected to be 1,511,770 in 2040, an increase of 134,237 or 9.7 percent from the 2020 Census population of 1,377,529. Beyond 2040, the population is projected to decrease to 1,501,909 by 2050.
- The absolute number of births is projected at first to increase from about 60,000 in the 2015 to 2020 period to 68,000 in the 2025 to 2030 period. However, the number of births will then decline, returning to less than 60,000 for the period 2045 to 2050. The initial increase results from population growth in the number of women between the ages of 30 and 44 and the overall increase in women of childbearing age (15 to 49) even with continued low fertility rates. The decline that ensues reflects continued low fertility rates and a declining number of women of childbearing age.
- The number of deaths will increase sharply from 63,500 in the 2020 to 2025 period to 120,000 in the 2045 to 2050 period due to the aging of the Baby Boom generation.
- With the rise in deaths, New Hampshire is projected to experience natural decline (an excess of deaths over births) beginning in the 2025 to 2030 period. By the 2045 to 2050 period the state will see an increasing level of natural decline, to 60,500.
- The population age 65 and over will increase from 265,413 in 2020 to 428,927 in 2040, an increase of 163,514, followed by a decline to 404,056 by 2050.
- The population under age 15 will increase from 207,059 in 2020 to 229,603 in 2035, followed by a decline to 214,232 by 2050. The percentage of the total population will change from 15.0 percent in 2020 to 14.3% in 2050.

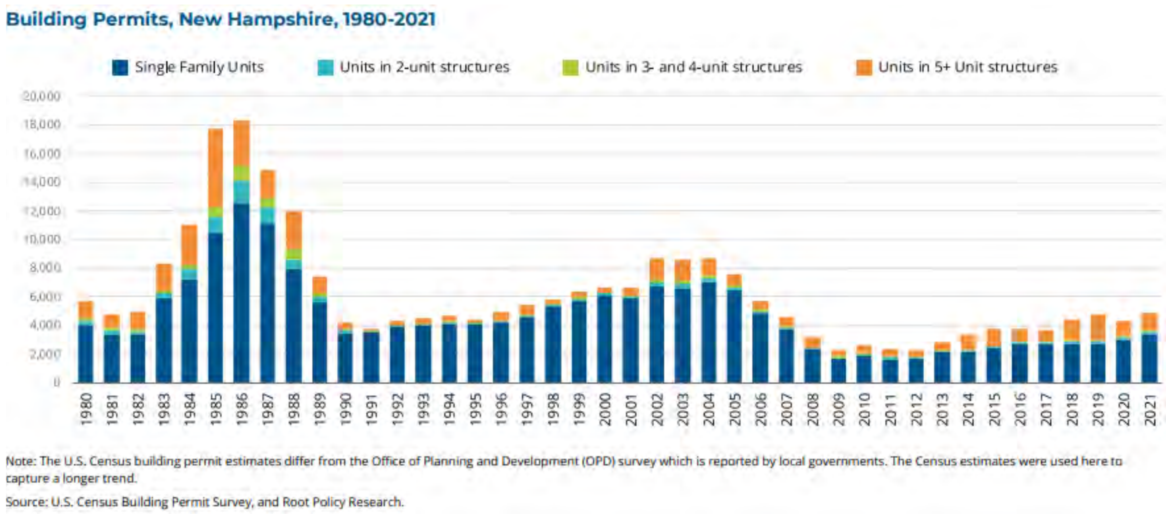
NH Population Change estimates 2020 – 2050 Population estimates for the State of New Hampshire by county based on a joint study by NH OSI and RPCs. (Source– NH OSI)							
State/County	2020 Census	2025	2030	2035	2040	2045	2050
New Hampshire	1,377,533	1,430,601	1,473,286	1,501,045	1,511,770	1,509,955	1,501,909
Belknap	63,705	66,371	68,635	69,872	70,366	70,338	70,103
Carroll	50,111	52,293	54,023	54,939	54,935	54,273	53,293
Cheshire	76,458	77,722	78,340	78,080	77,007	75,452	73,805
Coos	31,268	31,274	31,047	30,490	29,608	28,533	27,428
Grafton	91,118	94,984	98,030	99,463	99,711	98,998	97,777
Hillsborough	422,937	440,881	454,896	464,900	470,211	471,760	471,369
Merrimack	153,808	159,385	164,072	167,214	168,609	168,770	168,475
Rockingham	314,176	327,586	339,248	347,444	350,560	350,316	348,083
Strafford	130,889	136,162	140,565	144,214	146,813	148,384	149,435
Sullivan	43,063	43,943	44,429	44,429	43,950	43,131	42,141

3.9 CURRENT AND FUTURE DEVELOPMENT TRENDS

Historically, NH relied on paper and grain mills as the primary monetary providers in the State, but the decline of mill work throughout the 20th century prompted a transition, giving rise to smart technology manufacturing, tourism, and health care as the main drivers of the State's economy[7]. These fields have grown more quickly than others as the State works to open itself up for new manufacturing businesses, advertises the adventures possible throughout its abundant natural resources, works to fill the increased demand for skilled health care providers brought on by an aging population, and provides real-estate and incentives for the rapidly expanding biomedical industry in New England. Examples of this growth can be seen in the addition of Safran Aerospace Composites and Albany Engineered Composites, which integrated their companies into a manufacturing plant in Rochester[8], the expansion of ski mountains and resorts and continued improvement projects to New Hampshire trails and recreational areas[9], and the addition of the Advanced Regenerative Manufacturing Institute (ARMI) to the Manchester Millyard, which allows for the biomedical field to expand in a region now being dubbed the "mini-Cambridge."[10]

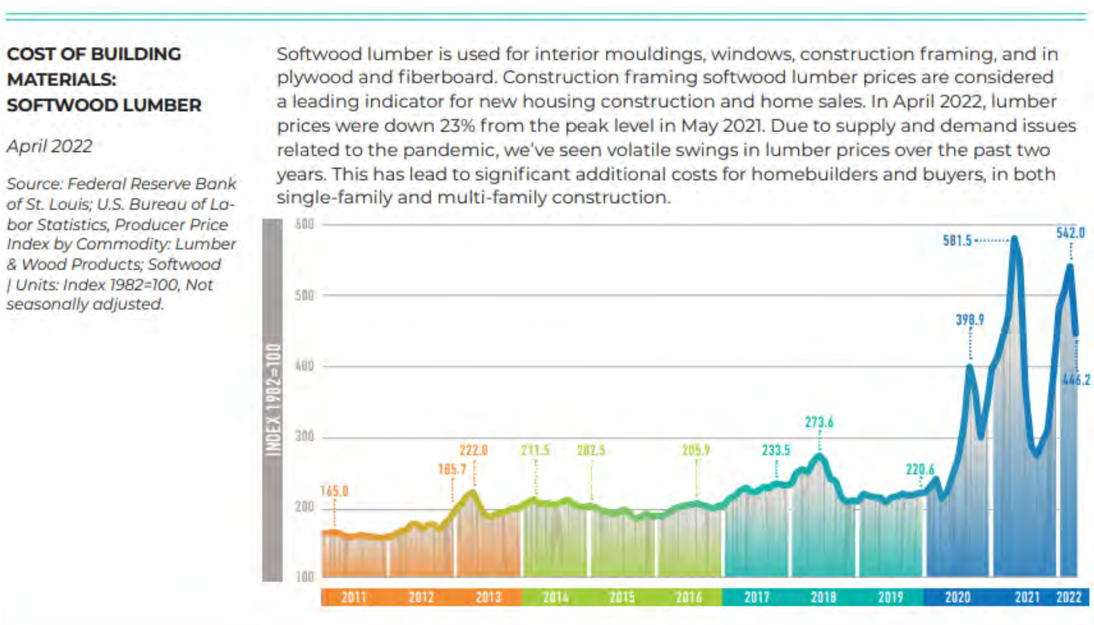
The Department of Resources and Economic Development (DRED) underwent reorganization in July of 2017 as a result of Governor Christopher T. Sununu's plan to refocus the Divisions of Economic Development and Travel and Tourism Development into the Department of Business and Economic Affairs. This was done in an effort to focus on business recruitment and economic development in the State. The project has focused on branding New Hampshire as "Open for Business" and includes a new State website[11] that focuses on why New Hampshire is the right location for businesses and how companies can move, start, and grow their business in the State. Additionally, the program has highlighted the advantages business will have in New Hampshire, such as low taxes and incentives, high quality of life in the State, and a skilled and plentiful workforce. New Hampshire is known to have one of the highest percentages of college educated citizens in the nation and consistently ranks high for the rate of people employed in the fields of science and technology.[12]

It is expected that growth will continue long term across the State as the government puts resources into branding and promoting the State as business friendly. Additionally, consideration will be given to developing and maintaining GIS layers, which may be utilized for examining current and future development trends (mitigation action item #34).
The below graphic provides information relative to the building permits issued by state.[13]



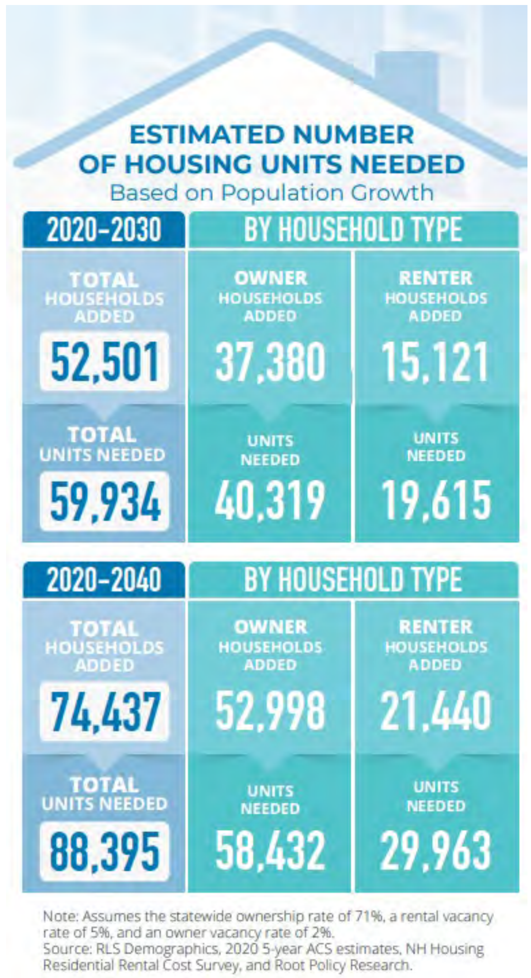
Source: 2023 Statewide Housing Needs Assessment

The below graphic demonstrates the cost of building materials, specifically related to softwood lumber which is utilized as an economic indicator for new housing construction and home sales. Illustrating there have been significant additional costs for homebuilders and buyers resulting in the need for the State to address the lack of affordable housing.



Source: 2022 NH Housing Market Report

"From 2017 to 2021, building permits for new housing unit construction in New Hampshire averaged about 4,000 per year. To meet production needs, building permit activity must increase by 36% statewide through 2030," according to the 2023 Statewide Housing Needs Assessment. It is estimated that between 2020 and 2030, an additional 60,000 units are needed, and this does not address the shortage of units needed for seasonal residence or second homes.



Source: 2023 Statewide Housing Needs Assessment

Due to the COVID-19 pandemic's disruption of the housing market it affected the number of people experiencing homelessness in the State. According to the 2023 Statewide Housing Needs Assessment, more than 4,400 people in New Hampshire experienced homelessness in fiscal year 2021[16]. Black and Hispanic residence are overrepresented in this population; they have less income on average, and therefore are more susceptible to housing instability.

While change in development is inevitable, it is important that jurisdictions consider their most threatened hazards and future impacts of climate change. Careful consideration should be given to the anticipated population growth in the state, it is important to also evaluate the projected houses to be added in the future. The below graphic provides a projected number of houses added between 2020 and 2040 by 5-year interval, by county in the state. It is expected that many households added will be seen in either Hillsborough or Rockingham Counties. In fact, these two areas overall based on the previous hazard analysis completed had the highest risk overall in the entire state. High risk hazards varied from inland or coastal flooding to winter weather (severe).

	2025	2030	2035	2040	Total Households Added Since 2020
New Hampshire	28,945	23,556	14,645	7,292	**74,437**
Belknap	1,558	1,337	794	328	**4,018**
Carroll	1,383	1,043	548	86	**3,060**
Cheshire	868	551	120	-216	**1,323**
Coos	292	89	-157	-383	**-158**
Grafton	2,126	1,989	1,176	635	**5,926**
Hillsborough	9,399	7,508	5,207	3,144	**25,258**
Merrimack	3,004	2,482	1,590	685	**7,761**
Rockingham	7,067	5,875	3,890	1,751	**18,584**
Strafford	2,547	2,365	1,536	1,377	**7,826**
Sullivan	653	397	35	-188	**896**

Source: RLS Demographics, 2020 5-year ACS estimates, and Root Policy Research.

Source: 2023 Statewide Housing Needs Assessment

Additionally, NH RSA 674:59 states that municipalities that have adopted land use regulations and ordinances shall provide regulations and ordinances that provide for reasonable and realistic opportunities for the development of Workforce Housing Opportunities. The adoption of Open-Space Residential Development ordinances reflects the need for new affordable housing options and the need for conservation. Open-Space or Cluster Development allows for structures to be grouped together in compact fashion allowing for open space and conservation, rather than traditional large-scale single-family housing developments that require a large amount woodland clearing and road development.

In the Town of Bedford[15], specific language in Article V Cluster Residential Development specifies design priorities such as lessening the area devoted to motor vehicle access and minimizing alteration of the natural site. The Article also specifies that natural surface drainage channels be incorporated into the design or preserved as open space. Open space can be used for recreational facilities, community wells, and timber management.

In 2022, state officials secured a $100 million investment into InvestNH.[14] $5 million was specifically set aside to provide grants to municipalities to study zoning and regulations that create barriers to housing development.

“The InvestNH initiatives are important pieces to the solution and will have a direct positive impact on affordable housing stock in the state. Of 1,472 units being built from the initial $60 million under InvestNH, 591(40%) are being built to increase housing stock in your cities, and the average affordability commitment is 31 years under the program." – Governor Christopher T. Sununu

These investments, coupled with changes to Open-Space Residential development ordinances, not only are communities seeking to better serve vulnerable communities, but also to help conserve green spaces and lessen the environmental impact of development.

For commercial properties in New Hampshire, the National Association of Realtors published quarter one data from 2023 that reviewed the square foot net absorption of commercial property compared to 2022.[15] Demonstrated by the table below, the vacancy rate and overall sales have decreased from 2022 Q1 to 2023 Q1.

	Net Absorption SF	Net Absorption SF 12 Months	Market Rent Growth 12 Months	Market Rent/SF	Vacancy Rate
2023 Q1	-307,582	359,129	8.7%	$10	3.7%
2022 Q1	182,515	891,613	8.1%	$9	4.1%
	Inventory SF	**Net Delivered SF**	**Net Delivered SF 12 Months**	**Market Cap Rate**	**Total Sales Volume**
2023 Q1	43,169,751	0	215,010	7.2%	$6.00M
2022 Q1	42,954,741	0	10,022	7.1%	$27.89M

Sources: NAR analysis on data from the U.S. Census Bureau, U.S. Bureau of Labor Statistics, Bureau of Economic Analysis, USPS, CoStar

In review of the City of Manchester local hazard mitigation plan, they addressed several expectations relative to future development that can be generally applied to other urban areas. These include infill within jurisdictions near interstates or main roadways, high density centers, low density peripheries, and the adaptive reuse of existing buildings.

Comparably to residential ordinances, jurisdictions that have commercial properties are adopting local regulations to deal with the current and future changes. For example, the Town of Windham has a commercial building size limit of 10,000 square feet in their Village Center Zoning District. Another prime example is in the Town of Londonderry, the Performance Overlay District limits the size of large commercial development. Communities in the western part of the state, such as the Town of Walpole are also addressing this by adopting a limit of 40,000 square foot limit in their Commercial District.

Relative to state assets, there are only two owned and operated facilities that have been constructed since 2018. One wooden building was constructed in Coos County (2019) and another wooden building was constructed in Grafton County (2020). Data is not presently available pertaining to state leased properties. Another area significant to discussion is concerning the new or redevelopment of college or university campuses within the state.

The University System of New Hampshire (USNH) Office of Capital Planning and Development is responsible for the management and oversight of all USNH capital planning and facilities and programs. USNH in compliance with RSAs 21-I:81-a and 21-I:81-b provides information to Keene State College, Plymouth State University, and the University of New Hampshire projects.[18] Data is limited pertaining to the Community College System of New Hampshire.

At the time of the development of this plan, commercial data relative to recent or projected development was not available to be included.

3.10 Development in Hazard Prone Areas

Currently the State implements State Executive Order 96-4, an Order for State agencies to comply with floodplain management requirements. This Executive Order, signed by Governor Merrill in 1996, requires all State agencies to comply with the flood plain management requirements of all local communities participating in the National Flood Insurance Program in which State-owned properties are located.

All other development requirements for hazard areas (e.g., floodplains, steep slopes, wetlands, etc.) are implemented at the local level through community Zoning Ordinances, Subdivision Regulations and Site Plan Regulations.

Based upon the continued increase in population and development throughout the State it can be assumed that New Hampshire's vulnerability to the identified hazards has increased. Similarly, State owned and/or operated assets remain increasingly vulnerable due to aging infrastructure.

Currently the State does not maintain summary data to track development and potential future growth at the State-owned properties level in hazard-prone areas nor does the State maintain a summary of State-wide development in hazard-prone areas, as the Executive Order (1996), NFIP, and Zoning Ordinances greatly restrict development within these areas. Information regarding previous and future development can be individually retrieved from several sources. Locally, a community's planning and/or zoning board maintains this information. Additional local information may be available within a community's Local Hazard Mitigation Plan. The New Hampshire Municipal Association provides a directory of incorporated communities websites, town office contacts, or city council contacts at www.nhmunicipal.org. NH HSEM Previous and future development in hazard prone areas that are related to mitigation efforts to limit potential risks and are funded through NH HSEM via Hazard Mitigation Assistance can be found in Appendix I. NH DOT Division of Project Development maintains information on current and future development for areas of development within their purview. A list of all NH DOT's "Active Construction Projects" can be found at www.dot.nh.gov.

3.11 State Building Code

The State of New Hampshire has adopted building codes which govern both residential and non-residential structures. The New Hampshire State Building Code uses the 2018 International Residential Code (IRC) and the 2018 International Building Code (IBC) as base standards for the State codes for residential and non-residential structures, respectively. There are other code standards which govern non-structural areas of design, all of which can be found at the State of New Hampshire Building Code website.[17]

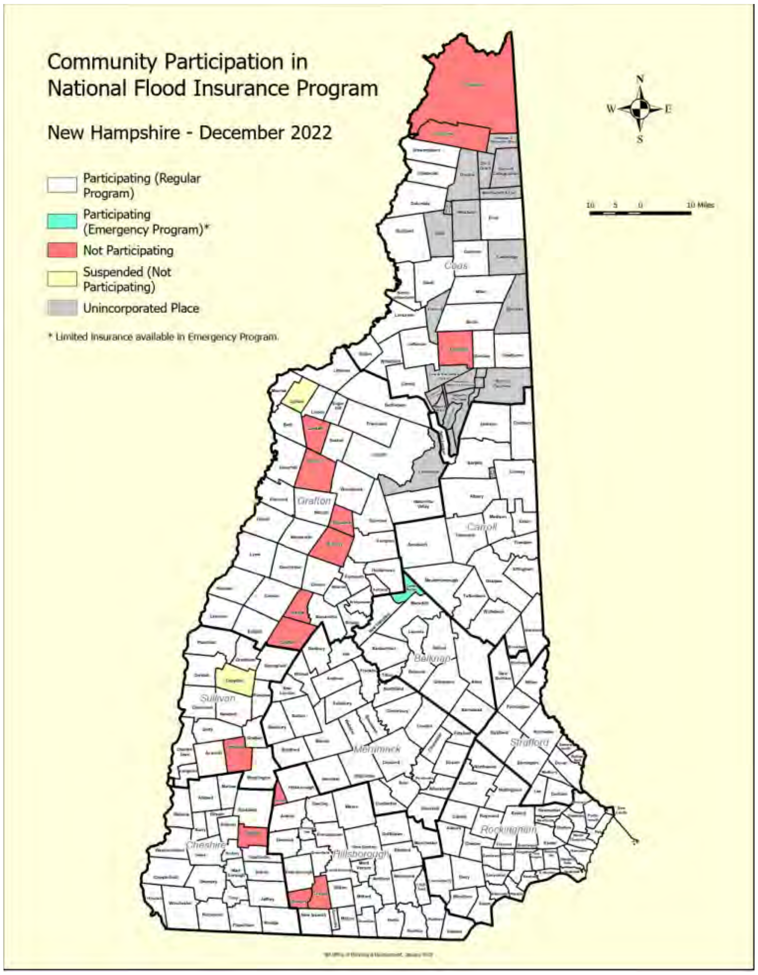
Many communities in New Hampshire do not have building code enforcement officials. This does not relieve the owner or design professional from meeting the requirements of the New Hampshire State Building Code in those communities without code enforcement. Not every community in New Hampshire enforces the requirements in IBC 2018, Chapter 17, for special inspections of structures.

NH RSA RSA 673:1 allows for the establishment of local planning boards that can adopt zoning ordinances and building codes. Originally established as the Office of Strategic Initiatives, the office now falls under the Department of Business and Economic Affairs, Office of Planning & Development (OPD). OPD serves as the central repository for all 'local land use' ordinances and other planning and zoning information. The same RSA provides for an annual survey to be conducted to gather information regarding any updated information.

Results from the 2021 Survey surveyed 234 municipalities and 9 village districts. Of note, there are only 18 municipalities without zoning codes.

- 173 municipalities have adopted local enforcement of State Building Codes
- 255 municipalities, including 25 unincorporated areas have Planning Boards in place
- 154 communities have Ground Water Protection Ordinances
- 179 have Wetland Protection Ordinances.

Municipalities that do not have zoning ordinances have opted to adopt floodplain development ordinances so that their community can participate in the National Flood Insurance Program. 220 communities participate in the National Flood Insurance Program.



Upon review of local hazard mitigation plans, many of the New Hampshire communities follow their own guidelines when it comes to planning and development in hazard prone areas.

3.12 National Flood Insurance Program

The Office of Planning and Development ("OPD") administers and coordinates the State's role in the National Flood Insurance Program ("NFIP"). The information within this section was obtained in collaboration with the Director of the Office of Planning and Development. The NFIP is a federal program administered by the Federal Emergency Management Agency ("FEMA") that allows property owners in participating communities to purchase insurance protection against losses from flooding. Communities can voluntarily participate in the NFIP by making an agreement with FEMA and adopting and enforcing floodplain regulations to reduce the flood risks of new construction in FEMA's designated special flood hazard areas. Since the 2018 Plan update, New Hampshire community participation in the NFIP has grown by 1 community for a total of 220 communities or 93 percent of the state's communities. These communities participate in the NFIP and have adopted at least the minimum standards of the NFIP, which regulate development in the 100- year, or 1% annual chance, floodplain. The regulations mitigate flood damage by requiring new and substantially improved structures to be elevated, or for non-residential structures, flood proofed to, or above the 1% annual chance Base Flood Elevation ("BFE"). With respect to hazard mitigation, the OPD NFIP staff's goal is to reduce the loss of life and property damage due to flooding. The OPD NFIP staff works with the State Hazard Mitigation Team in identifying and approving Hazard Mitigation Grant Program ("HMGP") and Flood Mitigation Assistance ("FMA") grants. The Biggert Waters Flood Insurance Reform Act of 2012 eliminated the Repetitive Flood Claim ("RFC") and Severe Repetitive Loss ("SRL") programs and moved their functions under the FMA program.

NH OPD conducts community assistance visits and formal contacts each year to varying communities to ensure that participating communities have the proper regulations, as well as, to educate the local officials as to their NFIP responsibilities and to offer technical assistance on the NFIP. OPD also provides general technical assistance related to the NFIP to local officials, the public, surveyors, realtors, and others by phone and email on a regular basis. These contacts along with annual workshops and training, a quarterly NFIP newsletter, and information made available on OPD's website play a vital role in ensuring that the primary goal of the NFIP, to reduce the loss of life and property due to flooding, is implemented.

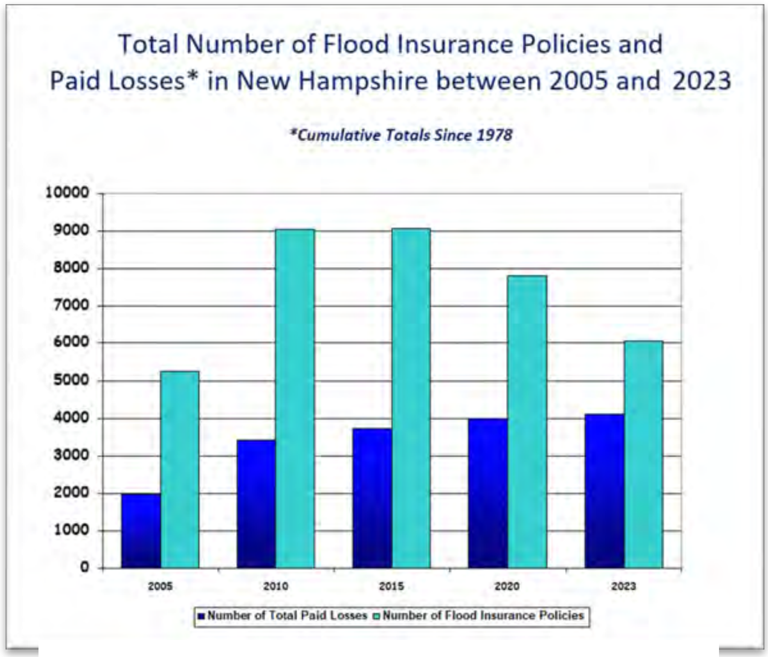
Flood insurance coverage in the State has continued to decrease from its peak of just over 9,000 policies in 2013 to the current number of policies of just over 6,000. The current total amount of flood insurance coverage is just over $1.5 million. In contrast, the State's flood insurance paid losses have doubled in the last almost 20 years and have resulted in just over $54 million in paid loss amounts.

NH OPD also provides a state model floodplain ordinance to make it easier for communities to meet NFIP minimum floodplain management standards and to encourage higher regulatory standards that can increase community resilience to flooding and earn communities credit through the Community Rating System ("CRS"), if they participate.

National Flood Insurance Program Statistics					
County	**NFIP Policies**	**Insurance in Force**	**Total Paid Losses**	**Total Paid Amount**	**Total Relative Loss Properties**
Belknap	174	$40,634,700	116	$980,204	40
Carroll	286	$76,029,900	278	$2,191,094	51
Cheshire	306	$80,112,000	244	$6,567,069	50
Coos	110	$21,624,800	86	$504,605	16
Grafton	607	$139,801,200	348	$4,493,629	104
Hillsborough	947	$249,921,200	597	$9,975,545	199
Merrimack	395	$107,289,900	306	$6,338,688	141
Rockingham	3,165	$770,051,600	1,875	$19,069,165	558
Strafford	186	$52,548,400	133	$2,213,318	41
Sullivan	115	$26,367,200	49	$986,881	6
Total:	**6,291**	**$1,564,380,900**	**4,032**	**$53,320,198**	**1,206**

"Repetitive Loss" means flood related damaged sustained by a structure on two separate occasions during a 10-year period for which the cost of repairs at the time of each such flood event, on the average, equals or exceeds 25 percent of the market value of the structure before the damage occurred. *Source: NH OPD, Dec 2022.*

Since 2011, New Hampshire's interagency pre- and post-incident response and recovery team of federal and state agencies has been working together to increase awareness and reduce flood risk and facilitate partnerships related to mitigating and recovering from flooding events in New Hampshire. In 2015, the State's team became part of the U.S. Army Corps of Engineers and the Federal Emergency Management Agency's collaborative initiative called the Silver Jackets. The team has worked on several projects together including the development of the 2018 New Hampshire Flood Hazards Handbook for use by the state's municipal officials as a resource to help communities prepare for, respond to, recover from, and mitigate floods.



(Source: *The Office of Planning and Development*

In 2020, the State's Floodplain Management Program developed a Substantial Damage Strategy. The purpose of this strategy is to identify and document activities that the Program staff will perform to ensure that local NFIP-participating communities are fully prepared to enforce Substantial Damage and Substantial Improvement ("SD/SI") requirements. SD/SI requirements are minimum NFIP standards included in all participating communities' floodplain regulations and within the State's Building Code that must be enforced by a community in order for it to remain in good standing in the program. The Strategy is organized into six main action areas: communication, training, data, recovery staff coordination, ensuring enforcement, and mitigation options coordination. The Program staff has also developed a web site page, which includes information and resource links, a training module, and past webinar recordings about substantial damage.

The structures in the state that are at high risk of flooding include the repetitive and severe repetitive loss structures, which also account for many of the structures that are experiencing repetitive losses due to increased precipitation across the state and more frequent high tide flooding along the Atlantic coast. The total repetitive and severe repetitive loss structure losses continue to slowly increase following the sharp increase of the back-to-back flooding events in 2006 and 2007 in the southern portion of the state. Currently, there are 741 repetitive loss buildings and just over $28 million in policy payments to those buildings.

The actions taken to help reduce the number of these structures is to encourage and assist the municipalities where these structures are located about FEMA's mitigation grants. A new action by the State will be to develop and maintain the State's priority mitigation property list, which will include repetitive loss and severe repetitive loss properties and any other known high-risk structures. The State will continue to work with the municipalities where these priority properties are located and assist them in exploring FEMA and other relevant grant sources to address the flood risk to these properties. OPD has not identified any additional NFIP challenges during their coordination with FEMA on behalf of the State.

The State's Floodplain Management Program staff works closely with the FEMA Region's flood risk staff on prioritizing mapping needs in the state and coordinating on FEMA mapping projects. The State developed and maintains a web site page that contains information and resource links about FEMA mapping information and available flood risk data for use by municipalities in their local planning and mitigation plans. In addition, the web page contains outreach materials that can be customized and distributed by the municipality to their residents about FEMA mapping information and flood risk data.
Repetitive Loss (SRL) programs and moved their functions under the FMA program.

3.13 COMMUNITY RATING SYSTEM

The information within this section was obtained in collaboration with the Director of the Office of Planning and Development ("OPD"). The Community Rating System (CRS) is a voluntary incentive program that encourages communities to adopt and enforce floodplain regulations and activities that go beyond the NFIP minimum requirements. The objective of CRS is to reward communities that are doing more than meeting the NFIP requirements by reducing the flood insurance premiums of their residents by a certain percentage. There are currently five communities in New Hampshire that participate in CRS. These communities are listed in the table below. Each one has a local hazard mitigation plan and is eligible to receive funding for flood mitigation projects.

CRS Communities in New Hampshire		
Community	**CRS class**	**Premium Discount**
Keene	8	10%
Marlborough	8	10%
Nashua	8	10%
Peterborough	8	10%
Winchester	9	5%

New Hampshire's Floodplain Management Program staff provides ongoing assistance to communities that are either participating in or interested in FEMA's Community Rating System ("CRS"). To help facilitate this assistance, in October 2018, the staff held the first meeting of the NH CRS Users Group. The purpose of the Group is to be a support and educational resource for communities that participate in CRS or who are interested in joining or learning more about the program. During the Group's quarterly meetings, attendees can share ideas, best practices, and hear from guest speakers about CRS-related topics.

3.14 Risk MAP

(Source, *FEMA)*

FEMA's current mapping program is called Risk MAP (Mapping, Assessment and Planning). The goal of the Risk MAP program is to deliver quality flood hazard data and maps that increase public awareness about flooding and lead to actions that reduce risk to life and property. The Risk MAP effort strengthens partnerships with local communities as the emphasis is on seeking innovative ways to identify hazards and weaving this information into the local and regional decision-making processes.

New Hampshire's current Risk MAP Business Plan outlines the State's strategic approach to supporting the goals of RiskMAP, with a particular focus on activities related to floodplain mapping and outreach. The Plan identifies the State's current project management activities and goals, as well as technical flood mapping and associated outreach efforts. It also provides updates on the State's related mapping activities, identifies the State's mapping needs and priorities, and presents the State's recommendations for future floodplain mapping.

There are currently several Risk MAP projects underway in New Hampshire. The first step in a Risk MAP project is called the Discovery process, which is used to help determine whether a mapping project is needed, and if so, what the scope of the project will be. The Discovery phase is completed at the watershed level, and there are several Discovery phases either currently underway or recently completed in the State. Following the Discovery phase, new Flood Insurance Rate Maps (FIRMs) and Flood Insurance Study (FIS) reports are created for that watershed and published as county maps. For communities located in multiple watersheds, they may be part of multiple Risk MAP projects. The Federal Emergency Management Agency (FEMA) will continue to update local communities at each step of the mapping project and provide opportunities for input. Current Risk MAP projects are detailed on OPD's website.

ENDNOTES – STATE PROFILE

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[2] International Air Transport Association (IATA) and Federal Aviation Administration (FAA) airport code. International Civil Aviation Organization (ICAO) airport code is KMHT

[3] All statistics/info on MHT was obtained from https://www.flymanchester.com

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[15] Town of Bedford, NH Cluster Residential Development (ecode360.com)

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[18] Capital Planning & Development | University System of New Hampshire (usnh.edu)

4. Hazard Identification and Risk Assessment

4.1 Introduction/Overview

The impact of expected, but unpredictable, natural, technological, and human-caused events can be reduced through emergency management and strategic planning.

The hazard identification and risk assessment processes form the foundation upon which we refine our hazard mitigation strategies and activities in order to minimize the potential impacts we experience as a result of the identified threat.

The risk assessment process allows the State of New Hampshire to evaluate risk to people, infrastructure, structures, and critical facilities that are vulnerable to hazards, and the degree to which injuries or damage may occur.

The hazards identified in the 2018 SHMP were reviewed and discussed internally by the SHMPC. We then sent the hazard narratives out to Subject Matter Expert (SME) stakeholder groups to be reviewed and updated.

44 CFR §201.4(c)(2): States are required to undertake a risk assessment that provides. '…the factual basis for activities proposed in the strategy portion of the mitigation plan. Statewide risk assessments must characterize and analyze natural hazards and risks to provide a statewide overview.'

4.2 Threat and Hazard Identification and Risk Assessment (THIRA) Integration

Presidential Policy Directive 8 (PPD-8) is aimed at strengthening the security and resilience of the United States through systematic preparation for the threats that pose the greatest risk to the security of the Nation, including acts of terrorism, cyber-attacks, pandemics, and catastrophic natural disasters.

National Preparedness is the shared responsibility of all levels of government, the private and non-profit sectors, and individual citizens within the Nation. Everyone has the ability to contribute to safeguarding the Nation from harm. PPD-8 aims to facilitate an integrated, nation-wide, capabilities-based approach to preparedness.

In 2018, the State of New Hampshire was required to complete an annual THIRA/SPR report as a condition of receiving federal funding for the Emergency Management Performance Grant (EMPG) Program and the Homeland Security Grant Program (HSGP), due December 31 of each year.

Due to a change in guidance and methodology released by from FEMA in 2018, the reporting period for the THIRA/SPR changed as follows:

2018	The THIRA/SPR had to be completed for cross-cutting Response, and Recovery core capabilities only.
2019	The THIRA/SPR had to be completed for all core capabilities.
2020-2022	The THIRA/SPR requirement shifted to a new three-year cycle, where only an update of the SPR will be required during the first two years, and a complete THIRA/SPR report will be due at the end of the third year for all core capabilities.

NH HSEM conducted and completed the THIRA/SPR with cooperation from over a dozen agencies and organizations, including state agencies, local communities, and private and non- profit sectors involved in all five mission areas of emergency management while following guidance from FEMA's Comprehensive Preparedness Guide (CPG) 201, Third Edition, May 2018.

The THIRA process helps communities determine:

A jurisdiction's plausible catastrophic events – natural, technological, and human-caused, Impacts of the specified events, Core capability targets related to impacts, Capability estimation of resources required to be better prepared, including shared resources, and Actions that could be employed to avoid, divert, lessen, or eliminate a threat or hazard.

The THIRA is a scenario-based review of the threats and hazards of most concern to the State that provides impacts of scenario driven threats and hazards along with desired response outcomes. From this information, the State develops *Capability Targets* which describe what the State seeks to be able to be prepared for and then identifies the resources required to meet the *Capability Targets*. The THIRA differs from a traditional Hazard Identification and Risk Assessment (HIRA) in that it only looks at the natural, technological and human caused hazards deemed to have the largest impact(s) to the State and relies on realistic scenarios; whereas a traditional HIRA is broader in nature and looks at potential natural hazards only, their probability of occurrence, and their potential impacts – no matter how small or large. The THIRA methodology provides a framework for emergency management organizations to define threats and hazards of concern to the State and its communities and assess the capabilities desired by the agencies designated to respond to the consequences of these threats and hazards.

The 2022 THIRA/SPR was developed by looking at past THIRA submissions and the HIRA, contained in the State Hazard Mitigation Plan. The planning team determined that New Hampshire faces unique challenges, and that the State has experienced unique challenges since the 2019 THIRA/SPR was completed. The State's COVID-19 response tested many of the state's capabilities, and scenarios were adjusted accordingly, including the addition of Pandemic.

The 2022 THIRA incorporated the following threats and hazards:

2022 THIRA Threats and Hazards		
Natural Hazards	**Technological Hazards**	**Human-caused Hazards**
• Coastal and Inland Flooding • Winter Storm/Ice storm • Pandemic	• Hazmat Release • Chemical	• Active Shooter • Cyber Attack • Explosive Devices

4.3 HAZARD IDENTIFICATION

The 2018 State Hazard Mitigation Plan identifies natural, human caused and technological hazards. The SHMPC determined that the 2023 Plan needed to focus its attention on natural hazards. These types of hazards are at the core of hazard mitigation and are hazards that New Hampshire can take meaningful steps to prevent.

Three elements were added to all 2023 Hazards. To make the information more accessible to those reviewing and utilizing the plan, tables were developed to keep the data organized and easily read.

- Community Lifelines: These are a new development for the State and local communities. These tables are meant to serve as a guide for discussion in community planning meetings, as well as baseline information for State Planners.

- Impact of Climate Change on Hazards: These tables are designed to guide local communities in their own discussions on how climate change impacts hazards in their area.

- Individuals/Communities Disproportionately Impacted by Hazards: The SHMPC wanted a clear and concise way to discuss how some community members feel the impacts from hazards differently. This helps us to further our goal of utilizing the Whole Community approach to discuss vulnerable populations. More information on this can be found in Section 4 with the County Risk Analysis.

4.4 2023 Changes to Threats and Hazards

2018 Threats and Hazards	2023 Hazards	Description of change(s)
Aging Infrastructure	Aging Infrastructure	Move to Annex E
Coastal Flooding	Coastal Flooding	
Conflagration		Move to Annex E
Cyber Event		Move to Annex E
Dam Failure		Replaced with High Hazard Potential Dam
Drought	Drought	
Earthquake	Earthquake	
Extreme Temperatures	Extreme Temperatures	
Infectious Diseases	Infectious Diseases	
Hazardous Materials		Move to Annex E
Inland Flooding	Inland Flooding	
Known and Emerging Contaminates		Move to Annex E
Tropical and Post-Tropical Cyclones	Tropical and Post-Tropical Cyclones	
Landslide	Landslide	
Lightning	Lightning	
Long Term Utility Outage		Move to Annex E
Mass Casualty Incident		Move to Annex E
Radiological	Radiological	
Severe Winter Weather	Severe Winter Weather	
Solar Storm and Space Weather	Solar Storm and Space Weather	
Avalanche	Avalanche	
Transport Accident		Move to Annex E
Terrorism/Violence		Move to Annex E
High Wind Events	High Wind Events	
Wildfire	Wildfire	

4.5 Meteorological Trends

September 2020, the CDC Climate and Health Program published a fact sheet to help communities about climate change impacts titled *Impacts of Climate Change in the Northeast*. The information outlined some of the potential impacts of changes in meteorological trends that will likely affect New England including:

- Changes in Precipitation
- Changes in Temperature
- Changes in Sea Level

Potential Impacts of Changes in Meteorological Trends

Communities may consider utilizing the *New Hampshire Climate Assessment 2021* publication. This report was supported and funded by the New Hampshire Department of Environmental Services (NH DES). This publication provides an overview of the report, information about relevant historical climate change impacts, and potential future climate change impacts. This publication is updated periodically, and communities should ensure that they are utilizing the most recent version available.

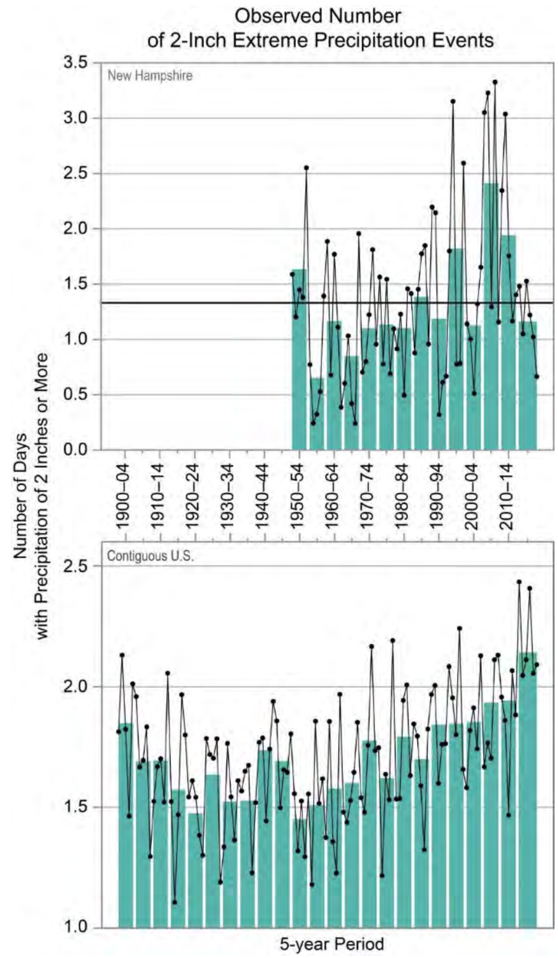
Communities may also consider reviewing the *NH Climate Action Plan* which was released in 2009. NH DES is utilizing Federal funding from the Inflation Reduction Act to update this publication and it is anticipated to be done by 2025.

The National Oceanic and Atmospheric Administration (NOAA), in partnership with the North Carolina Institute for Climate Studies (NCICS), have produced state climate summaries detailing changes and projections in temperature, precipitation, and sea-level rise. Additional information is also detailed within the *New Hampshire Climate Assessment 2021*. The key messages for the State of New Hampshire include the following:

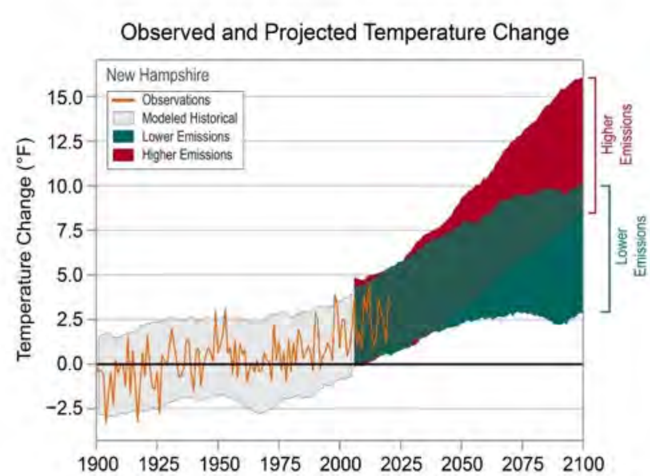
- The average annual temperature has increased approximately 3°F in New Hampshire since the early 20th century. Winter warming has been larger than any other season.
- Precipitation has increased during the last century, with the highest numbers of extreme precipitation events occurring over the last decade. Mean precipitation and precipitation extremes are projected to increase in the future, with associated increases in flooding.
- Rising sea levels pose significant risks to coastal communities and structures, such as inundation, land loss due to erosion, and greater flood vulnerability due to higher storm surge.

Potential Changes in Precipitation

- Increased soil erosion and agricultural runoff (including manure, fertilizer, and pesticides) may lead to excess nutrient loading of water bodies.
- Runoff may also increase potential food safety or public health issues from food and waterborne infections.



Potential Changes in Temperature



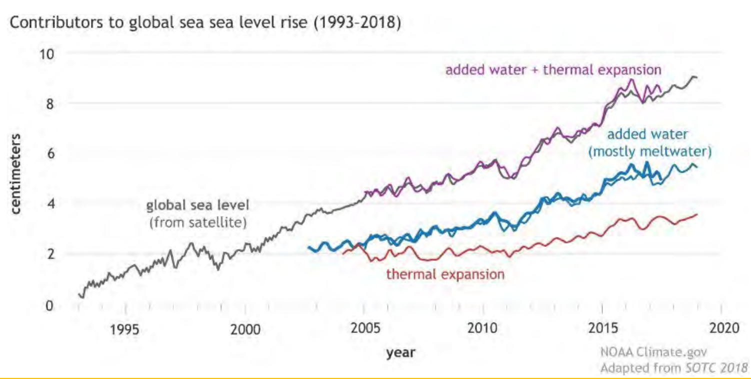
- Warmer winters and springs may have negative consequences on northern forest ecosystems, potentially impacting valuable rural industries, including logging and outdoor recreation.
- Potential changes to the growing season. This may increase pressure from weeds and pests, resulting in potential increased use of/demand for pesticides. This may increase the human health risks associated with potential chemical exposures.
- Potential increased exposure to vector-borne diseases.
- Warmer water temperature may lead to increasing prevalence of shell disease in lobsters

and pathogens in oysters - pathogens that infect shellfish also pose risks to human health if consumed.

- During extreme heat events, nighttime temperatures in the region’s big cities may be generally several degrees higher than surrounding regions, leading to a higher risk of heat-related injuries.
- The hottest days in the Northeast may also be associated with high concentrations of urban air pollutants including ground-level ozone.
- Winter warming may have large effects on snowfall and snow cover.

Potential Changes in Sea Level

- When coupled with storm surges, sea level rise can pose severe risks including flooding and soil erosion.
- Environmental impacts of sea level rise have associated physical, mental health, and economic impacts on people who live in coastal communities.



What are some of the signs of changes in meteorological trends?

- Temperatures rising world-wide due to greenhouse gases trapping more heat in the atmosphere.
- Droughts becoming longer and more extreme around the world.
- Tropical storms becoming more severe due to warmer ocean water temperatures.
- As temperatures rise, less snowpack in mountain ranges and polar areas and the snow melts faster.
- Sea ice in the Arctic Ocean around the North Pole melting faster with the warmer temperatures.
- Sea levels rising, threatening coastal communities and estuarine ecosystems.

Changes in Meteorological Trends, Vulnerable Populations, and Equity

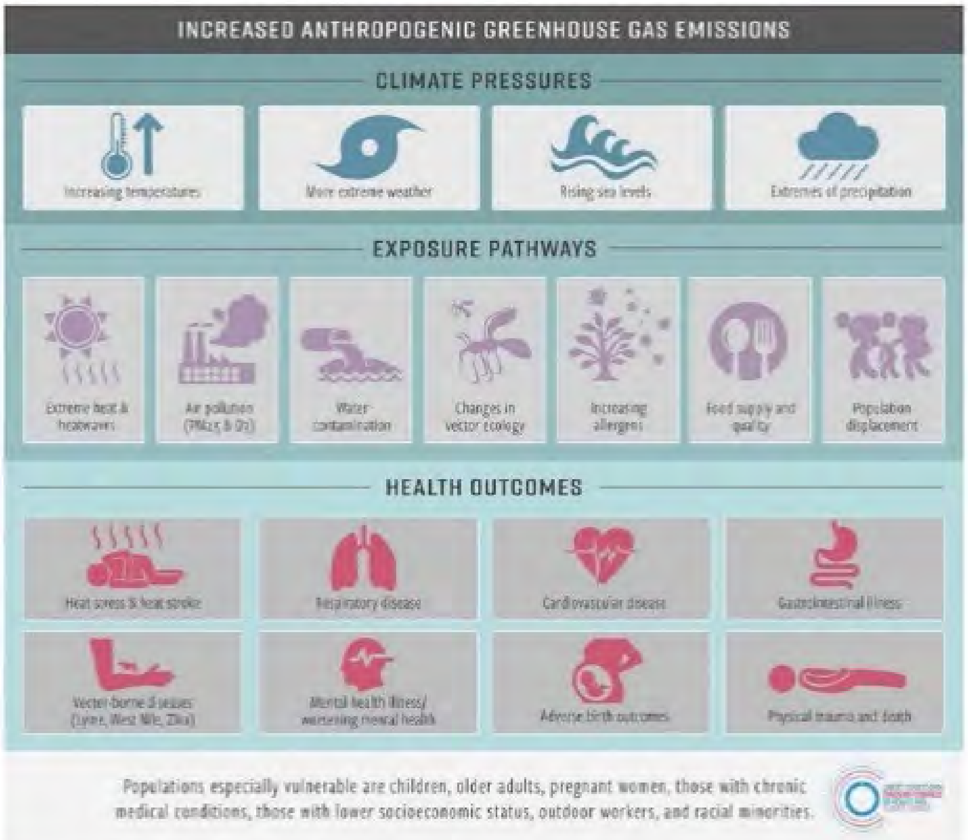


Figure created for Brief by M. Lee (Climate Nexus).

Nature-Based Solutions

Nature-Based Solutions are sustainable planning, design, environmental management, and engineering practices that weave natural features or processes into the built environment to promote adaptation and resilience. These solutions use natural features and processes to (taken from FEMA's *Nature-Based Solutions*[9]):

- Combat climate change
- Reduce flood risk
- Improve water quality
- Protect coastal property
- Restore and protect wetlands
- Stabilize shorelines
- Reduce urban heat
- Add recreational space
- And more

Nature-based solutions offer significant monetary and non-monetary benefits. They often come at a lower cost than traditional infrastructure.

These benefits include economic growth, green jobs, increased property values and better public health.

While FEMA uses the term "nature-based solutions," other organizations use related terms, such as green infrastructure, natural infrastructure, natural and nature-based features, or Engineering with Nature®, a program of the U.S. Army Corps of Engineers.

		Adaptation approaches			Mitigation	Feasibility dimensions	
Hazard	Response	Incremental	Transformational	Evidence/agreement	Co-benefits	Barriers	Enablers
Extreme storms causing severe flooding and erosion	Integrated ecosystem and watershed management	Restoration of stream corridors to incorporate environmental flows; continuing to build hardened surfaces and stream diversions in urban areas to accommodate infrequent, yet extreme, storm events	Restoration of streambanks and beds to stabilise and slow flows; use of drought-tolerant plantings and shade trees to reduce evaporation rates; incorporation of pervious surfaces in urban settings in combination with designating wide buffer area within floodplains to accommodate increased frequency of extreme events; integration of equity and justice considerations	*Medium*	Conservation of soil and increased opportunity for carbon sequestration	Sectors working in silos, inadequate financing, inability to identify shared goals (EC, INST, SOC, GEO)	Development of a coordinated suite of adaptation efforts, co-produced among stakeholders and across sectors (INST, SOC, ENV, TEC)

Notes:
This table is modified from the IPCC SR1.5 adaptation feasibility assessment for Land and Ecosystem Transitions (IPCC, 2018). Feasibility dimensions (can be barriers and/or enablers) are as follows: Economic (EC), Technological (TEC), Institutional (INST), Sociocultural (SOC), Environmental/Ecological (ENV) or Geophysical (GEO) (Chapter 16).

Simplified example for transitioning from incremental to transformative adaptation approaches to support future climate-resilient sustainable development.

4.6 Statewide Risk Assessment

The SHMPC met to discuss the statewide risk assessment and assign rating scores. Prior consideration had been given to climate change, current capabilities, State assets and critical infrastructure and their locations, population data, and previous/historical occurrences when determining the scale of impacts and overall risk (probability of occurrence). Subject matter experts were consulted to ensure accuracy of these ratings. The thoroughness of these considerations prompted the 2023 team to utilize the same methodology. State assets and their vulnerabilities are discussed in Chapter 7 of this plan.

4.7 METHOD FOR RATING IMPACTS, PROBABILITY OF OCCURRENCE, AND OVERALL RISK

Impacts

The impact is an estimate generally based on a hazard's effects on humans, property, and businesses. The SHMPC came together and determined the impact rating for each of the previously identified hazards. If a hazard was identified as a threat to the entire State, the impact rating was determined with the entire State in mind. The average impact score was calculated by computing the average of the human, property, and business impact scores. The impact ratings were broken into the following categories:

1: Inconvenience, reduced service/productivity, minor damages, non-life-threatening injuries
3: Moderate to major damages, temporary closure and reduced service/productivity, numerous injuries, and deaths
6: Devastation and significant injuries and deaths, permanent closure and/or relocation of services, long-term effects

Probability of Occurrence

The probability of occurrence is a numeric value that represents the likelihood that the given hazard will occur within the next 10 years. This value was chosen based on historical information provided by subject matter experts in the HIRA. The NH HSEM SHMP Internal Working Group came together and determined the probability of occurrence rating for each of the previously identified hazards. The probability of occurrence ratings was broken into the following categories:

1: 0-33% Probability of occurring within 10 years (Low)
2: 34-66% Probability of occurring within 10 years (Medium)
3: 67%-100% Probability of occurring within 10 years (High)

Overall Risk

The overall risk is a representation of the combined potential impact and probability of occurrence ratings. This is calculated by multiplying the probability of occurrence rating score by the impact rating score (the average of the human, property, and business impacts). The goal of identifying the overall risk of each identified hazard is to assist the State in determining which hazards pose the largest potential threat to the State. This will allow the SHMPC to use the overall risk ratings to develop targeted mitigation actions that allocate funding and resources to the highest rated hazards first. The overall risk ratings are broken down and color coded into the following categories:

Yellow	**(**Values 1-6) Hazard poses a low risk to most vulnerable counties identified.
Orange	**(**Values 7-12) Hazard poses a medium risk to most vulnerable counties identified.
Red	**(**Values 13-18) Hazard poses a high risk to most vulnerable counties identified

4.8 STATEWIDE RISK ASSESSMENT – RATING TABLE

Threat/Hazard	Classification	Human Impact	Property Impact	Economic/ Business Impact	Average Impact Score	Probability of Occurrence	Overall Risk
Avalanches	Natural	1	1	1	1	2	**2**
Coastal Flooding	Natural	3	6	6	5	3	**15**
Inland Flooding	Natural	6	6	6	6	3	**18**
Drought	Natural	1	3	3	2	2	**4**
Earthquakes (>4.0)	Natural	1	3	1	2	1	**2**
Extreme Temperatures	Natural	3	1	1	2	3	**6**
High Wind Events	Natural	3	6	3	5	3	**15**
Infectious Diseases	Natural	3	1	3	2	2	**4**
Landslide	Natural	1	3	3	2	3	**5**
Lightning	Natural	1	3	1	2	3	**6**
Severe Winter Weather	Natural	6	6	6	6	3	**18**
Solar Storms & Space Weather	Natural	3	1	3	2	1	**2**
Tropical & Post-Tropical Cyclone	Natural	6	6	6	6	2	**12**
Wildfire	Natural	1	1	1	1	2	**2**
Aging Infrastructure	Technological	3	6	3	4	3	**12**
Conflagration	Technological	6	6	6	6	2	**12**
Dam Failure	Technological	3	3	3	3	2	**6**
Known and Emerging Contaminants	Technological	6	6	3	5	3	**15**
Hazardous Materials	Technological	1	3	3	2	3	**6**
Long-Term Utility Outage	Technological	6	6	6	6	1	**6**
Radiological	Technological	1	1	3	2	1	**2**
Cyber Event	Human-caused	3	1	6	3	3	**9**
Mass Casualty Incident	Human-caused	6	1	3	3	1	**3**
Terrorism/Violence	Human-caused	6	3	3	3	3	**9**
Transport Accident	Human-caused	3	3	3	3	3	**9**

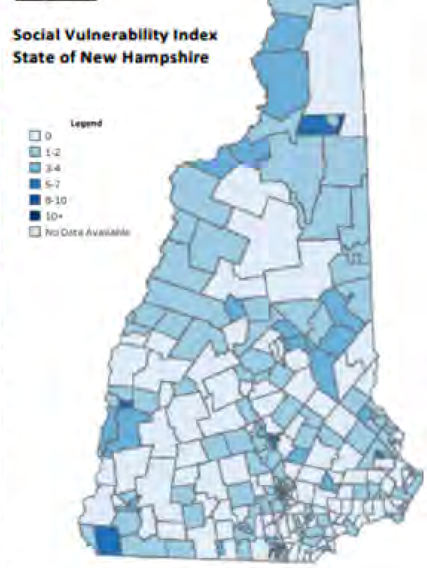
4.9 RISK ANALYSIS BY COUNTY

The Risk Analysis by County was compiled by a combination of efforts from the NH HSEM Mitigation team and Regional Planning Commissions. The State's various plan writers and Regional Planning Commissions conduct local risk assessments for the completion of Local Hazard Mitigation Plans and as such maintain the data and information regarding the risk at the local level.

The Regional Planning Commissions outlined the most vulnerable communities across the State for each hazard outlined in of the Plan. These communities were determined based upon the individual risk assessments and the impact to the populations, infrastructure, and community lifelines.

NATURAL HAZARDS	BELKNAP	CARROLL	CHESHIRE	COOS	GRAFTON	HILLSBOROUGH	MERRIMACK	ROCKINGHAM	STRAFFORD	SULLIVAN
AVALANCHE	0	2	0	3	0	0	0	0	0	0
COASTAL FLOODING	0	0	0	0	0	0	0	3	3	0
EARTHQUAKE > 4.0	2	2	1	3	1	2	3	2	2	2
DROUGHT	2	1	2	2	2	2	2	2	2	2
EXTREME TEMPERATURE	3	3	3	3	3	3	3	3	3	3
HIGH WIND	3	3	3	3	3	3	3	3	3	3
HURRICANE/TROPICAL CYCLONE	2	1	1	1	1	2	2	3	3	2
INFECTIOUS DISEASE	2	2	2	2	2	2	2	2	2	2
INLAND FLOODING	3	3	3	3	3	3	3	3	2	3
LANDSLIDE	0	0	1	1	1	1	1	1	1	2
LIGHTNING	2	1	1	1	1	2	1	1	1	1
SEVERE WINTER STORM	3	3	3	3	3	3	3	3	3	3
SOLAR STORM	1	1	1	1	1	1	1	1	1	1
WILDFIRE	1	3	1	3	2	2	2	3	3	2
Overall Risk Index	1	2	2	1	2	3	2	3	2	1
SOCIALLY VULNERABILE COMMUNITIES										
INCOME < FPL	8.0%	7.8%	9.8%	11%	9.4%	7.2%	7%	4.9%	9.2%	12.5%
EDUCATION % > 25YRS NOT HS GRAD	6.5%	5%	6.3%	11%	7%	7%	6.8%	4.5%	6.2%	9.3%
UNINSURED < 65YRS OLD	8%	12%	8%	9%	9%	7%	7%	5%	7%	9%
BIPOC HISPANIC NON-WHITE	5%	4%	6%	8%	9%	16%	8%	7%	9%	5%
CHILDREN < 5YRS OLD	4.1%	3.5%	4.5%	4%	1.3%	5.1%	4.5%	4.5%	4.5%	4.6%
INDIVIDUALS > 65YRS OLD	20.2%	27.7%	20%	5%	20%	15.6%	18.1%	17.8%	15%	21.4%
DISABILITY, AGE > 5YRS OLD	17%	16%	15%	22%	15%	12%	15%	11%	13%	14%
HOUSEHOLDS WITH NO VEHICLE	4%	5%	6%	9%	7%	6%	5%	3%	6%	6%
LIMITED ENGLISH > 5YRS OLD	0%	0%	0%	0%	1%	2%	1%	0%	1%	0%
SINGLE PARENT HOH	35%	38%	33%	39%	34%	30%	29%	26%	36%	41%
POPULATION DENSITY (PERSONS/MI^2)	158.5	53.8	108.2	17.4	53.3	452.5	164.9	451.8	356.2	80.1

RISK	
3	HIGH
2	MEDIUM
1	LOW
0	Minimal/ No Risk



The county analysis provided above was done by viewing data from the National Risk Index (Annex H), the New Hampshire Social Vulnerability Index Tool, feedback on vulnerabilities sought from Regional Planning Commissions, HSEM Field Staff area knowledge and approved Local Hazard Mitigation Plans.

It is important to understand that local jurisdictions know their communities the best and develop their own risk analysis which may differ from the State's analysis. Communities should consider utilizing tools like the ones used above when conducting their own local risk analysis.

Separate from natural hazards, there are known risk factors in the State that impact individuals and jurisdictions along with the hazards included in this plan. Aging infrastructure, local implementation of land use and zoning laws, and lack of affordable housing increase risk to natural hazards across the State. Local jurisdictions are provided the ability to address zoning through RSA to adopt ordinances that can reduce risk to infrastructure and vulnerable individuals within their communities.

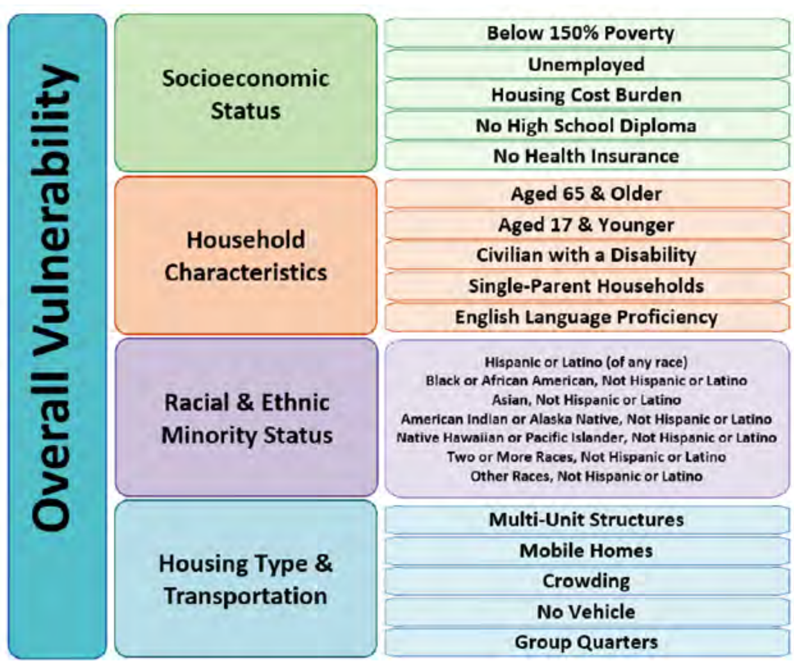
By taking advantage of federal funding available through NH HSEM, NH DOT, and NH DHHS, jurisdictions can begin to address the areas of greatest risk in their community.

Disproportionate Impacts of Hazards

To provide an overall view of the state's hazards and where vulnerable populations reside, compared to where the greatest risks are, information from the New Hampshire Social Vulnerability Tool was compiled and compared to overall hazard risks by county based on information from the National Vulnerability Index.

Every community must prepare for and respond to hazardous events[1], whether a natural disaster like a tornado or disease outbreak, or a human-made event such as a harmful chemical spill. Factors, such as poverty, accessible transportation, and shared housing may create an additional burden for members of the community during a significant event. These factors are known as social vulnerability. Social Vulnerability refers to the resilience of communities (the ability to survive and thrive) when confronted by external stresses on human health, stresses such as natural or human-caused disasters, or disease outbreaks. Socially Vulnerable Populations can include those who have special needs, such as, but not limited to, people without vehicles, people with disabilities, older adults, and people with limited English proficiency.

The CDC/ASTDR Social Vulnerability Index uses U.S. Census data on 16 social factors, detailed in the graphic below, to rank the social vulnerability of each census tract in the United States.[2] These social factors are grouped into four themes: Socioeconomic Status, Household Characteristics, Racial and Ethnic Minority Status, and Housing Type/Transportation. Each tract receives a separate ranking for each of the four themes, as well as an overall ranking. The rankings in the SVI can help emergency planners develop appropriate strategies to assist communities during an emergency. It also provides important information to ensure that community stakeholders are identified and included in emergency planning to represent the needs of and assets within their community.



The New Hampshire Social Vulnerability Index Tool is available to all communities in the State. Developed by The State of New Hampshire Department of Health and Human Services, the Tool uses social factors determined by CDC/ASTDR to provide an analysis of social vulnerability by town. Four overall themes are used to group social factors: Socioeconomic Status, Household Characteristics, Racial and Ethnic Minority Status and Housing Type/Transportation. Communities across the state can view their jurisdiction's specific information by visiting:

https://wisdom.dhhs.nh.gov/wisdom/dashboard.html?topic=social-determinants-of-health&subtopic=social-determinants-of-health&indicator=social-vulnerability-index-(svi).

It is important to note that social vulnerability does impact community lifelines in a variety of different ways. As an example, a jurisdiction with an area large population dependent on public transportation must view the transportation lifeline with a different 'lens' than a community that has no public transportation available. A community that experiences repeat flooding events in a particular area that is home to multiple long term care facilities needs to view that differently than a community that has no long-term care facilities in their jurisdiction.

For the purpose of this Plan, each hazard contains information on those individuals or communities that are disproportionately impacted by hazards focusing on the four following areas: Socially vulnerable populations (due to income, education, healthcare access and housing), children, individuals over the age of 65, individuals with a disability/disabilities and individuals with pre-existing or chronic health conditions. The information provided on these four areas focused on how individual hazards could create a greater need for assistance during an incident, or a greater need during the recovery period.

Local Hazard Mitigation planning committees should consider utilizing the tool developed by NH DHHS to determine which areas or populations of their community could be disproportionately impacted by natural hazards. Local governments know their communities the best and are in the best position to identify and analyze social vulnerabilities in the manner that is most appropriate for their mitigation strategies and actions.

Belknap County: Gilmanton, Belmont, Laconia, Gilford, Tilton, Alton, Sanbornton, Barnstead, Meredith, New Hampton, Center Harbor

Inland Flooding: Belknap County lies in the upper-central portion of the Merrimack River Watershed. Flooding is experienced along the Pemigewasset River on the county's eastern border and within the Lake Winnipesaukee basin, Winnipesaukee River, and connecting lakes. The Winnipesaukee River drains Lake Winnipesaukee, as it is passing through the heart of downtown Laconia through Lake Winnisquam, Silver Lake in Tilton, bifurcating Tilton, and Northfield and emptying into the Merrimack River.

Effects of "Shove Ice" from lake-forming ice are more a threat to property in this county than the effects of River Ice per se. The large lakes in the area form ice seasonally which may impact docks, wharfs, boathouses, nearby roads, bridges, culverts, and other infrastructure. Due to Belknap County's inland location, local risk assessments indicate that none of its communities are vulnerable to coastal flooding. The communities whose population, infrastructure, and community lifelines are most vulnerable to inland flooding are the Towns of Tilton, Barnstead, Sanbornton, and the City of Laconia.

Drought: Belknap County was impacted by the Severe Drought in 2016-2017, as was the rest of the State. The county hosts significant agricultural and livestock assets that are negatively impacted by such events. At the time of the preparation of this Plan, the State has located no specific data as to the losses from drought events for this county. The Town of Sanbornton and the Town of Center Harbor are the communities most affected by the impacts of this hazard.

Wildfire: Significant debris remains in the county forests from ice storms. All the data for this hazard is presented in the Plan. The communities most impacted by the effects of wildfire are the Towns of Gilford and Gilmanton.

Earthquake: New Hampshire lies in a zone of moderate seismic vulnerability generally. The county is in an area of particularly high seismicity that is evident in a crescent of historical events beginning in the Ossipee Range and following the general contour of the Merrimack River Valley. Tilton and Sanbornton's population, infrastructure, and community lifelines are identified as the most vulnerable to this hazard.

Landslide: At the time of the submission of this Plan, the State was unable to locate any county specific data with respect to this hazard type. However, the community whose population, infrastructure, and community lifelines would be the most vulnerable should this hazard present itself is the Town of New Hampton.

High Wind Events: Belknap County has experienced one known F2 event since July 3, 1972. The compilation of data from www.tornadoproject.com lists a total of seven tornadic events (all F1 events) from June 24, 1960, to June 25, 2012. Since the 2010 plan there has been one tornado, which occurred on June 25, 2012. The Town of Tilton and the Town of Center Harbor are the communities most vulnerable to the impacts of high wind events, including tornadic activity.

At the time of the submission of this Plan, the town of Tilton experienced a microburst with winds up to 80 MPH, on July 4, 2012. The communities whose population, infrastructure, and community lifelines are most impacted by high wind events such as down bursts are the Towns of Tilton and Center Harbor.

Tropical and Post-Tropical Cyclones: Belknap County has experienced high winds from some hurricane events but is at a more significant risk to flooding from the associated rainfall from hurricanes. The county experienced Tropical Storm Irene in August 2011. The county's most vulnerable communities to the impacts of this hazard are the Town of Alton and the Town of Barnstead.

Lightning: In 2012, three people were injured by lightning when it stuck the ground next to where they were standing in the City of Laconia. In addition, Belknap County has experienced a disproportionate amount of damage and human injury caused by lightning strikes since the last Plan. Tilton and Sanbornton's population, infrastructure, and community lifelines are identified as the most vulnerable to this hazard.

Severe Winter Weather: Belknap County is viewed to be vulnerable to severe winter weather. The county was impacted by severe winter weather during the 2016/2017 season (DR-4316). At the time of the submission of this Plan, the State was unable to locate any county specific data with respect to this hazard type. The communities whose population, infrastructure, and community lifelines are the most heavily impacted by the impacts associated with this hazard are the City of Laconia and the Town of Sanbornton.

Significant debris remains in the county forests from ice storms. During the recent 1998 Ice Storm, the only failure of a communications tower was in Belknap County. At the time of the submission of this Plan, the editor was unable to locate any county specific data with respect to this hazard type. The communities most impacted by severe winter weather such as ice storms are the communities of Laconia and Sanbornton.

Avalanche: Belknap County has a low risk for avalanche hazards. As determined by the Risk Assessments completed by the Regional Planning Commissions.

For a detailed list of participating jurisdictions in Belknap County whose hazard vulnerabilities have been reviewed by the state, see Appendix D.

The most overall vulnerable communities as identified by the risk assessments, impact to the population, infrastructure, and community lifelines are Tilton and Sanbornton. The below table outlines the average potential loss for the combined communities.

Most Vulnerable Communities: Belknap County	Structural Valuation	Average Building Value	5% Loss
	Residential	$222,654,603.50	$11,132,730.18
	Manufactured Housing	$10,251,550.00	$512,577.50
	Commercial/Industrial	$111,085,350.00	$5,554,267.50
	Utilities	$23,029,100.00	$1,151,455.00
	Tax-Exempt & Non-Taxable Buildings	$26,850,111.50	$1,342,505.58
	Total	**$393,870,715.00**	**$19,693,535.75**

These communities indicate that "new development has not increased the vulnerability of people or structures" in their communities. This is due in part to these most vulnerable communities maintaining Ordinances that restrict development in flood-prone areas.

Most Vulnerable Communities: Belknap County	Community Lifeline	Number of Facilities	Value
	Safety and Security	5	$1,830,100.00
	Food, Hydration, Shelter	11	$22,862,600.00
	Health and Medical	3	$10,443,100.00
	Energy	2	$1,879,600.00
	Communications	7	N/A
	Transportation	21	$470,500.00
	Hazardous Materials	2	N/A
	Water Systems	7	$3,989,800.00
	Total	**58**	**$41,475,700.00**

Notes: Local community critical facility data are incomplete and may include duplicate data from state-owned critical facilities. This information has been collected from historical inventories and local hazard mitigation plans. Estimated values are not available for most communities and are therefore incomplete.

The below communities were compiled to understand overall hazard risks within each county and was a combination of efforts which included the RPCs, HSEM field staff, historical data including Federally declared disasters, impacts to the populations, infrastructure, and community lifelines. Communities may consider utilizing the social vulnerability indicators, as demonstrated below, when understanding the most vulnerable hazards within each jurisdiction.

	INCOME < FPL	EDUCATION % > 25 YRS NOT HS GRAD	UNINSURED < 65 YRS OLD	BIPOC HISPANIC NON-WHITE	INDIVIDUALS > 65 YRS OLD	DISABILITY, AGE > 5 YRS OLD	HOUSEHOLDS WITH NO VEHICLE	LIMITED ENGLISH > 5 YRS OLD	SINGLE PARENT HOH	
Belknap County	8.0%	6.5%	8%	5%	20.2%	17%	4%	0%	35%	**Noted Hazard Vulnerabilities**
Alton	2%	7%	3%	3%	28%	20%	0%	0%	24%	Tropical and Post-Tropical Cyclone
Barnstead	5%	8%	10%	8%	13%	15%	2%	0%	37%	Flooding, Tropical and Post-Tropical Cyclone
Center Harbor	6.0%	4%	6%	3%	30%	17%	3%	0%	16%	Drought
Gilford	6.0%	2%	7%	4%	23%	10%	6%	0%	35%	Wildfire
Gilmanton	12.0%	4%	4%	5%	20%	14%	1%	0%	43%	Wildfire
Laconia	11.0%	9%	9%	6%	22%	18%	7%	0%	39%	Flooding, Severe Winter Weather
New Hampton	9%	7%	13%	7%	24%	20%	2%	1%	14%	Landslide
Sanbornton	4%	3%	4%	4%	17%	19%	3%	0%	13%	Flooding, Drought, Earthquake, High Win Events, Lightning, Severe Winter Weathe Avalanche
Tilton	8.0%	8.0%	10%	4%	24%	20%	2%	0%	34%	Flooding, Earthquake, High Wind Events, Lightning, Avalanche

Carroll County: Ossipee, Effingham, Tamworth, Freedom, Tuftonboro, Wakefield, Madison, Bartlett, Sandwich, Hart's Location, Conway, Wolfeboro, Albany, Brookfield, Eaton, Moultonborough, Jackson, Chatham

Inland Flooding: In the southern area of Carroll County is Lake Winnipesaukee, which feeds the Merrimack River watershed. The remainder of the county includes the Saco River Watershed. Extremely large amounts of rainfall have been recorded in the mountainous areas of the county that contributes to the "flashy" nature of the flooding in the Saco and its tributaries.

Effects of "Shove Ice" from lake-forming ice are a threat to property in the Southern part of this county. The large lakes in the area form ice seasonally which may impact docks, wharfs, boathouses and nearby roads, bridges, culverts, and other infrastructure. The rivers to the north are vulnerable to River Ice conditions. Erosion accelerated by the destabilizing effects on riverbanks is a significant issue all along the Saco River as well as many other State Rivers. Due to Carroll County's inland location, local risk assessments indicate that none of its communities are vulnerable to coastal flooding. The communities whose population, infrastructure, and community lifelines are most vulnerable to inland flooding are the Towns of Tamworth and Wolfeboro.

Drought: Carroll County was impacted by the drought events of 1960, 2000-2002, and 2016-2017. The County hosts significant agricultural and livestock assets that are negatively impacted by such events. At the time of the preparation of this Plan, the State has located no new data as to the losses from drought events specific for this county. The Town of Effingham and the Town of Tamworth are the communities most affected by the impacts of this hazard.

Wildfire: Significant debris still remains in the county forests from ice storms. All the data for this hazard is presented in this Plan. The State was unable to locate any new county specific data with respect to this hazard type. The Towns of Ossipee and Wolfeboro are the most vulnerable to the impacts of this hazard.

Earthquake: New Hampshire lies in a zone of moderate seismic vulnerability. The county is in an area of particularly high seismicity that is evident in a crescent of historical events beginning in the Ossipee Range and following the general contour of the Merrimack River Valley. The communities whose people, infrastructure, and community lifelines are the most impacted by this hazard are the Town of Ossipee and the Town of Wolfeboro.

Landslide: At the time of the submission of this Plan, the State was unable to locate any county specific data with respect to this hazard type. However, the communities whose population, infrastructure, and community lifelines would be the most vulnerable should this hazard present itself are the Towns of Tamworth and Sandwich.

High Wind Events: This County has experienced one known F2 event on July 18, 1963. The data from www.tornadoproject.com lists a total of nine tornadic events (all F1 or less events) from July 18, 1963, to August 7, 1986. There has been no additional tornadic activity since the 2010 Plan. The Town of Wolfeboro and the Town of Moultonborough are the communities most vulnerable to the impacts of high wind events, including tornadic activity.

At the time of the submission of this Plan, the State was unable to locate any county specific data with respect to down bursts. The communities whose population, infrastructure, and community lifelines are most impacted by high wind events such as down bursts are the Towns of Wolfeboro and Moultonborough.

Tropical and Post-Tropical Cyclones: The County has experienced high winds from some hurricane events but is at a more significant risk to flooding from the associated rainfall from hurricanes. Since 2010, the county recently experienced Tropical Storm Irene in August 2011. The Town of Wolfeboro and the Town of Sandwich are the communities most affected by the impacts of this hazard.

Lightning: Carroll County has experienced property damage and human injury as a result of lightning events in 2013 and 2020. At the time of the submission of this Plan, the State was unable to locate any county specific data with respect to this hazard type. The towns of Wolfeboro and Moultonborough have the most vulnerable population, infrastructure, and community lifelines to the impacts of this hazard.

Severe Winter Weather: Carroll County is viewed to be vulnerable to severe winter weather (DR-4316 & 4371). At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to this hazard type. The communities most affected by this hazard are the towns of Tamworth and Moultonborough based on the impact to their population, infrastructure, and community lifelines.

Significant debris still remains in the county forests from ice storms. At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to this hazard type. The communities most impacted by severe winter weather such as ice storms are the communities of Moultonborough and Tamworth.

Avalanche: This County has a moderate risk to avalanche due to the presence of slopes ranging from 25 to 50 degrees. The communities of Madison, Jackson, and Conway have the heightened vulnerability based upon their population, infrastructure, and community lifelines.

For a detailed list of participating jurisdictions in Carroll County whose hazard vulnerabilities have been reviewed by the state, see Appendix D.

The most overall vulnerable communities as identified by the risk assessments, impact to the population, infrastructure, and community lifelines are Effingham and Wolfeboro. The below table outlines the average potential loss for the combined communities.

Most Vulnerable Communities: Carroll County	Structural Valuation	Average Building Value	5% Loss
	Residential	$41,593,712.50	$2,079,685.63
	Manufactured Housing	$4,828,900.00	$241,445.00
	Commercial/Industrial	$66,349,050.00	$3,317,452.50
	Utilities	$6,083,900.00	$304,195.00
	Tax-Exempt & Non-Taxable Buildings	$8,314,475.00	$415,723.75
	Total	**$877,534,750.00**	**$43,876,737.50**

These communities indicate that "development trends indicate the possibility of several challenges for mitigation efforts." This is due in large part to growth in the area resulting in more construction along the communities' bodies of water. Additionally, these communities have summer populations that are disproportionate to their year-round residents due to the increasing number of people developing second homes along bodies of water.

Most Vulnerable Communities: Carroll County	Community Lifeline	Number of Facilities	Value
	Safety and Security	4	N/A
	Food, Hydration, Shelter	17	N/A
	Health and Medical	2	N/A
	Energy	9	N/A
	Communications	8	N/A
	Transportation	17	N/A
	Hazardous Materials	4	N/A
	Water Systems	6	N/A
	Total	**67**	**$242,412,790.00**

Notes: Local community critical facility data are incomplete and may include duplicate data from state-owned critical facilities. This information has been collected from historical inventories and local hazard mitigation plans. Estimated values are not available for most communities and are therefore incomplete

The below communities were compiled to understand overall hazard risks within each county and was a combination of efforts which included the RPCs, HSEM field staff, historical data including Federally declared disasters, impacts to the populations, infrastructure, and community lifelines. Communities may consider utilizing the social vulnerability indicators, as demonstrated below, when understanding the most vulnerable hazards within each jurisdiction.

	INCOME < FPL	EDUCATION % > 25YRS NOT HS GRAD	UNINSURED < 65YRS OLD	BIPOC HISPANIC NON-WHITE	INDIVIDUALS > 65YRS OLD	DISABILITY, AGE > 5YRS OLD	HOUSEHOLDS WITH NO VEHICLE	LIMITED ENGLISH > 5YRS OLD	SINGLE PARENT HOH	
Carroll County	7.8%	5.0%	12%	4%	27.7%	16%	5%	0%	38%	**Noted Hazard Vulnerabilities**
Conway	15.0%	4.0%	9%	4%	22%	12%	4%	0%	59%	Avalanche
Effingham	10%	7%	15%	7%	17%	10%	2%	0%	61%	Drought
Jackson	12%	1%	7%	0%	35%	7%	0%	0%	0%	Avalanche
Madison	8.0%	5%	10%	7%	25%	14%	2%	0%	19%	Avalanche
Moultonborough	6.0%	4%	12%	5%	29%	14%	3%	0%	50%	High Wind Event, Lightning
Ossipee	13%	12%	15%	10%	26%	21%	8%	0%	43%	Wildfire, Earthquake
Sandwich	5%	4%	12%	5%	36%	15%	2%	0%	35%	Landslide, Tropical and Post-Tropical Cyclone
Tamworth	10%	11%	13%	4%	17%	21%	11%	0%	35%	Flooding, Drought, Landslide, Severe Winter Weather
Wolfeboro	5%	6%	14%	3%	37%	23%	10%	0%	38%	Flooding, Wildfire, Earthquake, High Wind Event, Tropical and Post-Tropical Cyclone, Lightning, Severe Winter Weather

Cheshire County: Keene, Swanzey, Winchester, Chesterfield, Hinsdale, Marlborough, Westmoreland, Troy, Fitzwilliam, Jaffrey, Walpole, Alstead, Rindge, Surry, Gilsum, Harrisville, Stoddard, Richmond, Dublin, Roxbury, Nelson, Marlow, Sullivan

Inland Flooding: Cheshire County is located in the southwestern corner of the State and is bounded by the Connecticut River to the West. The City of Keene lies in the center of the county and encompasses a significant area of the floodplain of the upper Ashuelot River. The Ashuelot River also contributes to flooding in the towns of Winchester and Hinsdale

River Ice related flooding along the Connecticut River is a periodic issue in Chesterfield among other towns. Erosion accelerated by the destabilizing effects on riverbanks is a significant issue all along the Connecticut River as well as other state rivers. Additionally, River Ice may directly impact docks, wharfs, boathouses, nearby roads, bridges, culverts, and other infrastructure. Due to Cheshire County's inland location, local risk assessments indicate that none of its communities are vulnerable to coastal flooding. The communities whose population, infrastructure, and community lifelines are most vulnerable to inland flooding are the Towns of Alstead, Swanzey, and City of Keene.

Drought: Cheshire County was impacted by the drought events of 1960, 2000-2002, and 2016-2017. The County hosts significant agricultural and livestock assets that are negatively impacted by such events. At the time of the preparation of this Plan, the State has located no new data as to the losses from drought events specific for this county. Drought has far reaching impacts, as such, the Towns of Alstead, Dublin, Walpole, and Troy all have heightened vulnerability to this hazard.

Wildfire: Significant debris still remains in the county forests from ice storms. All the data for this hazard is presented in Section 6 of this Plan. The State was unable to locate any new county specific data with respect to this hazard type. The Town of Fitzwilliam and the Town of Harrisville are the communities whose population, infrastructure, and community lifelines are most impacted by this hazard.

Earthquake: New Hampshire lies in a zone of Moderate seismic vulnerability. At the time of the preparation of this Plan, the State has located no new specific data of losses from earthquake events for this county. The City of Keene and the Town of Sullivan have populations, infrastructure, and community lifelines most vulnerable to the impacts of earthquakes.

Landslide: At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to this hazard type. Some land formations along the Connecticut River are generally considered to be conducive to landslide activity. The communities whose population, infrastructure, and community lifelines would be the most vulnerable should this hazard present itself are the Towns of Chesterfield and Westmoreland.

High Wind Events: Risk of tornadoes is considered to be high in Cheshire County**.** It has experienced five known F2 events in the past. The compilation of data from www.tornadoproject.com lists a total of fourteen tornadic events (all additional are F1 or less events) from August 27, 1959 to July 3, 1997. There has been no additional tornadic activity since the 2010 Plan. The Town of Jaffrey, the Town of Swanzey, the Town of Dublin, and the Town of Chesterfield are the communities most vulnerable to the impacts of high wind events, including tornadic activity.

At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to down bursts. The communities whose population, infrastructure, and community lifelines are most impacted by high wind events such as down bursts are the Towns of Chesterfield, Dublin, Jaffrey, and Swanzey.

Tropical and Post-Tropical Cyclones: Cheshire County has experienced high winds from some hurricane events but is at a more significant risk to flooding from the associated hurricane rainfall. The 1938 event devastated this county because it received a direct hit. The Town of Swanzey and the Town of Chesterfield are the communities most affected by the impacts of this hazard.

Lightning: At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to this hazard type. The City of Keene and the Town of Jaffrey are the two communities whose population, infrastructure, and lifelines are most affected by impacts of this hazard.

Severe Winter Weather: Cheshire County is viewed to be vulnerable to severe winter weather (DR-4693). At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to this hazard type. The communities most affected by this hazard are the towns of Jaffrey and Swanzey and the City of Keene based on the impact to their population, infrastructure, and community lifelines.

Significant debris still remains in the county forests from ice storms. At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to this hazard type. The communities most impacted by severe winter weather such as ice storms are the communities of Keene, Jaffrey, and Swanzey.

Avalanche: This County has a low risk for avalanche hazards. As determined by the Risk Assessments completed by the Regional Planning Commissions.

For a detailed list of participating jurisdictions in Cheshire County whose hazard vulnerabilities have been reviewed by the state, see Appendix D.

The most overall vulnerable communities as identified by the risk assessments, impact to the population, infrastructure, and community lifelines are Keene and Swanzey. The below table outlines the average potential loss for the combined communities.

Most Vulnerable Communities: Cheshire County	Structural Valuation	Average Building Value	5% Loss
	Residential	$96,406,000.00	$4,820,300.00
	Manufactured Housing	N/A	N/A
	Commercial/Industrial	$378,660,000.00	$18,933,000.00
	Utilities	N/A	N/A
	Tax-Exempt & Non-Taxable Buildings	$19,200,000.00	$960,000.00
	Total	**$295,336,000.00**	**$14,766,800.00**

These communities did not identify any increased risks due to development trends and future development. This is due to two major factors. First, the communities are limiting development in hazard prone areas. Additionally, actions are being taken to reduce the impacts of hazards, such as “upsizing some culverts, bridge replacement, tree removal, and other actions.”

Most Vulnerable Communities: Cheshire County	Community Lifeline	Number of Facilities	Value
	Safety and Security	9	$16,776,000.00
	Food, Hydration, Shelter	8	$49,213,600.00
	Health and Medical	2	$50,562,100.00
	Energy	11	$49,840,300.00
	Communications	10	$3,632,000.00
	Transportation	23	N/A
	Hazardous Materials	8	N/A
	Water Systems	9	$122,621,800.00
	Total	**80**	**$292,645,800.00**

Notes: Local community critical facility data are incomplete and may include duplicate data from state-owned critical facilities. This information has been collected from historical inventories and local hazard mitigation plans. Estimated values are not available for most communities and are therefore incomplete.

The below communities were compiled to understand overall hazard risks within each county and was a combination of efforts which included the RPCs, HSEM field staff, historical data including Federally declared disasters, impacts to the populations, infrastructure, and community lifelines. Communities may consider utilizing the social vulnerability indicators, as demonstrated below, when understanding the most vulnerable hazards within each jurisdiction.

	INCOME < FPL	EDUCATION % > 25YRS NOT HS GRAD	UNINSURED < 65YRS OLD	BIPOC HISPANIC NON-WHITE	INDIVIDUALS > 65YRS OLD	DISABILITY, AGE > 5YRS OLD	HOUSEHOLDS WITH NO VEHICLE	LIMITED ENGLISH > 5YRS OLD	SINGLE PARENT HOH	
Cheshire County	9.8%	6.3%	8%	6%	20.0%	15%	6%	0%	33%	**Noted Hazard Vulnerabilities**
Alstead	15.0%	8.0%	13%	4%	25%	10%	7%	0%	70%	Flooding, Drought
Chesterfield	2%	4%	4%	1%	22%	13%	3%	0%	15%	Landslide, High Wind Event, Tropical and Post-Tropical Cyclone
Dublin	7%	4%	7%	7%	24%	10%	2%	0%	13%	Drought, High Wind Event
Fitzwilliam	4.0%	9%	19%	0%	22%	14%	2%	0%	7%	Wildfire
Harrisville	6.0%	6%	8%	11%	31%	12%	4%	0%	35%	Wildfire
Jaffrey	8%	5%	11%	5%	19%	18%	4%	1%	34%	High Wind Event, Lightning, Severe Winter Weather
Keene	13%	7%	5%	9%	18%	15%	11%	1%	43%	Flooding, Earthquake, Lightning, Severe Winter Weather
Sullivan	5%	9%	8%	1%	15%	10%	6%	0%	19%	Earthquake, High Wind Event
Swanzey	5%	6%	8%	5%	22%	22%	6%	0%	29%	Flooding, Tropical and Post-Tropical Cyclone, High Wind Event, Severe Winter Weather
Troy	8%	6%	8%	7%	14%	16%	3%	1%	52%	Drought
Walpole	4%	5%	7%	3%	21%	12%	2%	0%	21%	Drought
Westmoreland	2%	3%	4%	2%	27%	7%	1%	0%	30%	Landslide

Coös County: Berlin, Carroll, Clarksville, Colebrook, Columbia, Dalton, Dummer, Errol, Gorham, Jefferson, Lancaster, Milan, Northumberland, Pittsburg, Randolph, Shelburne, Stark, Stewartstown, Stratford, Whitefield

Inland Flooding: Coös County is divided with the Connecticut River watershed to the West and the Androscoggin River watershed to the East. The Connecticut River borders the county from its southwestern-most tip to the Canadian Border (near Stewartstown), where it is then bordered by the forests of the Province of Quebec, which also borders it to the North. The western side of the county is bordered by the forests of Maine. The White Mountains to the South receive considerable amounts of rainfall and the snowpack which forms in both the high and mid elevations may present a significant seasonal flood hazard. The weather patterns north of the White Mountains may vary considerably from the rest of the State and this has led to significant losses from flooding which have gone "undeclared" as they were not in synchronicity with the declared losses in the southern areas of the State.

Flooding from River Ice is a significant issue throughout this county and the effects of flooding as well as the direct impact on structures have been recorded in Lancaster; from the Israel River, and Gorham; with the Androscoggin, Moose and Peabody Rivers among other areas. Erosion accelerated by the destabilizing effects on riverbanks is a significant issue. Due to Coös County's inland location, local risk assessments indicate that none of its communities are vulnerable to coastal flooding. The communities whose population, infrastructure, and community lifelines are most vulnerable to inland flooding are the Towns of Clarksville, Colebrook, Gorham, and Lancaster.

Drought: Coös County was impacted by the drought events of 1960, 2000-2002, and 2016-2017. The County hosts significant agricultural and livestock assets that are negatively impacted by such events. At the time of the preparation of this Plan, the State has located no new data as to the losses from drought events specific for this county. Drought has far reaching impacts, as such, the Towns of Carroll, Lancaster, Whitefield, and the City of Berlin all have heightened vulnerability to this hazard.

Wildfire: Significant debris still remains in the county forests from ice storms. All the data for this hazard is presented in Section 6 of this Plan. The State was unable to locate any new county specific data with respect to this hazard type. Given the heavy forest cover countywide, this hazard type is of particular concern during dry periods. The communities whose population, infrastructure, and community lifelines are at a heightened vulnerability to the impacts of this hazard are the City of Berlin and the Town of Gorham.

Earthquake: New Hampshire lies in a zone of moderate seismic vulnerability. Areas to the north of the county lie close to the St. Lawrence River Valley and areas of very significant seismicity. Toward the southeastern portion of the county is the Ossipee Range, the center of the highest seismicity within the boundary of the State. The City of Berlin, the Town of Gorham, the Town of Lancaster, and the Town of Pittsburg are vulnerable to the impacts of this hazard.

Landslide: Indications are that the land formations throughout large areas of this county predispose some areas to this hazard type. At the time of the submission of this Plan, however, the State was unable to locate any new county specific data with respect to this hazard type. Due to the mountainous region of Coös County much of the county has the potential to experience landslides. However, the Towns of Clarksville, Errol, Gorham, and Stark are particularly vulnerable due to their population, infrastructure, and community lifelines.

High Wind Events: The County has experienced one known F2 event in the recent past (May 5, 1929). The data from www.tornadoproject.com lists a total of five tornadic events (all additional are F1 or less events) from July 9, 1956 to July 2, 1994. There have been two additional tornados since the 2010 plan; one on August 21, 2011 (F1) and the other on July 17, 2012 (F0). The Town of Carroll, the Town of Colebrook, the Town of Columbia, and the City of Berlin are the communities most vulnerable to the impacts of high wind events, including tornadic activity.

At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to this hazard type. The communities whose population, infrastructure, and community lifelines are most impacted by high wind events such as down bursts are the Towns of Carroll, Colebrook, Columbia, and the City of Berlin.

Tropical and Post Tropical Cyclones: Coös County has experienced high winds from some hurricane events but is at a more significant risk to flooding from the associated hurricane rainfall. Since 2010, the county recently experienced Tropical Storm Irene in August 2011. The Town of Gorham and the Town of Lancaster are the communities most affected by the impacts of this hazard.

Lightning: At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to this hazard type. The City of Berlin and the Town of Gorham are the most impacted by the effects of this hazard.

Severe Winter Weather: Coös County is viewed to be vulnerable to severe winter weather. At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to this hazard type. However, the communities whose population, infrastructure, and community lifelines are most impacted are the City of Berlin and the Towns of Errol, Milan, and Pittsburg.

Significant debris still remains in the county forests from ice storms. At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to this hazard type. The communities most impacted by severe winter weather such as ice storms are the communities of Berlin, Errol, Milan, and Pittsburg.

Avalanche: This County has the highest risk for avalanche hazards due to heavy snowfall amounts and slopes ranging from 25 to 50 degrees. The communities most vulnerable are the Towns of Carroll, Colebrook, Errol, and Gorham.

For a detailed list of participating jurisdictions in Coos County whose hazard vulnerabilities have been reviewed by the state, see Appendix D.

The most overall vulnerable communities as identified by the risk assessments, impact to the population, infrastructure, and community lifelines are the City of Berlin and the Towns of Colebrook and Gorham. The below table outlines the average potential loss for the combined communities.

Most Vulnerable Communities: Coös County	Structural Valuation	Average Building Value	5% Loss
	Residential	$245,084,830.00	$12,254,241.50
	Manufactured Housing	$3,934,100.00	$196,705.00
	Commercial/Industrial	$41,995,178.50	$2,099,758.93
	Utilities	$96,290,550.00	$4,814,527.50
	Tax-Exempt & Non-Taxable Buildings	$266,747,364.00	$13,337,368.20
	Total	**$552,762,561.67**	**$27,638,128.08**

These communities maintain Ordinances that restrict development in flood-prone areas by utilizing the Special Flood Hazard Area Overlay Zone to inform their local planning boards and zoning ordinances. As such, they do not deem future development as increasing their vulnerability.

Most Vulnerable Communities: Coös County	Community Lifeline	Number of Facilities	Value
	Safety and Security	6	N/A
	Food, Hydration, Shelter	12	N/A
	Health and Medical	3	N/A
	Energy	11	N/A
	Communications	9	N/A
	Transportation	38	N/A
	Hazardous Materials	N/A	N/A
	Water Systems	23	N/A
	Total	**102**	**N/A**

Notes: Local community critical facility data are incomplete and may include duplicate data from state-owned critical facilities. This information has been collected from historical inventories and local hazard mitigation plans. Estimated values are not available for most communities and are therefore incomplete.

The below communities were compiled to understand overall hazard risks within each county and was a combination of efforts which included the RPCs, HSEM field staff, historical data including Federally declared disasters, impacts to the populations, infrastructure, and community lifelines. Communities may consider utilizing the social vulnerability indicators, as demonstrated below, when understanding the most vulnerable hazards within each jurisdiction.

	INCOME < FPL	EDUCATION % > 25 YRS NOT HS GRAD	UNINSURED < 65 YRS OLD	BIPOC HISPANIC NON-WHITE	INDIVIDUALS > 65 YRS OLD	DISABILITY, AGE > 5 YRS OLD	HOUSEHOLDS WITH NO VEHICLE	LIMITED ENGLISH > 5 YRS OLD	SINGLE PARENT HOH	
Coos County	11.0%	11.0%	9%	8%	5.0%	22%	9%	0%	39%	**Noted Hazard Vulnerabilities**
Berlin	19.0%	15.0%	14%	14%	19%	25%	16%	1%	48%	Drought, Wildfire, Earthquake, High Wind Event, Lightning, Severe Winter Weather
Carroll	11.0%	6.0%	13%	5%	25%	16%	0%	0%	0%	Drought, High Wind Event, Avalanche
Clarksville	11.0%	11.0%	15%	9%	23%	27%	4%	0%	20%	Flooding, Landslide
Colebrook	12.0%	15.0%	7%	2%	26%	21%	9%	0%	33%	Flooding, High Wind Event, Avalanche
Columbia	13.0%	14.0%	5%	1%	25%	27%	7%	0%	38%	High Wind Event
Errol	18.0%	2.0%	9%	0%	32%	42%	2%	0%	42%	Landslide, Severe Winter Weather, Avalanche
Gorham	4.0%	8.0%	4%	8%	25%	32%	7%	1%	32%	Earthquake, Severe Winter Weather, Avalanche
Lancaster	8.0%	8.0%	5%	3%	23%	20%	7%	0%	35%	Flooding, Drought, Earthquake, Tropical and Post-Tropical Cyclone
Milan	8.0%	9.0%	9%	5%	19%	17%	2%	0%	38%	Severe Winter Weather
Pittsburg	8.0%	9.0%	6%	3%	34%	19%	3%	0%	10%	Earthquake, Severe Winter Weather
Stark	13.0%	9.0%	4%	3%	26%	24%	5%	0%	43%	Landslide
Whitefield	16.0%	10.0%	9%	8%	31%	22%	8%	0%	37%	Drought

Grafton County: Alexandria, Ashland, Bath, Benton, Bethlehem, Bridgewater, Bristol, Campton, Canaan, Dorchester, Easton, Ellsworth, Enfield, Franconia, Grafton, Groton, Hanover, Haverhill, Hebron, Holderness, Landaff, Lebanon, Lincoln, Lisbon, Littleton, Lyman, Lyme, Monroe, Orange, Orford, Piermont, Plymouth, Rumney, Sugar Hill, Thornton, Warren, Waterville Valley, Wentworth, Woodstock

Inland Flooding: Grafton County is bordered to the West and North by the Connecticut River, to the Northwest by the White Mountains and to the South by Sullivan and Belknap counties. Communities along the Connecticut River experience periodic flooding and the snowpack and rainfall captured by the White Mountains contributes to flash flood conditions along the Pemigewasset (Pemi), the Ammonoosuc and their tributaries. The Pemi, Baker, Beebe, Mad and other rivers that drain into the White Mountains are well known to be extremely “flashy.” Grafton has been hit hard with flooding since 2010 and has been involved with of two of the four presidentially declared disasters.

River Ice related flooding along the Connecticut is a periodic issue in Lebanon, Littleton, and several of the smaller communities along the river. Erosion accelerated by the destabilizing effects on riverbanks is a significant issue all along the Connecticut River and other state rivers. Additionally, River Ice may directly impact docks, wharfs, boathouses nearby roads, bridges, culverts, and other infrastructure. River Ice is an issue for the Town of Plymouth, which lies at the confluence of the Pemi and Baker Rivers. Due to Grafton County’s inland location, local risk assessments indicate that none of its communities are vulnerable to coastal flooding. The communities whose population, infrastructure, and community lifelines are most vulnerable to inland flooding are the Towns of Campton, Dorchester, Groton, and Plymouth.

Drought: Grafton County was impacted by the drought events of 1960, 2000-2002, and 2016-2017. The County hosts significant agricultural and livestock assets that are negatively impacted by such events. At the time of the preparation of this Plan, the State has located no new data as to the losses from drought events specific for this county. The communities most affected by the impacts of drought are the Town of Alexandria, the Town of Haverhill, the Town of Orford, and the Town of Piermont.

Wildfire: Significant debris still remains in the county forests from ice storms. All the data for this hazard is presented in Section 6 of this Plan. The State was unable to locate any new county specific data with respect to this hazard type. Given the heavy forest cover countywide, this hazard type is of particular concern during dry periods. The Towns of Alexandria, Bridgewater, Lincoln, Orange, Waterville Valley, and Woodstock experience heightened vulnerability to their population, infrastructure, and community lifelines.

Earthquake: New Hampshire generally lies in a zone of Moderate seismic vulnerability. At the time of the preparation of this Plan, the State has located no new specific data as to the losses from earthquake events for this county. However, this communities whose population, infrastructure, and community lifelines are vulnerable to the impacts of this hazard are the Towns of Bristol, Campton, Hanover, Littleton, Plymouth, Thornton, and the City of Lebanon.

Landslide: At the time of the submission of this Plan, the State was unable to locate any county specific data with respect to this hazard type. Some land formations along the Connecticut River are generally considered to be conducive to landslide activity. The Town of Alexandria, the Town of Benton, the Town of Bridgewater, the Town of Hebron, the Town of Plymouth, and the Town of Rumney have heightened vulnerability to the impacts of this hazard.

High Wind Events: Grafton County has experienced two known F2 events in the past. The compilation of data from www.tornadoproject.com lists a total of 8 tornadic events (six additional are F1 or less events) from July 14, 1963 to June 11, 1973. There have been two events since the 2010 plan; one on August 21, 2011 (F1) and the other on July 17, 2012 (F0). The Towns of Alexandria, Bristol, Easton, Franconia, Littleton, and Waterville Valley are the communities most vulnerable to the impacts of high wind events, including tornadic activity.

At the time of the submission of this Plan, the state was unable to locate any new county specific data with respect to this hazard type. However, the communities whose population, infrastructure, and community lifelines are most impacted by high wind events such as down bursts are the Towns of Alexandria, Bristol, Easton, Franconia, Littleton, and Waterville Valley.

Tropical and Post-Tropical Cyclones: Grafton County has experienced high winds from some hurricane events but is at a more significant risk to flooding from the associated hurricane rainfall. August 2011 Tropical Storm Irene had a significant flooding impact on Grafton County. The Town of Campton, the Town of Holderness, and the Town of Plymouth are vulnerable to impacts of this hazard.

Lightning: At the time of the submission of this Plan, the state was unable to locate any new county specific data with respect to this hazard type. The communities of Benton, Bridgewater, Hanover, Landaff, Lebanon, and Plymouth are vulnerable to the impacts of this hazard.

Severe Winter Weather: Grafton County is viewed to be vulnerable to severe winter weather. At the time of the submission of this Plan, the editor was unable to locate any new county specific data with respect to this hazard type. However, the communities whose population, infrastructure, and community lifelines are most impacted are the Towns of Bristol, Franconia, Lincoln and Plymouth.

Significant debris still remains in the county forests from ice storms. At the time of the submission of this Plan, the editor was unable to locate any new county specific data with respect to this hazard type. The communities most impacted by severe winter weather such as ice storms are the communities of Bristol, Franconia, Lincoln, and Plymouth.

Avalanche: This County has a low risk for avalanche hazards. However, the Town of Alexandria, the Town of Bridgewater, the Town of Lincoln, and the Town of Woodstock have a heightened vulnerability to their population, infrastructure, and community lifelines.

For a detailed list of participating jurisdictions in Grafton County whose hazard vulnerabilities have been reviewed by the state, see Appendix D.

The most overall vulnerable communities as identified by the risk assessments, impact to the population, infrastructure, and community lifelines are the Town of Alexandria and the Town of Plymouth. The below table outlines the average potential loss for the combined communities.

Most Vulnerable Communities: Grafton County	Structural Valuation	Average Building Value	5% Loss
	Residential	$146,323,012.50	$7,316,150.63
	Manufactured Housing	$5,794,500.00	$289,725.00
	Commercial/Industrial	$86,198,530.00	$4,309,926.50
	Utilities	$26,762,800.00	$1,338,140.00
	Tax-Exempt & Non-Taxable Buildings	$269,637,988.00	$13,481,899.40
	Total	**$534,716,830.50**	**$26,735,841.53**

These communities indicate that "development changes have not changed the over-all vulnerability" in their communities. This is due in part to these most vulnerable communities maintaining building permitting that restrict development in flood-prone areas. However, they did recognize that future development in currently low risk areas could increase the risk and thus may require new mitigation priorities in those areas in future local mitigation plan updates.

Most Vulnerable Communities: Grafton County	Community Lifeline	Number of Facilities	Value
	Safety and Security	9	$5,511,500.00
	Food, Hydration, Shelter	10	$52,823,300.00
	Health and Medical	2	$23,255,700.00
	Energy	4	$30,612,700.00
	Communications	3	$2,480,000.00
	Transportation	6	$150,000.00
	Hazardous Materials	2	$424,214.00
	Water Systems	6	$1,443,700.00
	Total	**42**	**$113,796,900.00**

Notes: Local community critical facility data are incomplete and may include duplicate data from state-owned critical facilities. This information has been collected from historical inventories and local hazard mitigation plans. Estimated values are not available for most communities and are therefore incomplete.

The below communities were compiled to understand overall hazard risks within each county and was a combination of efforts which included the RPCs, HSEM field staff, historical data including Federally declared disasters, impacts to the populations, infrastructure, and community lifelines. Communities may consider utilizing the social vulnerability indicators, as demonstrated below, when understanding the most vulnerable hazards within each jurisdiction.

	INCOME < FPL	EDUCATION % > 25YRS NOT HS GRAD	UNINSURED < 65YRS OLD	BIPOC HISPANIC NON-WHITE	INDIVIDUALS > 65YRS OLD	DISABILITY, AGE > 5YRS OLD	HOUSEHOLDS WITH NO VEHICLE	LIMITED ENGLISH > 5YRS OLD	SINGLE PARENT HOH	
Grafton County	9.4%	7.0%	9%	9%	20.0%	15%	7%	1%	34%	**Noted Hazard Vulnerabilities**
Alexandria	8.0%	9.0%	11%	5%	19%	15%	2%	0%	17%	Drought, Wildfire, Landslide, High Wind Event, Avalanche
Benton	4%	24%	13%	6%	39%	16%	2%	2%	30%	Landslide, Lightning
Bridgewater	9%	7%	6%	2%	32%	15%	2%	0%	23%	Wildfire, Landslide, Lightning, Avalanche
Bristol	10.0%	9%	14%	11%	19%	17%	7%	1%	24%	Wildfire, Earthquake, High Wind Event, Severe Winter Weather
Campton	7.0%	13%	8%	1%	19%	14%	5%	0%	25%	Flooding, Earthquake, Tropical and Post-Tropical Cyclone
Dorchester	9%	15%	13%	5%	25%	23%	3%	1%	15%	Flooding
Easton	1%	5%	5%	5%	35%	20%	7%	0%	45%	High Wind Event
Franconia	2%	2%	4%	6%	33%	13%	2%	0%	19%	High Wind Event, Severe Winter Weather
Groton	2%	24%	17%	0%	22%	36%	9%	0%	60%	Flooding
Hanover	8%	3%	2%	22%	13%	6%	7%	1%	25%	Earthquake, Lightning
Haverhill	8%	13%	4%	5%	20%	15%	5%	0%	35%	Drought
Hebron	9%	2%	4%	5%	51%	20%	3%	0%	16%	Landslide
Holderness	11%	6%	8%	4%	21%	19%	3%	0%	32%	Tropical and Post-Tropical Cyclone
Landaff	18%	10%	7%	3%	24%	20%	3%	0%	17%	Lightning
Lebanon	11%	7%	7%	15%	20%	15%	9%	1%	39%	Earthquake, Lightning
Lincoln	9%	6%	11%	6%	31%	19%	10%	0%	31%	Wildfire, Severe Winter Weather, Avalanche
Littleton	20%	7%	12%	4%	21%	26%	13%	0%	72%	Earthquake, High Wind Event
Orange	7%	2%	6%	5%	28%	20%	0%	0%	42%	Wildfire
Orford	10%	13%	28%	28%	19%	10%	1%	19%	20%	Drought
Piermont	3%	6%	7%	3%	20%	14%	3%	0%	18%	Drought
Plymouth	14%	6%	14%	9%	18%	20%	11%	2%	49%	Flooding, Earthquake, Landslide, Tropical and Post-Tropical Cyclone, Lightning, Severe Winter Weather
Rumney	14%	7%	20%	4%	20%	13%	3%	0%	33%	Landslide
Thornton	3%	2%	11%	7%	21%	10%	2%	0%	25%	Earthquake
Waterville Valley	0%	0%	0%	2%	30%	7%	0%	0%	30%	Wildfire, High Wind Event
Woodstock	6%	7%	10%	9%	20%	11%	9%	0%	27%	Wildfire, Avalanche

Hillsborough County: Amherst, Antrim, Bedford, Bennington, Brookline, Deering, Francestown, Goffstown, Greenfield, Greenville, Hancock, Hillsborough, Hollis, Hudson, Litchfield, Lyndeborough, Manchester, Mason, Merrimack, Milford, Mont Vernon, Nashua, New Boston, New Ipswich, Pelham, Peterborough, Sharon, Temple, Weare, Wilton, Windsor

Inland Flooding: Hillsborough County, the most populated County in New Hampshire, it is bordered to the South by Massachusetts and also comprises much of the Southern and western Merrimack River Watershed. The Merrimack River flows through the eastern portion of this county through the heavily populated cities of Manchester, Merrimack, and Nashua. Urban development and land use exacerbate storm water runoff issues in the eastern areas of the county while the western areas are moderately to heavy forested areas flooding in the western portions of the county periodically occurs along the Contoocook River from Peterborough to Hillsborough.

Flooding from River Ice is a less significant threat in this region than in other portions of the State but the communities in the western regions, principally along the Contoocook River, periodically experience this hazard. Due to Hillsborough County's inland location, local risk assessments indicate that none of its communities are vulnerable to coastal flooding. Given a variety of factors that impact the City of Manchester and the Town of Goffstown these are the communities identified as the most vulnerable to inland flooding. However, the communities of Hillsborough and Antrim also hold a heightened vulnerability to their population, infrastructure, and community lifelines.

Drought: Hillsborough County was impacted by the drought events of 1960, 2000-2002, and 2016-2017. The County hosts significant agricultural and livestock assets that are negatively impacted by such events. At the time of the preparation of this Plan, the State has located no new data as to the losses from drought events specific for this county. The communities whose population, infrastructure, and community liveliness are the most vulnerable to the impacts of this hazard are New Boston and Francestown.

Wildfire: Significant debris still remains in the county forests from ice storms. All the data for this hazard is presented in this Plan. The State was unable to locate any new county specific data with respect to this hazard type. Given the heavy forest cover countywide, this hazard type is of particular concern during dry periods. The Towns of Weare and Goffstown are the most vulnerable to the impacts of this hazard.

Earthquake: New Hampshire generally lies in a zone of moderate seismic vulnerability. Hillsborough County is in an area of particularly high seismicity that is evident in a crescent of historical events beginning in the Ossipee Range and following the general contour of the Merrimack River Valley. The City of Manchester and the Town of Goffstown are the communities most vulnerable to this hazard.

Landslide: At the time of the submission of the Plan, the State was unable to locate any new county specific data with respect to this hazard type. Some land formations along the Merrimack River are generally considered to be conducive to landslide activity. The most vulnerable communities for this particular hazard have been determined to be the Towns of Francestown and New Boston

High Wind Events: Risk of tornadoes is considered to be high in this county. Hillsborough County has experienced three known F2 events and one F3 event. The compilation of data from www.tornadoproject.com lists a total of eighteen tornadic events (all F1or less events) from July 27, 1956 to June 16, 1986. There has been no additional tornadic activity since the 2010 plan. The Town of New Boston, the Town of Francestown, and the Town of Brookline are the communities most vulnerable to the impacts of high wind events, including tornadic activity.

At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to down bursts. This does not negate that there are areas of specific vulnerability or that some communities may be disproportionately affected by this hazard. The communities most impacted by high wind events such as down bursts are the Towns of New Boston, Francestown, and Brookline.

Tropical and Post-Tropical Cyclones: Hillsborough County has experienced high winds from some hurricane events but is at a more significant risk to flooding from the associated rainfall from hurricanes. The 1938 hurricane devastated this county, because it received a direct hit. The communities with the most vulnerable population, infrastructure, and lifelines to this hazard are the Town of Goffstown and the City of Manchester.

Lightning: At the time of the submission of this Plan, the Town of Goffstown has a lightning strike at their Babe Ruth League facility, caused $200,000 in damage. The Town of Goffstown, the Town of Weare, and the Town of Antrim are the communities whose population, infrastructure, and lifelines are the most vulnerable to this hazard.

Severe Winter Weather: Hillsborough County is viewed to be vulnerable to severe winter weather. The County of Hillsborough received a presidential declaration for an October Nor'easter that dropped heavy snow, caused widespread power outages and debris. The communities whose population, infrastructure, and community lifelines are most vulnerable to this hazard are Antrim, Goffstown, Hillsborough, Lyndeborough, Manchester and Mason.

Significant debris still remains in the county forests from ice storms. At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to this hazard type. The communities who are the most impacted by severe winter weather such as ice storms are the Towns of Antrim, Goffstown, and Hillsborough, and the City of Manchester.

Avalanche: Hillsborough County has negligible risk for avalanche hazards as determined by the Risk Assessments completed by the Regional Planning Commission

For a detailed list of participating jurisdictions in Hillsborough County whose hazard vulnerabilities have been reviewed by the state, see Appendix D.

The most overall vulnerable communities as identified by the risk assessments, impact to the population, infrastructure, and community lifelines are Antrim and Manchester. The below table outlines the average potential loss for the combined communities.

Most Vulnerable Communities: Hillsborough County	Structural Valuation	Average Building Value	5% Loss
	Residential	$3,238,941,189.50	$161,947,059.48
	Manufactured Housing	$3,159,700.00	$157,985.00
	Commercial/Industrial	$1,762,940,960.50	$88,147,048.03
	Utilities	$154,839,300.00	$7,741,965.00
	Tax-Exempt & Non-Taxable Buildings	N/A	N/A
	Total	**$5,840,860,000.00**	**$292,043,000.00**

These communities indicate that there are local restrictions on future development in hazard prone areas as a result of ordinance standards that discourage development in areas such as flood hazard areas, slopes in excess of 20%, or wildlife habitats.

Most Vulnerable Communities: Hillsborough County	Community Lifeline	Number of Facilities	Value
	Safety and Security	32	$221,650,800.00
	Food, Hydration, Shelter	15	$193,872,500.00
	Health and Medical	4	$112,861,300.00
	Energy	N/A	N/A
	Communications	3	$21,453,800.00
	Transportation	7	$19,015,800.00
	Hazardous Materials	19	$150,026,200.00
	Water Systems	5	$62,912,500.00
	Total	**85**	**$610,312,900.00**

Notes: Local community critical facility data are incomplete and may include duplicate data from state-owned critical facilities. This information has been collected from historical inventories and local hazard mitigation plans. Estimated values are not available for most communities and are therefore incomplete.

The below communities were compiled to understand overall hazard risks within each county and was a combination of efforts which included the RPCs, HSEM field staff, historical data including Federally declared disasters, impacts to the populations, infrastructure, and community lifelines. Communities may consider utilizing the social vulnerability indicators, as demonstrated below, when understanding the most vulnerable hazards within each jurisdiction.

	INCOME < FPL	EDUCATION % >25 YRS NOT HS GRAD	UNINSURED < 65 YRS OLD	BIPOC HISPANIC NON-WHITE	INDIVIDUALS > 65 YRS OLD	DISABILITY, AGE > 5 YRS OLD	HOUSEHOLDS WITH NO VEHICLE	LIMITED ENGLISH > 5 YRS OLD	SINGLE PARENT HOH	
Hillsborough County	7.2%	7.0%	7%	16%	15.6%	12%	6%	2%	30%	**Noted Hazard Vulnerabilities**
Antrim	7.0%	8.0%	10%	3%	17%	12%	2%	0%	24%	Flooding, Lightning, Severe Winter Weather
Brookline	1%	4%	2%	7%	10%	7%	3%	0%	14%	High Wind Event
Francestown	3%	5%	6%	5%	22%	8%	3%	0%	23%	Drought, Landslide, High Wind Event
Goffstown	6.0%	7%	7%	6%	16%	13%	2%	0%	28%	Wildfire, Tropical and Post-Tropical Cyclone, Lightning, Severe Winter Weather
Hillsborough	6.0%	8%	2%	6%	16%	15%	2%	0%	31%	Flooding, Severe Winter Weather
Lyndeborough	4%	5%	6%	2%	18%	8%	2%	0%	20%	Severe Winter Weather
Manchester	14%	13%	11%	23%	23%	15%	9%	4%	46%	Tropical and Post-Tropical Cyclone, Severe Winter Weather
Mason	4%	5%	7%	8%	15%	9%	2%	0%	23%	Severe Winter Weather
New Boston	1%	3%	4%	2%	11%	7%	2%	0%	22%	Drought, Landslide, High Wind Event
Weare	6%	4%	6%	5%	11%	9%	0%	0%	22%	Wildfire, Lightning

Merrimack County: Allenstown, Andover, Boscawen, Bow, Bradford, Canterbury, Chichester, Concord, Danbury, Dunbarton, Epsom, Franklin, Henniker, Hill, Hooksett, Hopkinton, Loudon, New London, Newbury, Northfield, Pembroke, Pittsfield, Salisbury, Sutton, Warner, Webster, Wilmot

Inland Flooding: Merrimack County, as its name reflects, lies almost exclusively in the Merrimack River Watershed. At the confluence of the Pemigewasset, the Winnipesaukee and the Merrimack Rivers, the Town of Franklin has seen such significant flooding that it is the site of a U.S. Army Corps of Engineers Flood Control Dam. Flash flooding along the Contoocook River and its tributaries is repetitive. Related flooding is experienced at the confluence of the Contoocook and Merrimack Rivers during peak events.

Flooding from River Ice is less significant a threat in this region than in other portions of the State, but the communities in the western part of the county, (principally along the Contoocook), experience this hazard periodically. Due to Merrimack County's inland location, local risk assessments indicate that none of its communities are vulnerable to coastal flooding. Given a variety of factors that impact the Towns of Andover, Epsom, Hill, Hooksett, and Pittsfield these are the communities identified as the most vulnerable to inland flooding.

Drought: Merrimack County was impacted by the drought events of 1960, 2000-2002, and 2016-2017. The county hosts significant agricultural and livestock assets, which are negatively impacted by such events. At the time of the preparation of this Plan, the State has located no new specific data as to the losses from Drought events for this county. The communities whose population, infrastructure, and community lifelines are most impacted by the affects of this hazard are the Towns of Andover, Boscawen, Hooksett, and the City of Concord.

Wildfire: Significant debris still remains in the county forests from ice storms. All the data for this hazard is presented in this Plan. The State was unable to locate any new county specific data with respect to this hazard type. Given the heavy forest cover countywide, this hazard type is of particular concern during dry periods. The Town of Boscawen, the Town of Epsom, the Town of Hill, and the Town of Hooksett experience a heightened impact from this hazard.

Earthquake: New Hampshire generally lies in a zone of moderate seismic vulnerability. Merrimack County is in an area of particularly high seismicity that is evident in a crescent of historical events beginning in the Ossipee Range and following the general contour of the Merrimack River Valley. At the time of the submission of this plan, there was a small 1.2 earthquake felt in Concord in September 2012. The Cities of Concord and Franklin, as well as the Town of Hooksett are the most vulnerable to the impacts of this hazard do to the strain on their population, infrastructure, and community lifelines.

Landslide: At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to this hazard type. Some land formations along the Merrimack River are generally considered to be conducive to landslide activity. The communities of Hill and Hooksett are the most vulnerable to the effects caused by this hazard.

High Wind Events: Merrimack County has experienced three F1 events according to the compilation of data from www.tornadoproject.com from July 12, 1967, to August 15, 1976. There has been no additional tornadic activity since the 2010 Plan. The Town of Canterbury, the Town of Hooksett, the Town of Northfield, the Town of Pittsfield, and the City of Franklin are the communities most vulnerable to the impacts of high wind events, including tornadic activity.

The Town of Bow experienced a microburst September 6, 2011, with winds exceeding 60 MPH. The communities whose population, infrastructure, and community lifelines are most impacted by high wind events such as down bursts are the Towns Canterbury, Hooksett, Northfield, Pittsfield, and the City of Franklin.

Tropical and Post Tropical Cyclones: Merrimack County has experienced high winds from some hurricane events but is at a more significant risk to flooding from the associated rainfall from hurricanes. August 2011 Tropical Storm Irene had a significant impact on Merrimack County. The Towns of Andover and Epsom, as well as the Cities of Concord and Franklin experience a heightened vulnerability to this hazard.

Lightning: At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to this hazard type. However, the communities whose population, infrastructure, and community lifelines are vulnerable to the impacts of this hazard are the Towns of Epsom, Hill, Hooksett, Loudon, and Warner.

Severe Winter Weather: Merrimack County is viewed to be vulnerable to severe winter weather. At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to this hazard type. The communities whose population, infrastructure, and community lifelines are most vulnerable to this hazard are Franklin, Hooksett, Northfield, Sutton, and Warner.

Significant debris still remains in the county forests from ice storms. At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to this hazard type. The communities who are the most impacted by severe winter weather such as ice storms are the Towns of Hooksett, Northfield, Sutton, Warner, and the City of Franklin.

Avalanche: This County has a low risk for avalanche hazards. However, the Towns of Henniker and Hooksett have a heightened vulnerability to their population, infrastructure, and lifelines to the impacts of this hazard should it present.

For a detailed list of participating jurisdictions in Merrimack County whose hazard vulnerabilities have been reviewed by the state, see Appendix D.

The most overall vulnerable communities as identified by the risk assessments, impact to the population, infrastructure, and community lifelines are Epsom, Franklin, and Hooksett. The below table outlines the average potential loss for the combined communities.

Most Vulnerable Communities: Merrimack County	Structural Valuation	Average Building Value	5% Loss
	Residential	$131,840,580.00	$6,592,029.00
	Manufactured Housing	$24,651,600.00	$1,232,580.00
	Commercial/Industrial	$119,777,650.00	$5,988,882.50
	Utilities	$69,036,430.00	$3,451,821.50
	Tax-Exempt & Non-Taxable Buildings	N/A	N/A
	Total	**$1,058,440,595.00**	**$52,922,029.75**

These communities indicate that they "will follow building regulations to ensure that any building in hazardous areas will be built to minimize vulnerability to the hazards." This will be accomplished by utilizing Zoning, Floodplain, and Subdivision ordinances.

Most Vulnerable Communities: Merrimack County	Community Lifeline	Number of Facilities	Value
	Safety and Security	6	$6,993,800.00
	Food, Hydration, Shelter	3	$9,740,000.00
	Health and Medical	1	$12,319,800.00
	Energy	0	N/A
	Communications	0	N/A
	Transportation	2	$436,300.00
	Hazardous Materials	2	N/A
	Water Systems	3	$2,743,400.00
	Total	**17**	**$32,233,300.00**

Notes: Local community critical facility data are incomplete and may include duplicate data from state-owned critical facilities. This information has been collected from historical inventories and local hazard mitigation plans. Estimated values are not available for most communities and are therefore incomplete.

The below communities were compiled to understand overall hazard risks within each county and was a combination of efforts which included the RPCs, HSEM field staff, historical data including Federally declared disasters, impacts to the populations, infrastructure, and community lifelines. Communities may consider utilizing the social vulnerability indicators, as demonstrated below, when understanding the most vulnerable hazards within each jurisdiction.

	INCOME < FPL	EDUCATION % > 25 YRS NOT HS GRAD	UNINSURED < 65 YRS OLD	BIPOC HISPANIC NON-WHITE	INDIVIDUALS > 65 YRS OLD	DISABILITY, AGE > 5 YRS OLD	HOUSEHOLDS WITH NO VEHICLE	LIMITED ENGLISH > 5 YRS OLD	SINGLE PARENT HOH	
Merrimack County	7.0%	6.8%	7%	8%	18.1%	15%	5%	1%	29%	**Noted Hazard Vulnerabilities**
Andover	11.0%	6.0%	6%	2%	17%	14%	2%	0%	24%	Flooding, Drought, Tropical and Post-Tropical Cyclone
Boscawen	3.0%	11.0%	5%	2%	21%	20%	6%	0%	35%	Drought, Wildfire
Canterbury	3.0%	4.0%	9%	8%	18%	15%	3%	0%	21%	High Wind Event
Concord	9.0%	8.0%	7%	14%	16%	16%	10%	3%	36%	Drought, Earthquake, Tropical and Post-Tropical Cyclone
Epsom	4.0%	7.0%	4%	5%	19%	14%	2%	0%	31%	Flooding, Wildfire, Tropical and Post-Tropical Cyclone, Lightning
Franklin	9.0%	10.0%	9%	5%	22%	20%	10%	0%	42%	Earthquake, High Wind Event, Tropical and Post-Tropical Cyclone, Severe Winter Weather
Hill	10.0%	9.0%	9%	2%	18%	16%	0%	0%	30%	Flooding, Wildfire, Landslide, Lightning
Hooksett	4.0%	6.0%	4%	8%	15%	13%	1%	1%	13%	Flooding, Drought, Wildfire, Earthquake, Landslide, High Wind Event, Lightning, Severe Winter Weather
Loudon	7.0%	4.0%	10%	1%	21%	13%	4%	0%	14%	Lightning
Northfield	6.0%	11.0%	7%	7%	11%	19%	0%	0%	53%	High Wind Event, Severe Winter Weather
Pittsfield	13.0%	11.0%	10%	4%	15%	27%	8%	0%	30%	Flooding, High Wind Event
Sutton	2.0%	2.0%	6%	5%	20%	6%	2%	0%	20%	Severe Winter Weather
Warner	7.0%	7.0%	6%	7%	20%	17%	6%	0%	38%	Lightning, Severe Winter Weather

Rockingham County: Atkinson, Auburn, Brentwood, Candia, Chester, Danville, Deerfield, Derry, East Kingston, Epping, Exeter, Fremont, Greenland, Hampstead, Hampton, Hampton Falls, Kensington, Kingston, Londonderry, New Castle, Newfields, Newington, Newmarket, Newton, North Hampton, Northwood, Nottingham, Plaistow, Portsmouth, Raymond, Rye, Salem, Sandown, Seabrook, South Hampton, Stratham, Windham

Coastal and Inland Flooding: Rockingham County the second most heavily populated county, it is bordered to the South by Massachusetts. The county is divided between the southern portion of the Piscataqua and the southeastern Merrimack River Watersheds. The region is primarily low rolling hills and floodplain; consequently, inundation flooding is typical. The county also possesses the only direct seacoast in the State and is therefore positioned with exposure to coastal flooding damage from hurricanes, Nor'easters and possibly tsunami events.

Flooding from River Ice has not proven to be a significant hazard in this county in the recent past. At the time of the submission of this Plan, the State was unable to locate any county specific data with respect to this hazard type. Given the moderating effects on the seasonal temperatures from the Southern latitude and coastal exposure, the county is viewed as having a limited risk from this hazard type. Based upon the impact of coastal flooding to the population, infrastructure, and community lifelines the City of Portsmouth and the Town of Hampton are the communities most vulnerable to the impacts of this hazard. Likewise, the Town of Raymond, the Town of Epping, and the Town of Freemont are the most vulnerable communities to the impacts of inland flooding.

Drought: Rockingham County was impacted by the drought events of 1960, 2000-2002, and 2016-2017. The county hosts significant agricultural and livestock assets, which are negatively impacted by such events. At the time of the preparation of this Plan, the State has located no new specific data as to the losses from drought events for this county. Drought has far reaching impacts, as such, the Towns of Freemont, Hampton Falls, Kingston, and Stratham all have heightened vulnerability to this hazard.

Wildfire: Significant debris still remains in the county forests from ice storms. Given the salt marsh environments in the county, wildland fire hazards related to Phragmites Australis along the coast are viewed as significant. All the data for this hazard is presented in this Plan. The State was unable to locate any new county specific data with respect to this hazard type. The population, infrastructure, and community lifelines of the Towns of Kingston, East Kingston, Hampton Falls, and Raymond are most vulnerable to the impacts of this hazard.

Earthquake: New Hampshire generally lies in a zone of Moderate seismic vulnerability. Rockingham County is in an area of particularly high seismicity that is evident in a crescent of historical events beginning in the Ossipee Range and following the general contour of the Merrimack River Valley. Additionally, it is believed that the largest earthquake of record in New England was the 1755 “Cape Ann” event, just offshore of the New Hampshire coast. At the submission of this plan the State was unable to locate any new county specific data with respect to this hazard type. The communities of Epping, Exeter, Portsmouth, and Raymond are all uniquely vulnerable to the impacts of earthquakes.

Landslide: This County, due to its low elevation is not prone to landslide hazards. However, the communities whose population, infrastructure, and community lifelines would be the most vulnerable should this hazard present itself are the Town of Epping and the Town of Raymond.

High Wind Events: Risk of tornadoes is considered to be high in this county. The county has experienced four known F2 events and one F3 event in the past. The compilation of data from www.tornadoproject.com lists a total of five additional tornadic events (all additional are F1or less events) from July 31, 1954, to July 24, 2008. There has been no additional tornadic activity since 2010 Plan. The Town of Hampton, the Town of Rye, and the Town of Seabrook are the communities most vulnerable to the impacts of high wind events, including tornadic activity.

The community of Stratham received a presidential declaration from downburst activity. As with tornadoes, this is perceived to be a significant hazard in Rockingham County. At the submission of this plan the State was unable to locate any new county specific data with respect to this hazard type. The communities whose population, infrastructure, and community lifelines are most impacted by high wind events such as down bursts are the Towns of Hampton, Rye, and Seabrook.

Tropical and Post-Tropical Cyclones: Rockingham County has experienced high winds from some hurricane events and is positioned to experience storm surge related flooding, beach erosion and significant wind damage from these events. At the submission of this plan the State was unable to locate any new county specific data with respect to this hazard type. The county's most vulnerable communities to the impacts of this hazard are the Town of Hampton, the Town of New Castle, and the Town of Rye.

Lightning: At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to this hazard type. This does not negate that there are areas of specific vulnerability, and communities that would be disproportionately affected due to their population needs, infrastructure, and community lifelines. The Town of East Kingston, the Town of Hampton, the Town of Hampton Falls, and the Town of Kensington have been identified as the most vulnerable to the impacts of lightning.

Severe Winter Weather: Rockingham County is viewed to be vulnerable to severe winter weather (DR-4371). At the time of the submission of this Plan, the county received a presidential declaration for an October Nor'easter that dropped heavy snow, caused widespread power outages and debris. The Town of Epping, the Town of Raymond, and the Town of Rye are the communities who are the most vulnerable to the impact of this hazard.

Significant debris still remains in the county forests from ice storms. At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to this hazard type. The communities whose population, infrastructure, and community lifelines are most impacted by severe winter weather such as ice storms are the Towns of Epping, Raymond, and Rye.

Avalanche: Rockingham County has negligible risk for avalanche hazards as determined by the Risk Assessments completed by the Regional Planning Commission.

For a detailed list of participating jurisdictions in Rockingham County whose hazard vulnerabilities have been reviewed by the state, see Appendix D.

The most overall vulnerable communities as identified by the risk assessments, impact to the population, infrastructure, and community lifelines are Hampton and Portsmouth. The below table outlines the average potential loss for the combined communities.

Most Vulnerable Communities: Rockingham County	Structural Valuation	Average Building Value	5% Loss
	Residential	$3,241,589,080.00	$162,079,454.00
	Manufactured Housing	$21,759,500.00	$1,087,975.00
	Commercial/Industrial	$454,362,120.00	$22,718,106.00
	Utilities	$133,957,500.00	$6,697,875.00
	Tax-Exempt & Non-Taxable Buildings	N/A	N/A
	Total	**$5,431,633,760.00**	**$271,581,688.00**

These communities indicate that "new development has not increased the vulnerability of people or structures" in their communities. This is due in part to these most vulnerable communities maintaining Ordinances that restrict development in flood-prone areas.

Most Vulnerable Communities: Rockingham County	Community Lifeline	Number of Facilities	Value
	Safety and Security	10	N/A
	Food, Hydration, Shelter	3	N/A
	Health and Medical	8	N/A
	Energy	13	N/A
	Communications	11	N/A
	Transportation	17	N/A
	Hazardous Materials	9	N/A
	Water Systems	43	N/A
	Total	**114**	N/A

Notes: Local community critical facility data are incomplete and may include duplicate data from state-owned critical facilities. This information has been collected from historical inventories and local hazard mitigation plans. Estimated values are not available for most communities and are therefore incomplete.

The below communities were compiled to understand overall hazard risks within each county and was a combination of efforts which included the RPCs, HSEM field staff, historical data including Federally declared disasters, impacts to the populations, infrastructure, and community lifelines. Communities may consider utilizing the social vulnerability indicators, as demonstrated below, when understanding the most vulnerable hazards within each jurisdiction.

	INCOME < FPL	EDUCATION % > 25 YRS NOT HS GRAD	UNINSURED < 65 YRS OLD	BIPOC HISPANIC NON-WHITE	INDIVIDUALS > 65 YRS OLD	DISABILITY, AGE > 5 YRS OLD	HOUSEHOLDS WITH NO VEHICLE	LIMITED ENGLISH > 5 YRS OLD	SINGLE PARENT HOH	
Rockingham County	4.9%	4.5%	5%	7%	17.8%	11%	3%	0%	26%	**Noted Hazard Vulnerabilities**
East Kingston	6.0%	4.0%	6%	2%	19%	10%	1%	0%	15%	Wildfire, Lightning
Epping	5.0%	8.0%	9%	6%	18%	17%	1%	1%	18%	Flooding, Earthquake, Landslide, Severe Winter Weather
Exeter	6.0%	5.0%	5%	8%	23%	16%	7%	0%	26%	Earthquake
Freemont	2.0%	5.0%	2%	3%	17%	8%	0%	0%	17%	Flooding, Drought
Hampton	4.0%	2.0%	7%	5%	24%	12%	3%	0%	25%	Flooding, High Wind Event, Tropical and Post-Tropical Cyclone, Lightning
Hampton Falls	4.0%	3.0%	3%	2%	16%	7%	0%	0%	17%	Drought, Wildfire, Lightning
Kensington	2.0%	3.0%	5%	4%	20%	10%	2%	0%	21%	Lightning
Kingston	8.0%	7.0%	8%	3%	17%	10%	2%	0%	36%	Drought, Wildfire
New Castle	1.0%	0.0%	1%	0%	39%	10%	2%	0%	22%	Tropical and Post-Tropical Cyclone
Portsmouth	7.0%	4.0%	5%	12%	17%	10%	7%	1%	34%	Flooding, Earthquake
Raymond	7.0%	6.0%	5%	4%	11%	22%	2%	0%	34%	Flooding, Wildfire, Earthquake, Landslide, Severe Winter Weather
Rye	4.0%	2.0%	6%	2%	28%	11%	2%	0%	24%	High Wind Event, Tropical and Post-Tropical Cyclone, Severe Winter Weather
Seabrook	5.0%	10.0%	9%	5%	26%	19%	5%	1%	31%	High Wind Event
Stratham	2.0%	3.0%	3%	8%	16%	8%	0%	0%	13%	Drought

Strafford County: Barrington, Dover, Durham, Farmington, Lee, Madbury, Middleton, Milton, New Durham, Rochester, Rollinsford, Somersworth, Strafford

Flooding: Bordered to the North and West by the Salmon Falls and Piscataqua Rivers, Strafford County lies primarily in the Piscataqua River Watershed. The region is primarily low rolling hills and floodplain, consequently, inundation flooding is typical. The county also possesses tidal river, estuarine and salt marsh environments. Therefore, these areas are positioned with exposure to coastal flooding damage from hurricane, nor'easters and possibly tsunami events.

Flooding from River Ice has not proven to be a significant hazard in this county in the recent past. At the time of the submission of this Plan, the State was unable to locate any county specific data with respect to this hazard type. Given the moderating effects on the seasonal temperatures from the southern latitude and coastal exposure, the county is viewed as having a limited risk from this hazard type. Based upon the impact of coastal flooding to the population, infrastructure, and community lifelines the City of Dover and the Town of Durham are the communities most vulnerable to the impacts of this hazard. Likewise, the Town of Middleton, and the Town of Milton are the most vulnerable communities to the impacts of inland flooding.

Drought: Strafford County was impacted by the drought events of 1960, 2000-2002, and 2016-2017. The county hosts significant agricultural and livestock assets that are negatively impacted by such events. At the time of the preparation of this Plan, the State has located no new specific data as to the losses from drought events for this county. The Towns of Cities of Dover and Rochester have heightened vulnerability to this hazard.

Wildfire: Significant debris still remains in the county forests from ice storms. Given the salt marsh environments in the county, wildland fire hazards related to Phragmites Austrailis along the coast are viewed as significant. All the data for this hazard is presented in this Plan. The State was unable to locate any new county specific data with respect to this hazard type. However, the Towns of Middleton and New Durham have communities whose population, infrastructure, and community lifelines will experience a heightened impact from this hazard.

Earthquake: New Hampshire generally lies in a zone of Moderate seismic vulnerability. The county is in an area of particularly high seismicity that is evident in a crescent of historical events beginning in the Ossipee Range and following the general contour of the Merrimack River Valley (See Section III of this document). Additionally, it is believed that the largest earthquake of record in New England was the 1755 "Cape Ann" event, just offshore of the New Hampshire coast. At the submission of this plan the State was unable to locate any new county specific data with respect to this hazard type. The Town of Middleton and the Town of New Durham are the most vulnerable to the impacts of this hazard.

Landslide: Strafford County, due to its low elevation, is not prone to landslide hazards. However, due to the impacts on the population, infrastructure, and community lifelines the Towns of Middleton and New Durham are the most vulnerable.

High Wind Events: Strafford County has experienced three known F2 events in the past. The compilation of data from www.tornadoproject.com lists a total of two additional tornadic events (both additional are F1or less events). There has been no additional tornadic activity since the 2010 plan. The Town of Milton, and the Town of New Durham are the communities most vulnerable to the impacts of high wind events, including tornadic activity.

As with tornadoes, down bursts is perceived to be a significant hazard in this County. At the submission of this plan the State was unable to locate any new county specific data with respect to this hazard type. The communities whose population, infrastructure, and community lifelines are most impacted by high wind events such as down bursts are the Towns of Milton and New Durham.

Tropical and Post-Tropical Cyclones: Strafford County has experienced high winds from some hurricane events and is positioned to experience storm surge related flooding, beach erosion and significant wind damage from these events. August 2011 Tropical Storm Irene had a significant impact on Strafford County. The county's most vulnerable communities to the impacts of this hazard are the Town of Durham and the City of Dover.

Lightning: At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to this hazard type. This does not negate that there are areas of specific vulnerability, and communities that would be disproportionately affected due to their population needs, infrastructure, and community lifelines. The Town of Farmington and the Town of New Durham have been identified as the most vulnerable to the impacts of lightning.

Severe Winter Weather: Strafford County is viewed to be vulnerable to severe winter weather (DR-4371). At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to this hazard type. The Town of Durham and the City of Rochester are the communities who are the most vulnerable to the impact of this hazard.

Significant debris still remains in the county forests from ice storms. At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to this hazard type. The communities whose population, infrastructure, and community lifelines are most impacted by severe winter weather such as ice storms are the Town of Durham and the City of Rochester.

Avalanche: This County has a low risk for avalanche hazards as determined by the Risk Assessments completed by the Regional Planning Commission.

For a detailed list of participating jurisdictions in Strafford County whose hazard vulnerabilities have been reviewed by the state, see Appendix D.

The most overall vulnerable communities as identified by the risk assessments, impact to the population, infrastructure, and community lifelines are Farmington and Rochester. The below table outlines the average potential loss for the combined communities.

Most Vulnerable Communities: Strafford County	Structural Valuation	Average Building Value	5% Loss
	Residential	$648,574,902.00	$32,428,745.10
	Manufactured Housing	$63,240,750.00	$3,162,037.50
	Commercial/Industrial	$180,964,848.00	$9,048,242.40
	Utilities	$50,096,650.00	$2,504,832.50
	Tax-Exempt & Non-Taxable Buildings	N/A	N/A
	Total	**$942,877,150.00**	**$47,143,857.50**

These communities indicate that the major vulnerabilities to their population, infrastructure, and community lifelines is the result historic development. These communities do not foresee future development increasing their vulnerability due to their adoption of the most recent building and zoning regulations causing "comprehensive updates" to the community ordinances.

Most Vulnerable Communities: Strafford County	Community Lifeline	Number of Facilities	Value
	Safety and Security	4	$424,100.00
	Food, Hydration, Shelter	3	$85,019,800.00
	Health and Medical	3	N/A
	Energy	2	$87,035,100.00
	Communications	3	N/A
	Transportation	51	$101,103,000.00
	Hazardous Materials	N/A	N/A
	Water Systems	24	$6,200,000.00
	Total	**90**	**$279,782,000.00**

Notes: Local community critical facility data are incomplete and may include duplicate data from state-owned critical facilities. This information has been collected from historical inventories and local hazard mitigation plans. Estimated values are not available for most communities and are therefore incomplete.

The below communities were compiled to understand overall hazard risks within each county and was a combination of efforts which included the RPCs, HSEM field staff, historical data including Federally declared disasters, impacts to the populations, infrastructure, and community lifelines. Communities may consider utilizing the social vulnerability indicators, as demonstrated below, when understanding the most vulnerable hazards within each jurisdiction.

	INCOME < FPL	EDUCATION % >25YRS NOT HS GRAD	UNINSURED < 65YRS OLD	BIPOC HISPANIC NON-WHITE	INDIVIDUALS > 65YRS OLD	DISABILITY, AGE > 5YRS OLD	HOUSEHOLDS WITH NO VEHICLE	LIMITED ENGLISH > 5YRS OLD	SINGLE PARENT HOH	
Strafford County	4.9%	4.5%	5%	7%	17.8%	11%	3%	0%	26%	**Noted Hazard Vulnerabilities**
Dover	10.0%	6.0%	8%	12%	16%	13%	8%	1%	35%	Flooding, Drought, Tropical and Post-Tropical Cyclone
Durham	27%	2%	2%	10%	8%	6%	10%	0%	21%	Flooding, Tropical and Post-Tropical Cyclone, Severe Winter Weather
Farmington	10%	10%	6%	4%	16%	16%	5%	1%	39%	Lightning
Middleton	5.0%	10%	11%	6%	12%	10%	4%	0%	25%	Flooding, Wildfire, Earthquake, Landslide
Milton	3%	7%	10%	2%	19%	15%	3%	0%	16%	Flooding, High Wind Event
New Durham	6%	5%	6%	4%	17%	13%	3%	0%	32%	Wildfire, Earthquake, Landslide, High Wind Event, Lightning
Rochester	10%	11%	8%	8%	18%	18%	7%	1%	41%	Drought, Severe Winter Weather

Sullivan County: Acworth, Charlestown, Claremont, Cornish, Croydon, Goshen, Grantham, Langdon, Lempster, Newport, Plainfield, Springfield, Sunapee, Unity, Washington

Inland Flooding: Sullivan County lies in the Southwestern area of the State and is bound by the Connecticut River to the west. The City of Claremont lies in the center of the county and encompasses a significant area of the floodplain of the upper Sugar River.

River Ice related flooding along the Connecticut River is a periodic issue in Charlestown and other towns. Erosion accelerated by the destabilizing effects on riverbanks is a significant issue all along the Connecticut and other State Rivers. Additionally, River Ice may directly impact upon docks, wharfs, boathouses and nearby roads, bridges, culverts, and other infrastructure. Due to Sullivan County's inland location, local risk assessments indicate that none of its communities are vulnerable to coastal flooding. Given a variety of factors that impact the Town of Charlestown and the City of Claremont these are the communities identified as the most vulnerable to inland flooding.

Drought: Sullivan County was impacted by the drought events of 1960, 2000-2002, and 2016-2017. The county hosts significant agricultural and livestock assets that are negatively impacted by such events. At the time of the preparation of this Plan, the State has located no new specific data as to the losses from Drought events for this county. The communities whose population, infrastructure, and community lifelines are the most impacted by this hazard are the Towns of Acworth and Unity.

Wildfire: Significant debris still remains in the forests from the 2008 flooding event. Aside from the data presented in this Plan, the State was unable to locate any new county specific data with respect to this hazard type. Given the heavy forest cover countywide, this hazard type is of particular concern during dry periods. The communities whose population, infrastructure, and community lifelines are the most impacted by this hazard are the Towns of Acworth and Unity.

Earthquake: New Hampshire generally lies in a zone of moderate seismic vulnerability. Sullivan County is in an area of particularly high seismicity that is evident in a crescent of historical events beginning in the Ossipee Range and following the general contour of the Merrimack River Valley. At the time of this submission there has been no new activity with this hazard. The communities whose population, infrastructure, and community lifelines are the most impacted by this hazard are the City of Claremont and the Town of Newport.

Landslide: Some land formations along the Connecticut River are generally considered to be conducive to landslide activity. At the time of the submission of this Plan, the State was unable to locate any new county specific data with regard to this hazard type. Additional research is ongoing. The communities whose population, infrastructure, and community lifelines are the most impacted by this hazard are the Towns of Acworth and Unity.

High Wind Events: Sullivan County has experienced four known events (all F1 or less events) in the past. The compilation of data from www.tornadoproject.com lists four additional tornadic events from October 24, 1955, to July 16, 1963. There has been no additional tornadic activity since the 2010 Plan. The communities whose population, infrastructure, and community lifelines are the most impacted by this hazard are the Towns of Acworth and Unity.

At the time of the submission of this Plan, the State was unable to locate any new county-specific data with respect to down bursts. The communities whose population, infrastructure, and community lifelines are the most impacted by this hazard are the Towns of Acworth and Unity.

Tropical and Post-Tropical Cyclones: Sullivan County has experienced high winds from some hurricane events but is at a more significant risk to flooding from the associated hurricane rainfall. The 1938 hurricane event impacted this county because it received a near direct hit as well as Tropical Storm Irene in August 2011. The communities whose population, infrastructure, and community lifelines are the most impacted by this hazard are the Town of Newport and the City of Claremont.

Lightning: At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to this hazard type. The communities whose population, infrastructure, and community lifelines are the most impacted by this hazard are the Towns of Croydon and Sunapee.

Severe Winter Weather: Sullivan County is viewed to be vulnerable to severe winter weather (DR-4693). At the time of the submission of this Plan, the State was unable to locate any new county specific data with respect to this hazard type. The communities whose population, infrastructure, and community lifelines are the most impacted by this hazard are the Towns of Charlestown and Newport.

Significant debris still remains in the county forests from ice storms. At the time of the submission of this Plan, the State was unable to locate any county specific data with respect to this hazard type. The communities whose population, infrastructure, and community lifelines are the most impacted by this hazard are the Towns of Acworth and Unity.

Avalanche: This County has a low risk for avalanche hazards as determined by the Risk Assessments completed by the Regional Planning Commission.

For a detailed list of participating jurisdictions in Sullivan County whose hazard vulnerabilities have been reviewed by the state, see Appendix D.

The most overall vulnerable communities as identified by the risk assessments, impact to the population, infrastructure, and community lifelines are the Towns of Acworth and Unity, and the City of Claremont. The below table outlines the average potential loss for the combined communities.

Most Vulnerable Communities: Sullivan County	Structural Valuation	Average Building Value	5% Loss
	Residential	$58,719,226.00	$2,935,961.30
	Manufactured Housing	N/A	N/A
	Commercial/Industrial	$62,212,900.00	$3,110,645.00
	Utilities	N/A	N/A
	Tax-Exempt & Non-Taxable Buildings	N/A	N/A
	Total	**$880,910,476.00**	**$44,045,523.80**

These communities indicate they do not feel that they are more vulnerable to hazards as a result of development. This is due in part to these most vulnerable communities maintaining Ordinances that restrict development in floodplain, floodway, streambank, and historic areas.

Most Vulnerable Communities: Sullivan County	Community Lifeline	Number of Facilities	Value
	Safety and Security	2	$282,000.00
	Food, Hydration, Shelter	N/A	N/A
	Health and Medical	N/A	N/A
	Energy	N/A	N/A
	Communications	N/A	N/A
	Transportation	1	$85,000.00
	Hazardous Materials	N/A	N/A
	Water Systems	2	$63,539,152.00
	Total	**5**	**$63,906,152.00**

Notes: Local community critical facility data are incomplete and may include duplicate data from state-owned critical facilities. This information has been collected from historical inventories and local hazard mitigation plans. Estimated values are not available for most communities and are therefore incomplete.

The below communities were compiled to understand overall hazard risks within each county and was a combination of efforts which included the RPCs, HSEM field staff, historical data including Federally declared disasters, impacts to the populations, infrastructure, and community lifelines. Communities may consider utilizing the social vulnerability indicators, as demonstrated below, when understanding the most vulnerable hazards within each jurisdiction.

	INCOME < FPL	EDUCATION % > 25YRS NOT HS GRAD	UNINSURED < 65YRS OLD	BIPOC HISPANIC NON-WHITE	INDIVIDUALS > 65YRS OLD	DISABILITY, AGE > 5YRS OLD	HOUSEHOLDS WITH NO VEHICLE	LIMITED ENGLISH > 5YRS OLD	SINGLE PARENT HOH	
Sullivan County	12.5%	9.3%	9%	5%	21.4%	14%	6%	0%	41%	**Noted Hazard Vulnerabilities**
Acworth	4.0%	7.0%	19%	5%	31%	13%	2%	0%	20%	Drought, Wildfire, Landslide, High Wind Event, Severe Winter Weather
Charlestown	15%	9%	8%	6%	21%	14%	4%	0%	59%	Flooding, Severe Winter Weather
Claremont	16%	12%	7%	6%	18%	19%	11%	0%	50%	Flooding, Earthquake, Tropical and Post-Tropical Cyclone
Croydon	10.0%	9%	8%	2%	16%	11%	2%	0%	32%	Lightning
Newport	12.0%	12%	15%	7%	19%	18%	8%	0%	45%	Earthquake, Tropical and Post-Tropical Cyclone, Severe Winter Weather
Sunapee	8%	2%	9%	1%	20%	8%	5%	0%	25%	Lightning
Unity	10%	20%	18%	4%	30%	12%	1%	1%	52%	Drought, Wildfire, Landslide, High Wind Event, Severe Winter Weather

[1] CDC/ASTDR SVI Fact Sheet, CDC/ASTDR https://www.atsdr.cdc.gov/placeandhealth/svi/fact_sheet/fact_sheet.html

5. History of Disasters Declarations in New Hampshire

Major Disaster Declarations in New Hampshire 1953 – 2022

FEMA Definition: The President can declare a major disaster for any natural event, including any hurricane, tornado, storm, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, or drought, or, regardless of cause, fire, flood, or explosion, that the President determines has caused damage of such severity that it is beyond the combined capabilities of state and local governments to respond. A major disaster declaration provides a wide range of federal assistance programs for individuals and public infrastructure, including funds for both emergency and permanent work.

DR #	Declaration Date	Incident Description	AKA	Declaration Type	Total Funds
4693	3/12/2023	Severe Winter Weather and Inland Flooding	December 22-25, 2022	Major Disaster Declaration	$3,102,420.00
4624	10/4/2021	Severe Storms and Flooding	July 29-30 Flooding	Major Disaster Declaration	$1,293,973.48
4622	9/30/2021	Severe Storms and Flooding	July 17-19 Flooding	Major Disaster Declaration	$836,136.31
4516	4/3/2020	COVID-19	COVID-19	Major Disaster Declaration	$203,266,928.77
4457	8/15/2019	Severe Storm and Flooding	July 11 Storms	Major Disaster Declaration	$ 3,202,283
4370	6/8/2018	Severe Weather and Flooding	March Coastal Storm	Major Disaster Declaration	$ 895,861
4371	6/8/2018	Severe Winter Weather and Snowstorm	March 13 Blizzard	Major Disaster Declaration	$ 3,477,506
4355	1/2/2018	Severe Storms and Flooding	Oct 30 Storms & Flooding	Major Disaster Declaration	$ 12,434,377
4329	8/9/2017	Severe Storms and Flooding	July 1 Severe Wx	Major Disaster Declaration	$ 9,953,803
4316	6/1/2017	Severe Winter Storm	March 14 Severe Wx	Major Disaster Declaration	$ 2,502,300
4209	3/25/2015	Severe Winter Storm and Snowstorm		Major Disaster Declaration	$ 5,795,156
4139	8/2/2013	Severe Storms, Flooding, and Landslides		Major Disaster Declaration	$ 6,991,778
4105	3/19/2013	Severe Winter Storm and Snowstorm		Major Disaster Declaration	$ 7,098,650
4095	11/28/2012	Hurricane Sandy	Sandy	Major Disaster Declaration	$ 2,447,947
4065	6/15/2012	Severe Storm and Flooding	May 2012 Flood	Major Disaster Declaration	$ 3,549,545
4049	12/5/2011	Severe Storm and Snowstorm	Oct 2011 Severe Storm	Major Disaster Declaration	$ 3,854,615

4026	9/3/2011	Tropical Storm Irene	TS Irene	Major Disaster Declaration	$ 21,612,923
4006	7/22/2011	Severe Storms and Flooding	May Flood 2011	Major Disaster Declaration	$ 1,415,207

Emergency Declarations in New Hampshire 1953 – 2022					
FEMA Definition: The President can declare an emergency for any occasion or instance when the President determines federal assistance is needed. Emergency declarations supplement State and local or Indian tribal government efforts in providing emergency services, such as the protection of lives, property, public health, and safety, or to lessen or avert the threat of a catastrophe in any part of the United States. The total amount of assistance provided for in a single emergency may not exceed $5 million. The President shall report to Congress if this amount is exceeded.					
DR #	**Declaration Date**	**Incident Description**	**AKA**	**Declaration Type**	**Total Funds**
3445	3/13/2020	COVID-19	COVID-19	Emergency Declaration	N/A
3360	10/30/2012	Hurricane Sandy	Sandy	Emergency Declaration	$ 644,940
3344	11/1/2011	Severe Storm		Emergency Declaration	N/A
3333	8/27/2011	Hurricane Irene	TS Irene Cat B	Emergency Declaration	$ 551,168
3297	12/13/2008	Severe Winter Storm		Emergency Declaration	$ -
3258	9/19/2005	Hurricane Katrina Evacuation		Emergency Declaration	$ 9,887
3211	4/28/2005	Snow		Emergency Declaration	$ 2,112,182
3207	3/30/2005	Snow		Emergency Declaration	$ 3,611,491
3208	3/30/2005	Snow		Emergency Declaration	$ 1,121,727
3193	1/15/2004	Snow		Emergency Declaration	$ 2,631,915
3177	3/11/2003	Snowstorm		Emergency Declaration	$ 2,288,671
3166	3/28/2001	Snowstorm		Emergency Declaration	$ 3,433,252
3101	3/16/1993	Blizzards, High Winds and Record Snowfall		Emergency Declaration	$ 644,698
3073	3/15/1979	Flooding		Emergency Declaration	$ -

Governor Executive Order - State of Emergency in New Hampshire 1953 – 2022					
NH Title I, Chapter 4, Section 45 - State of Emergency Declaration; Powers*: I. The governor shall have the power to declare a state of emergency, as defined in RSA 21-P:35, VIII, by executive order if the governor finds that a natural, technological, or man-made disaster of major proportions is imminent or has occurred within this state, and that the safety and welfare of the inhabitants of this state require an invocation of the provisions of this section. As soon as practicable, the governor shall notify the speaker of the house of representatives and the senate president of the impending issuance of emergency orders under this section and provide a description of such orders. The general court shall have the same power to declare a state of emergency by concurrent resolution of the house and senate. An executive order or concurrent resolution declaring a state of emergency shall specify the: **(a)** Nature of the emergency; **(b)** Political subdivisions or geographic areas subject to the declaration; **(c)** Conditions that have brought about the emergency; and **(d)** Duration of the state of emergency, if less than 21 days.					
*https://www.gencourt.state.nh.us/rsa/html/I/4/4-45.htm					
DR #	**Declaration Date**	**Incident Description**	AKA	**Declaration Type**	**Total Funds**
2020-04	3/13/2020 - 6/11/2021	Public Health Outbreak		Governor Executive Order - State of Emergency	N/A
2015-1	1/26/2015	Severe Winter Storm		Governor Executive Order - State of Emergency	N/A
2014-6	8/14/2014	Public Health Outbreak		Governor Executive Order - State of Emergency	N/A
2013-8	6/26/2013	Severe Storms and Flooding		Governor Executive Order - State of Emergency	N/A
2013-3	2/8/2013	Severe Winter Storm		Governor Executive Order - State of Emergency	N/A
2010-1	2/25/2010	Severe Winter Storm		Governor Executive Order - State of Emergency	N/A
2008-12	12/11/2008	Severe Winter Storm		Governor Executive Order - State of Emergency	N/A
2003-9	8/11/2003	Severe Storms and Flooding		Governor Executive Order - State of Emergency	N/A

6. Hazard Profiles and History of Events

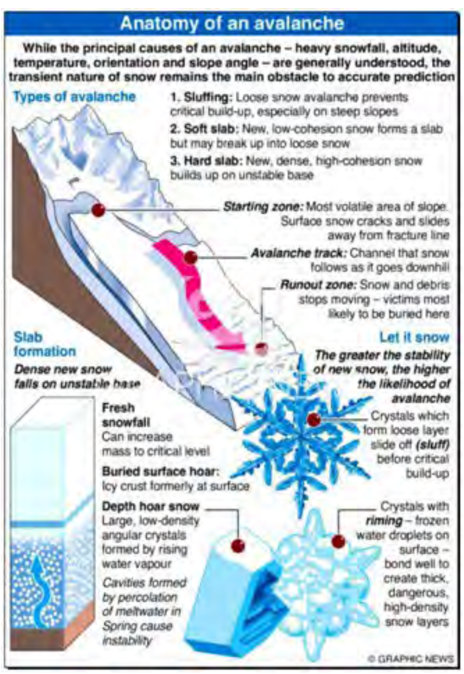
This section contains a compilation of information related to the hazards identified in this Plan's HIRA, which includes the definition of the hazard, where the hazard impacts the State, the extent of the hazard, previous occurrences, summation of future risk, and the highest probable extent of the hazard which could impact the location and/or the State. Also included in the hazard information are Community Lifelines Impacts, Impacts of Climate Change on the Hazard, as well as information on Individuals/ Communities Disproportionately Impacted by Hazard.

6.1 Hazard: Avalanche

Hazard Overview: Avalanche	
HIRA Risk	**Low**
Future Probability	**High**
Counties at Risk	**All**

Definition

An avalanche is a slope failure consisting of a mass of rapidly moving, fluidized snow that slides down a mountainside. The flow can be composed of snow, ice, water, soil, rocks, and trees. An avalanche is a large mass of snow and ice, falling, sliding, or flowing under the force of gravity.[1] An avalanche can be comparable to a landslide; only with snow instead of earth.[2]



Anatomy of an Avalanche
(Source, Graphic News)

Natural and human-caused snow avalanches most often result from structural weaknesses of mountainside and unstable snow and ice formations. Factors leading to these conditions include recent heavy snow, temperature, wind direction, snowpack conditions, slope angle, and slope orientation. Heavy snowfall followed by high winds often create areas of unstable snow accumulations that can be set in motion by human activities, such as hiking, ice climbing, skiing, and snowboarding.

There are three categories of avalanches:

- Soft Slab – consists of soft, low-density snow
- Hard Slab – consists of dense, hard-packed snow
- Loose Snow (also called sluffs or point releases) – release from a single point, typically on a very steep slope

Location

The mountainous regions of Carroll, Coos, and Grafton counties are at risk for avalanches, with the highest risk of avalanches occurring in the Presidential Range, particularly on Mount Washington.

Avalanches are well known to occur on New Hampshire's Mount Washington which, at 6,288 feet, is the tallest mountain in the northeastern United States. On a clear day, Vermont, New York, Massachusetts, Maine, Quebec, and the Atlantic Ocean can be viewed from the summit. The weather on Mount Washington is considered by many to be the worst in the world. The highest wind velocity ever measured on earth, 231 miles per hour, was clocked on the summit of Mount Washington on April 12, 1934. In fact, Mount Washington experiences hurricane force wind speeds, which are winds 75+ mph, on over one hundred days a year.

Mount *Washington from the East* (from atop Wildcat "D" peak). The summit of Mount Washington is in the clouds, as is so often the case. From left to right can be seen the Gulf of Slides, Tuckerman Ravine, the Ravine of Raymond Cataract, and Huntington Ravine, each of which has been the scene of one or more avalanche fatalities. (MWOBS)

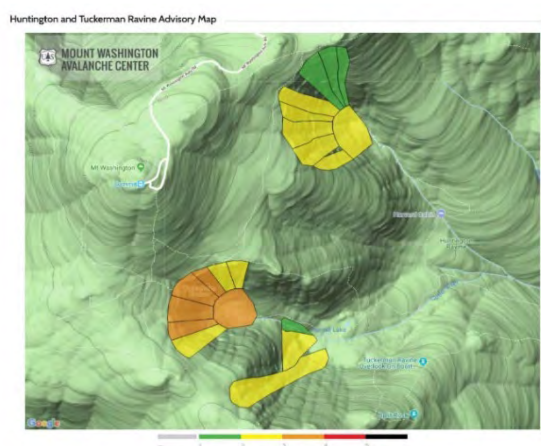
The below locations are examples which were highlighted through a combination of efforts which included a survey completed by the RPCs and NH HSEM field staff, historical data, and the National Risk Index.

In Jackson (Carroll County), though the risk of Avalanche is low, there is still an estimate structure loss of between $0 to 2,758,805 which is 0 to 1% of potential loss in the community. Because of the steepness of the terrain and heavy snowfall potential, it is recognized that avalanches should be listed as a hazard due to remote terrains where they are possible. Of these remote areas, the mountains in Pinkham Notch (Coos County) and around Mount Washington (Coos County) would be the most susceptible. The impact on human life, property, or business would be minimal if any; only with a unique combination of factors could a snow avalanche cause damage to structures.

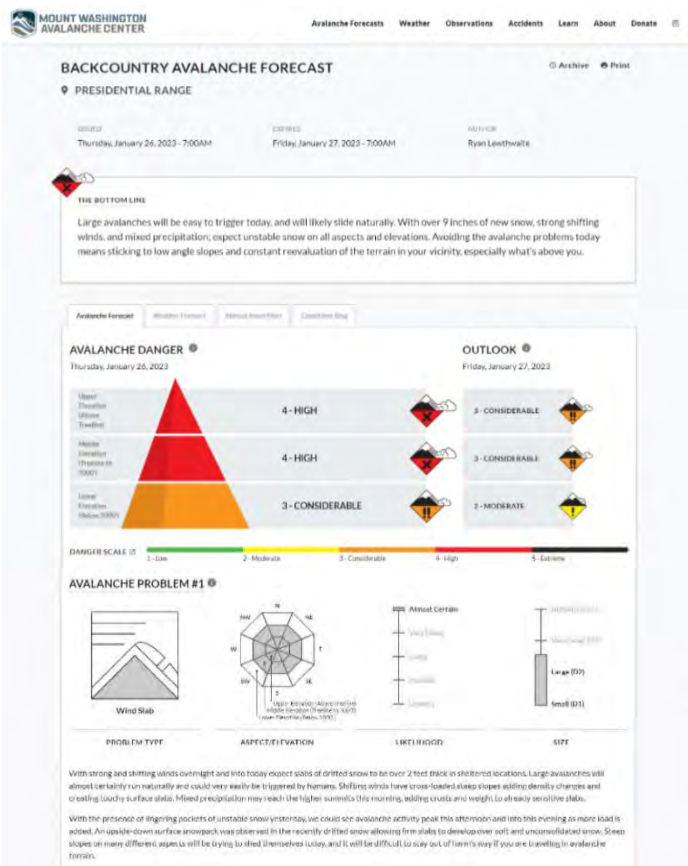
Background and Evolving Hazard Information

The Mount Washington Avalanche Center (MWAC) forecast area covers approximately 106 square miles (67,840 Acres) and is comprised of regions on the White Mountain National Forest and NH State Parks. The MWAC monitors the mountain's conditions, provides a Weather and Snowpack Tracker, and maintains a list of forecaster and public observer avalanche, snowpack, and weather observations.

The MWAC issues daily Backcountry Avalanche Forecast and Avalanche Forecast Map that include specific information for Huntington and Tuckerman Ravines, including current snowpack conditions, cause of snowpack instability, safety recommendations, and weather forecast information. Certain areas of the mountain may be closed because of elevated avalanche danger. The National Weather Service in Gray, ME collaborates with the Mount Washington Avalanche Center to relay Backcountry Avalanche Warnings to the public through their established messaging and broadcast channels.

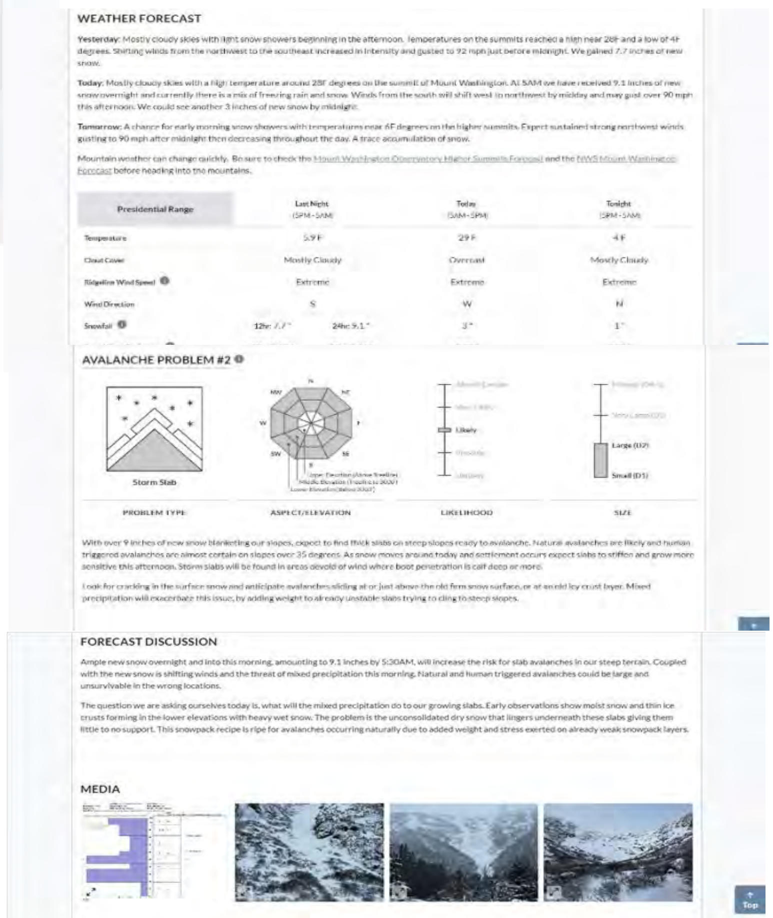


Left: *White Mountain National Forest Avalanche board (Source, MWAC)*
Right: *Example Mount Washington Avalanche Center Advisory Map (Source, MWAC)*



Left: Mt. Washington Avalanche Center's Avalanche Map

Below: Mt. Washington Avalanche Center's Backcountry Avalanche Forecast



Extent

North American Public Avalanche Danger Scale (NAPADS) is a system that rates avalanche danger and provides general travel advice based on the likelihood, size, and distribution of expected avalanches. It consists of five levels, from least to highest amount of danger: 1 – Low, 2 – Moderate, 3 – Considerable, 4 – High, 5 – Extreme. Danger ratings are typically provided for three distinct elevation bands. Although the danger ratings are assigned numerical levels, the danger increases exponentially between levels. In other words, the hazard rises more dramatically as it ascends toward the higher levels on the scale.[3]

North American Public Avalanche Danger Scale

Avalanche danger is determined by the likelihood, size, and distribution of avalanches.
Safe backcountry travel requires training and experience. You control your risk by choosing when, where, and how you travel.

Danger Level	Travel Advice	Likelihood	Size and Distribution
5 - Extreme	**Extraordinarily dangerous avalanche conditions.** Avoid all avalanche terrain.	Natural and human-triggered avalanches certain.	Very large avalanches in many areas.
4 - High	**Very dangerous avalanche conditions.** Travel in avalanche terrain not recommended.	Natural avalanches likely; human-triggered avalanches very likely.	Large avalanches in many areas; or very large avalanches in specific areas.
3 - Considerable	**Dangerous avalanche conditions.** Careful snowpack evaluation, cautious route-finding, and conservative decision-making essential.	Natural avalanches possible; human-triggered avalanches likely.	Small avalanches in many areas; or large avalanches in specific areas; or very large avalanches in isolated areas.
2 - Moderate	**Heightened avalanche conditions on specific terrain features.** Evaluate snow and terrain carefully; identify features of concern.	Natural avalanches unlikely; human-triggered avalanches possible.	Small avalanches in specific areas; or large avalanches in isolated areas.
1 - Low	**Generally safe avalanche conditions.** Watch for unstable snow on isolated terrain features.	Natural and human-triggered avalanches unlikely.	Small avalanches in isolated areas or extreme terrain.

North American Public Avalanche Danger Scale
(Source, National Avalanche Center)

Impacts

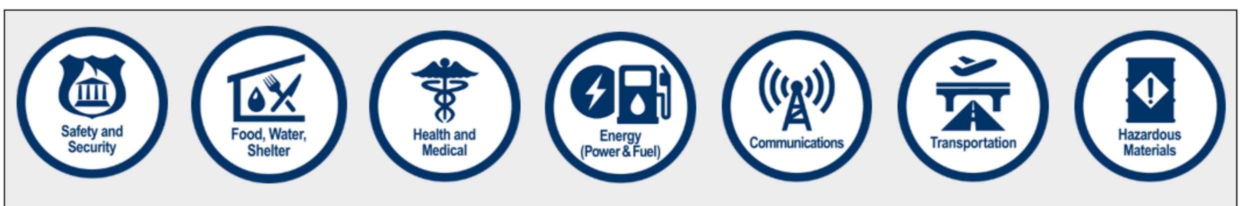
In the US, avalanches kill 25 – 30 people and injure many more each winter.[4] The extent of an avalanche prone area is determined by the amount of risk for natural or human triggered reactions based on factors such as snowpack distribution and other atmospheric conditions. The North American Public Avalanche Danger Scale (NAPADS) below, obtained from the National Avalanche Center (www.avalanche.org) shows the five danger classifications that are used to express avalanche risk.

Avalanches present a significant threat to hikers, skiers, and other people recreating on the mountain. Falling ice and rocks can cause injury or death. Cracks, holes, and crevasses in the snowpack can cause individuals to become trapped or buried in snow, which can result in extreme cold injuries, suffocation, and possibly death.

Avalanches are a common occurrence in high terrain areas in New Hampshire during the winter and spring months. Enhanced warning capabilities have allowed for people engaging in outdoor activities in these areas during avalanche season to be more prepared for the conditions and make smart choices when choosing to venture into these areas. That said, it is expected that the need for rescues due to avalanches will continue, especially as the popularity of extreme winter sports continues to increase.

Death or Injury

The most severe impact of an avalanche is death. Asphyxiation is the most common cause of death, followed by death from injury, and lastly, by hypothermia.



Search and Rescue operations train and prepare for response in hazardous conditions. Roads in avalanche prone areas will impact emergency services.	Search and Rescue operations train and prepare for response in hazardous conditions. Roads in avalanche prone areas will impact emergency services.	Search and Rescue operations train and prepare for response in hazardous conditions. Roads in avalanche prone areas will impact emergency services.	Search and Rescue operations train and prepare for response in hazardous conditions. Roads in avalanche prone areas will impact emergency services.	Search and Rescue operations train and prepare for response in hazardous conditions. Roads in avalanche prone areas will impact emergency services.	Search and Rescue operations train and prepare for response in hazardous conditions. Roads in avalanche prone areas will impact emergency services.	Search and Rescue operations train and prepare for response in hazardous conditions. Roads in avalanche prone areas will impact emergency services.

In New Hampshire, avalanches pose little threat to populated areas. Main impacts from this hazard are felt in the Presidential range, in high terrain areas, where few permanent structures and residents exist.

Previous Occurrences: History of Avalanches Events in New Hampshire				
Event Date	**Event Description**	**Impacts**	**Location**	**Additional Information**
2/25/2023	Skier-triggered avalanche Hard Slab – R2, D2	No injuries	Lip area, Tuckerman Ravine, Mount Washington	Elevation: 4,800’ Vertical Fall: 400’ Debris Depth: 5’ max Video footage from other people on scene: 1. https://youtu.be/KKHUXPdLjYg 2. https://youtu.be/pa5sz88Vp9U
	Team of 1 skier and 1 snowboarder. Both had previous backcountry experience. Both people were carrying avalanche rescue equipment including a beacon, shovel, and probe. Skier triggered a thin wind slab and continued skiing. Just after, a hard slab fractured underneath the skier and propagated diagonally out in both directions. Skier stopped above the crown. Snowboarder trapped and dragged by hard debris, slid down into and through Chicken Rock Gully into the Tuckerman Ravine floor. Snowboarder came to rest at the edge of Lunch Rocks, partially buried to waist, able to self-extricate and did not sustain any injuries. This avalanche had the destructive potential to bury and kill a person. **OF NOTE:** Due to a slight language barrier, it was not clear if they had understood the avalanche forecast or the location of that day’s avalanche problem. They had a map but did not have familiarity with the terrain in Tuckerman Ravine. They chose to enter this terrain with a false assumption of stability, which ultimately proved to be inaccurate. This incident, and especially the quality video that goes along with it, is a great example of the characteristics and danger of a hard slab avalanche.			
03/04/2022	Skier-triggered avalanche Hard Slab – R3, D2	No injuries	Sluice, Tuckerman Ravine, Mount Washington	
	Skier-triggered avalanche, carried about 300 feet, buried, and uninjured, coming to rest on top of the debris pile above “Lunch Rocks.”[5]			
12/05/2021	Human-triggered avalanche Soft Slab – R3, D2	Serious injuries, Rescue required	Left Gully, Tuckerman Ravine, Mount Washington	
	Single skier triggered shallow soft-slab avalanche near the top of Left Gully and was caught and carried. Same skier triggered a second, larger avalanche, was carried 800 vertical feet, landed on top of the snow at the mouth of the gully unharmed. A second, solo skier halfway up the gully transitioning from climbing to skiing when hit by the second avalanche. The second skier was carried 450 vertical feet over exposed rocks, passed the first skier, coming to a stop on top of the avalanche debris pile well below the entrance to the gully with serious injuries requiring immediate medical attention. Initial skier and partner provided aid to the injured skier until Harvard Cabin Caretaker arrived and radioed USFS Ski Rangers for rescue. Took the 9-person team four hours to transport patient via rescue litter sled to ambulance.			

02/01/2021	Human-triggered avalanche Wind Slab – Estimated D1	Fatality	Ammonoosuc Ravine, Mount Washington	
	Backcountry skier was traveling alone and most likely triggered a pocket of unstable snow on a hard wind crust from the previous week. Skier was trapped and buried in avalanche debris piled up against face of overhanging rock buttress, resulting in fatality. Subsequent avalanche buried victim further during snow storm the following day. Victim recovered two days following event. [6]			
01/22/2021	Human-triggered avalanche Wind Slab – D1-2	No injuries, Bystander rescue	Left Gully, Tuckerman Ravine, Mount Washington	
	Skier caught in avalanche triggered by friend, carried 850 vertical feet (max speed 53mph), buried face down but could lift head, body buried 2' – 3'. [7]			
02/20/2020	Human-triggered avalanche Soft Slab	No injuries	Sluice, Sluice Buttress/Ice area, Tuckerman Ravine, Mount Washington	
	Snowboarder, triggered, caught, carried, not buried. [8]			
02/20/2020	Human-triggered avalanche; Soft Slab	No injuries	Headwall, Tuckerman Ravine, Mount Washington	
	Avalanche spanned a majority of the headwall, started Center Headwall, first smaller avalanche failed mid slab, which then stepped down to bed surface. Crown spans from high in Chute across Center Headwall. Party of two caught and carried, not buried.[9]			
11/30/2019	Human-triggered avalanche; Wind Slab	No injuries	Tuckerman Ravine, Mount Washington	
	Two skiers ascending Chute triggered a wind slab which fractured from his feet up and across the slope. The resulting 30' wide and 2'+ deep crown spanned the width of the gully. The skiers were both captured by the flowing debris and carried for 200 vertical feet and 30 vertical feet downhill.[10]			

<table>
<tr><td>4/11/2019</td><td>Human-triggered avalanche; Wind Slab – R4, D2</td><td>Fatality</td><td>Raymond Cataract, Cutler River Drainage, Tuckerman Ravine, Mount Washington</td><td>At least three parties later stated they observed and reported the fresh crown line indicating recent avalanche, yet none looked or did beacon search of the debris where a ski and pole were clearly visible on the surface of the snow just 75’ uphill of the burial site.</td></tr>
<tr><td></td><td colspan="4">Single backcountry skier observed skiing Raymond Cataract around 1200. MWOBS web camera showed avalanche occur between 1200 and 1205. 1330 Snow Ranger informed about fresh crown line on Raymond Cataract. Ranger geared up and hiked to a viewpoint to investigate. At 1353 he observed one set of ski tracks above the fresh crown. Ranger called for backup, hiked to area of debris pile, received single avalanche beacon signal, and located and partially uncovered the victim, still alive, at 1418. Victim struggled to stand as Rangers dug and collapsed around 1430. Victim freed from the debris pile at 1434 and CPR was initiated. Continuous CPR performed during one-hour transport via rescue litter. Advanced Life Support measures aggressively applied by LifeFlight and EMS, victim was pronounced deceased at 1600.
Autopsy revealed victim died of hypothermia with no trauma or other medical factors noted. When the patient began to struggle and stand up, metabolic waste products, which had pooled in his blood stream, rushed back to his heart, and triggered cardiac arrest (circum- rescue collapse).</td></tr>
<tr><td>04/07/2019</td><td>7 Human-triggered avalanches ; R1-2, D1-2</td><td>1 Minor injury, 1 Major injury</td><td>Lobster Claw, Little Headwall, Left Gully, Chute, and Hillman’s Highway, Tuckerman Ravine, Mount Washington</td><td>40+ people were skiing/climbing Hillman’s that day.</td></tr>
<tr><td></td><td colspan="4">Three avalanches were intentionally triggered by skiers who were ski cutting[11] in Lobster Claw (R1, D1) and Little Headwall (R1, D1.5); Two avalanches unintentionally triggered by skiers in Left Gully and Chute (both R2, D1) in which no one was caught or carried by either; Single skier unintentionally triggered two avalanches at Hillman’s Highway. Initial avalanche (R2, D2), triggered as they entered the looker’s left fork and traveled 2/3 of the way down, caught and carried at least 5 people resulting in two injuries, one minor and one major but not life threatening. Same skier then triggered second avalanche (R2-D1) by beginning to ski the hang fire slab above initial avalanche crown right after initial rescue team arrived. Second avalanche didn’t capture or injure anyone.[12]</td></tr>
</table>

03/10/2018	Human-triggered avalanches	No injuries	Hillman's Highway, Gulf of Slides, Tuckerman Ravine, Mount Washington	
	Three skiers entered Hillman's despite warning from Snow Ranger, avalanche occurred and two were struck by debris, knocked down, and carried downslope. Two skiers climbing middle gully in the Fingers area of Gulf of Slides. Slab failed a "couple hundred feet above" and hit both skiers. The first was carried but escaped the main flow of debris while the other skier clung to bush. Skier that was carried turned his beacon to search and could not locate a signal of his partner, who was still above him. Caught and carried skier texted for help on his cell phone, but the pair made contact and called off the rescue. Skier who held onto bush lost his poles while the skier who was carried lost all his equipment though eventually recovered one ski.			
04/02/2017	Avalanche	Near-miss	Mt. Washington	Two skiers triggered an avalanche on an area of the mountain known as "the Duchess"
01/17/2016	Avalanche	Minor injuries	Mt. Washington	2 hikers and a skier suffered minor injuries during an avalanche on Tuckerman Ravine.
03/29/2015	Avalanches	Minor injuries	Mt. Washington	6 avalanches in one day, 4 of which were triggered by humans, only one avalanche resulted in minor injuries.
03/01/2013	Avalanche	Fatality	Mt. Washington	Ice climber died from injuries sustained in an avalanche in Pinnacle Gully
01/01/2013	Avalanche	Injuries	Mt. Washington	3 climbers swept over the edge in Central Gully in Huntington Ravine were injured
01/03/2012	Avalanche	No injuries	Mt. Washington	Two skiers triggered a small avalanche
2012	Mt. Washington Events	Injuries and Fatalities, Rescue required	Mt. Washington	2 confirmed deaths and 10 rescues
11/29/2003	Avalanche	Injuries and Fatalities	Mt. Washington	Large avalanche, 100+ yards of debris, 100' fall, 2 deaths from trauma. [13]
01/05/1997	Avalanche	Fatality	Mt. Washington	One fatality in an avalanche.

Impact of Climate Change on Hazard	
Climate Change Projection	**Impact on Hazard**
Increase in Sea Level	
Increase in Precipitation	• Increased amount of snow, would increase avalanche danger • Increase in wet snow could result in more avalanches • Heavier, wetter avalanches are larger and less predictable, extending further than those composed of dry, light snow[14] • As snow density in avalanche debris increases, respiration of completely buried victims will be more limited • Air masses may still be cold enough for intense snowfall, with increased snow depth at high elevations (related to higher snowfall intensity with increasing air temperature) resulting in major avalanche cycles • Longer dry spells punctuated by more intense storms • Midwinter rains can also build slick ice layers and more dust layers can also destabilize the snowpack
Increase in Temperature	• Blunt trauma and secondary injuries will likely become more frequent due to decrease in snow cover[15] • Seasonal snow line will occur at higher elevations, reducing risk of lower-elevation avalanches especially toward spring. • Potential for increase in avalanches at higher elevations in winter because of more favorable conditions for wet-snow avalanches earlier in the season • Shorter snow season • Duration and extent of snowpack will decrease • Changes in the frequency, intensity, and types of snowfalls, according to elevation • At lower elevations, the frequency and intensity of snowfall is likely to decrease, causing the snowpack to be thinner and wetter, with a higher average density • The duration and geographic extent of the snowpack will decrease at lower elevations • At moderate and high elevations, changes in temperature and precipitation may be more dynamic, with rapid oscillations between extremes • Extreme temperature swings early in the season make snow layers less cohesive

Individuals/ Communities Disproportionately Impacted by Hazard	
Individual/Community	**Description of Increased Impact**
Socially Vulnerable Populations (due to income, education, health care access, and housing)	• May experience limited financial resources or cultural, language, or citizenship barriers that restrict their access to health care, social services, and safe, nutritious food
Children	• Spending more time outdoors than adults, increases their exposure to heat and cold, rain and snow, outdoor allergens, and insect bites. • Dependance on others for care increases vulnerability
Individuals Aged ≥ 65 Years	• Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with a Disability/Disabilities	• Emergency warnings and other important messages may not be available in formats that are accessible to individuals with certain disabilities (such vision or blindness, hearing loss, or mobility issues). • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with Pre-existing or Chronic Health Conditions (including behavioral health)	• Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.

ENDNOTES – HAZARD: AVALANCHE

[1] Dictionary of Geological Terms, 3rd ed., s.v. "avalanche."

[2] http://www.naturaldisasters.ednet.ns.ca/Projects/Avalanche/bja.htm

[3] North American Public Avalanche Danger Scale, National Avalanche Center. https://avalanche.org/avalanche-encyclopedia/human/resources/north-american-public-avalanche-danger-scale/

[4] Avalanche Basics, National Avalanche Center, (2023). https://avalanche.org/avalanche-education/

[5] Skier-triggered avalanche – Sluice, Tuckerman Ravine, MWAC, Incidents & Accidents. https://www.mountwashingtonavalanchecenter.org/skier-triggered-avalanche-sluice-tuckerman-ravine-march-4-2022/

[6] Ian Forgays – Avalanche fatality, Ammonoosuc Ravine, Mount Washington. https://www.mountwashingtonavalanchecenter.org/19846-2/

[7] Human-triggered avalanche – Left Gully, Tuckerman Ravine, MWAC, Incidents & Accidents. https://www.mountwashingtonavalanchecenter.org/human-triggered-avalanche-left-gully-tuckerman-ravine/

[8] Avalanche – Tuckerman Ravine – 04/02/2019_1330, MWAC, Incidents & Accidents. https://www.mountwashingtonavalanchecenter.org/avalanche-tuckerman-ravine/

[9] Avalanche – Tuckerman Ravine – 04/02/2019_1100, MWAC, Incidents & Accidents. https://www.mountwashingtonavalanchecenter.org/tuckerman-ravine-avalanche/

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6.2 HAZARD: COASTAL FLOODING

Hazard Overview: Coastal Flooding	
HIRA Risk	**High**
Future Probability	**High**
Counties at Risk	**Rockingham & Strafford Counties**

Definition

Coastal flooding is defined by the National Oceanic and Atmospheric Administration (NOAA) as flooding which occurs when water is driven onto land from an adjacent body of water. This generally occurs when there are significant storms, such as tropical and extratropical cyclones (NWS Internet Services Team, 2009). Coastal flooding can also occur with high tides in many locations. Also described as “nuisance”, “sunny-day” and “recurrent” flooding, minor high tide flooding is becoming increasingly common with little or no concurrent storm effects (NOAA, 2023). By definition, flooding in coastal areas caused by precipitation is considered inland (riverine) flooding; however, it is important to note that the combination of heavy rain and coastal flooding can lead to compound flooding in coastal regions (Wahl, Jain, Bender, Meyers, & Luther, 2015). Coastal flooding not only results in the many problems identified for inland flooding but could also include additional issues resulting from storms and/or recurrent flooding. These problems can include but are not limited to—beach and shoreline erosion; loss or submergence of wetlands, other coastal ecosystems, and developed land; impacts from saltwater intrusion and high groundwater tables; loss of coastal structures (sea walls, piers, bulkheads, bridges, or buildings); overwhelmed public infrastructure; water quality impairments; and hazardous waste exposure. Loss of life and property damage can be more severe in coastal storm events due to velocity of wave action and accompanying winds.

Location

New Hampshire has 235 miles of coastline, including 18 miles of shoreline exposed to the Atlantic Ocean (New Hampshire Office of Strategic Initiatives) and 217 miles of tidally influenced shoreline within the Great Bay and Hampton- Seabrook estuaries (NH Department of Environmental Services, 2023). Seventeen municipalities form the New Hampshire Coastal Zone within Rockingham and Strafford counties as shown on the left (NH Department of Environmental Services, 2023). In New Hampshire, coastal flooding can occur in any of these 17 coastal zone municipalities.

Atlantic Coast Municipalities

New Hampshire's seven Atlantic Coast communities include Hampton, Hampton Falls, North Hampton, New Castle, Portsmouth, Rye, and Seabrook. These communities are located in the southeastern corner of the State and are directly exposed to the Atlantic Ocean. The Atlantic Coast is characterized by tidal and riverine systems and landforms. The southern Atlantic Coast consists of a barrier beach system including the extensive salt marshes of the Hampton-Seabrook Estuary, a broad sand beach at Hampton, and dune systems in Hampton and Seabrook. The northern Atlantic Coast is marked by prominent bedrock headlands, small cove beaches, and tidal waterways that extend far inland. The primary inland riverine systems include the Taylor River and Winnicut River.

Great Bay Municipalities

New Hampshire's Great Bay (tidally- influenced) municipalities include Dover, Durham, Exeter, Greenland, Madbury, Newfields, Newington, Newmarket, Rollinsford, and Stratham. These communities are located in the southeastern corner of the State surrounding Great Bay, which is a nationally recognized Estuarine Research Reserve.

Most of the Great Bay communities lie within the Piscataqua River Basin through which flow a number of coastal rivers, including the Cocheco, Lamprey, Oyster, Exeter, Winnicut, and Salmon Falls. The Salmon Falls River flows south into the Piscataqua River and acts as the boundary between New Hampshire and Maine before draining into the Gulf of Maine through Portsmouth Harbor. Influenced by historic development patterns and significant changes in land use, as well as extreme precipitation and coastal surge, these complex freshwater river systems have experienced more frequent and significant flooding during storm events in the past 12 years. These contributing factors translate into the Great Bay communities being vulnerable to both salt water and freshwater flooding.

The below locations are examples which were highlighted through a combination of efforts which included a survey completed by the RPCs and NH HSEM field staff, historical data, and the National Risk Index.

The City of Dover (Strafford County) is impacted by coastal flooding. Portions of land and property in the 100-year floodplain specifically along the mainstream of the Cochecho River and its tributaries; Fresh Creek; the Salmon Falls River; the Bellamy River; and the Piscataqua River. According to the C-RiSe assessment report, the inland coastal portion of Dover that is most susceptible to coastal flooding is located in low areas along the Bellamy River; the Piscataqua River; at the Confluence of the Cochecho River; and the Salmon Falls River; and along the shores of Little Bay. In 2006 and 2007, there were two 100-year events that resulted in impacts to local transportation infrastructure, including: Middle Street over Canney Brook, County Farm Road over Jackson Brook, Blackwater Road over Blackwater Brook, and Watson Road over the Cochecho River. The City of Dover has also identified several other issues within the community due to frequent flooding which include boat launches, walking trails, transportation lots, the Children's Museum, and residential apartments. Coastal flooding could impact critical facilities including the water and sewer pipes, seven pump stations, and two dams. Several transportation assets are impacted, including evacuation routes, and local urban compact areas. Based on the high hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately $208,929,340 in estimate potential losses from flooding.

In Durham (Strafford County) though most of the infrastructure and critical facilities appear to be outside the areas that are most susceptible to sea-level rise, several community assets, including important evacuation routes and commuter corridors on Routes 4 and 108, municipal water and sewer infrastructure, and two dams are at risk.

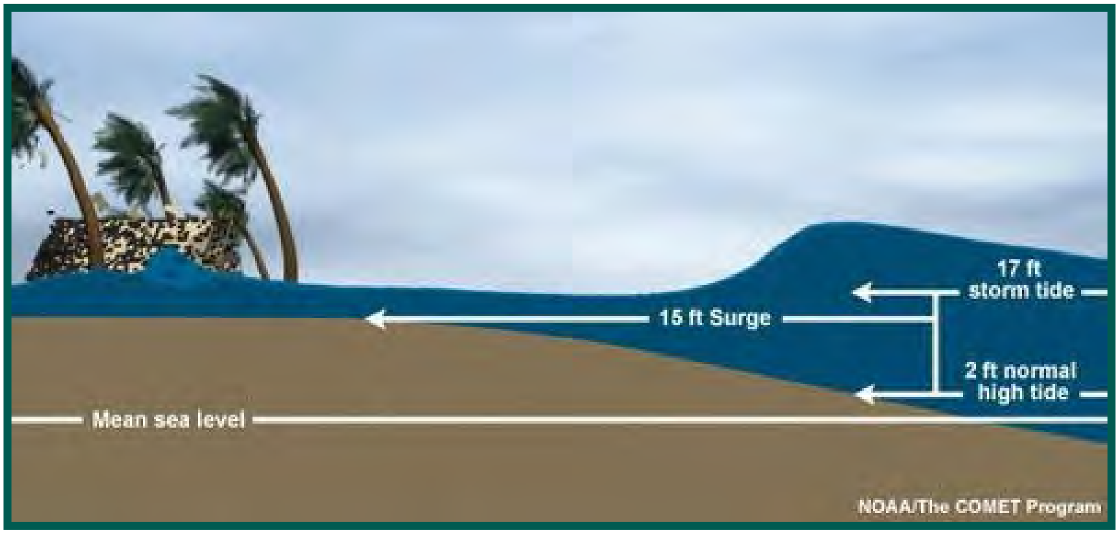
For the Town of Hampton (Rockingham County), when storms strike in connection with high tides, the waters can flow three feet deep or more, especially west of Ashworth Avenue where many residences have been built on filled marshland. Impacts are possible to both infrastructure and critical facilities. Any other flooding, such as riverine flooding, will be covered in the inland flooding hazard section.

Background and Evolving Hazard Information

Coastal floods are caused by extreme sea levels, which arise as a combination of four main factors: waves, astronomical tides, storm surges, and relative mean sea level (University of Southampton, 2016). Rainfall can exacerbate coastal flooding, leading to compounded impacts. New Hampshire experiences coastal flooding from episodic coastal inundation that result from tropical cyclones (hurricanes) and extratropical storms (Nor'easters) and occasional high tides, as well as chronic coastal inundation due to sea-level rise. Types of episodic and chronic coastal inundation factors are defined below:

Storm surge

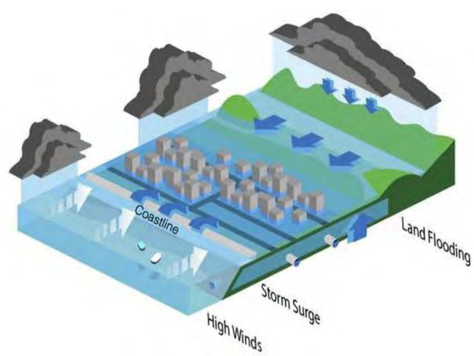
Storm surge is produced by storm winds that drive ocean waters onshore, resulting in a short-term rise in sea level (National Hurricane Center, n.d.). The abnormal rise in sea level can cause extreme flooding in coastal areas, particularly when storm surge coincides with high tide. Storm surges can be further exacerbated by surface wave action caused by the friction between wind and water (National Oceanic and Atmospheric Administration, 2023). Wave action can cause significant damage.



Combining high tide and storm surge to understand the storm tide (Source: NOAA)

Tidal/High-tide/nuisance flooding

High tide flooding, also described as “nuisance”, “sunny-day” and “recurrent” flooding, is flooding that leads to public inconveniences, such as road closures. It is increasingly common as coastal sea levels rise and developed areas expand and change drainage patterns in coastal areas. It is often caused by or exacerbated during astronomical spring tides when the gravitational pull 95 percent of high tides that occur in Hampton could reach or exceed the 10-foot MLLW threshold for high tide flooding. Between of the sun is ‘added’ to that of the moon, causing high tides to be higher and low tides to be lower than normal. This type of minor flooding often occurs with little or no concurrent storm effects (NWS Internet Services Team, 2009).



Understanding compound flooding from land and ocean sources
(Source, Theodore Scontras – University of Maine)

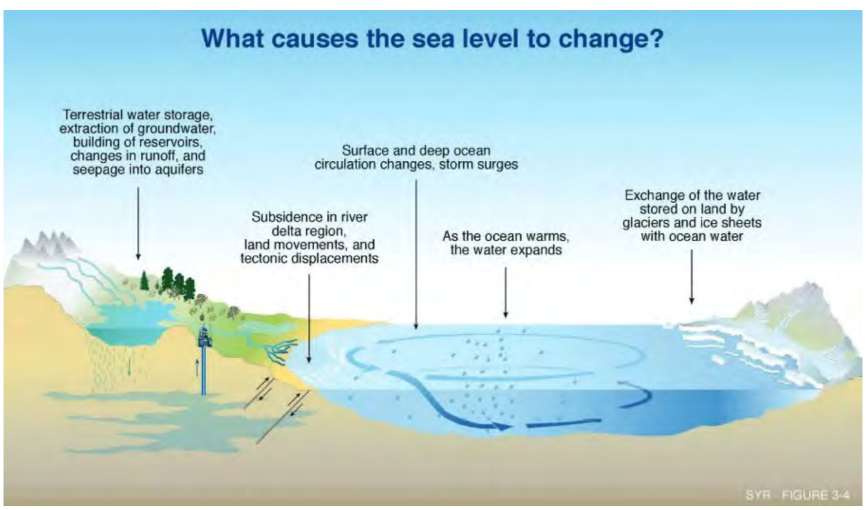
Compound flooding

(e.g., freshwater flooding + storm surge and/or high tide)

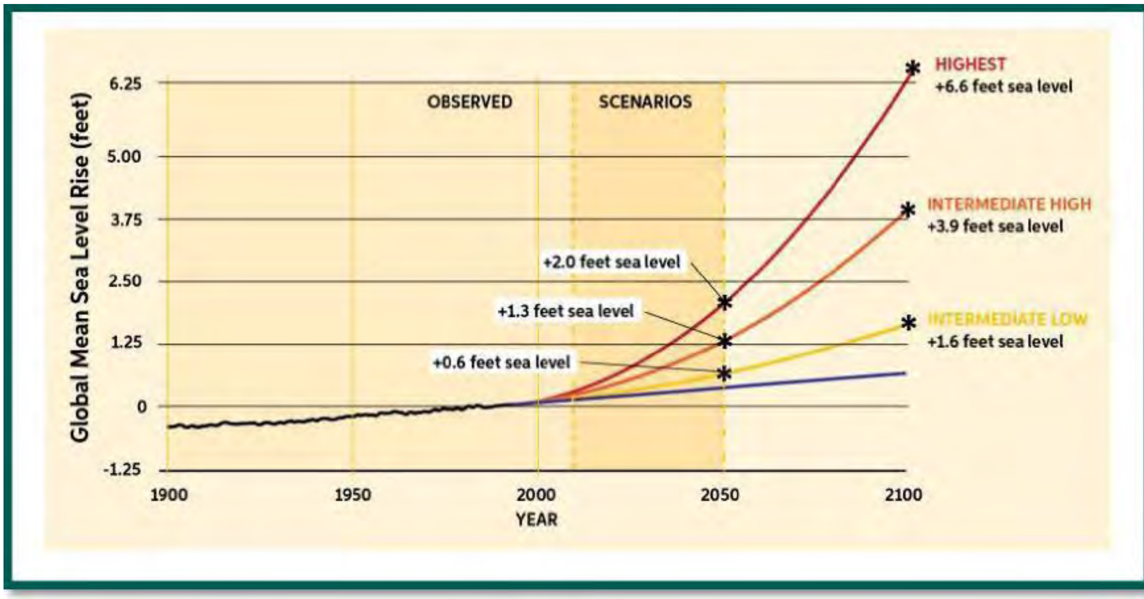
Compound flooding can occur when storm surge and heavy precipitation happen concurrently. High tidal or surge water levels can impede stormwater draining into the sea, causing flooding inland. High rainfall can add yet more water to an existing tidal flood. The risks of flood impacts from compound flooding in low-lying coastal areas is often much greater than from either coastal flooding or inland flooding in isolation (University of New Hampshire, 2019).

Sea-level rise

According to the 2019 New Hampshire Coastal Flood Risk Assessment, "based on tide-gauge data from Seavey Island and Portland, Maine, Relative Sea Level (RSL) in coastal New Hampshire/southern Maine has risen approximately 7.5 – 8.0 inches from 1912–2018." (University of New Hampshire, 2019). Sea levels are expected to continue rising at an accelerating rate well beyond the end of the 21st century due to natural and human-driven changes to the global climate and local landscape. The rate of ice mass loss from the Greenland and Antarctic ice sheets is largely driving the rate and amount of sea-level rise, which in turn will be determined by the global greenhouse gas concentration. Relative sea-level rise (RSLR) projections estimate that coastal New Hampshire is likely to experience RSLR of 0.5 - 1.3 feet between 2000-2050 if global greenhouse gas concentrations stabilize. There is a 1-in-100 chance that RSLR will exceed 2.0 feet by 2050 and a 1-in-1000 chance that RSLR will exceed 2.9 feet by 2050 if global greenhouse gas concentrations stabilize. After 2050, projections become increasingly dependent on global greenhouse gas concentrations and there is much larger range in RSLR projections through 2150. Coastal New Hampshire is likely to experience 1.0-2.9 feet RSLR by 2100 if greenhouse gas emissions stabilize after 2050. However, if global greenhouse gas concentrations continue to grow throughout the 21st century, coastal New Hampshire is likely to experience RSLR of 1.5-3.8 feet by 2100. There is a 1-in-100 change that RSLR will exceed 5.3 feet by 2100 if greenhouse gas emissions stabilize.



Factors that contribute to sea level change.
(Source, IPCC 2021)



Sea-level rise scenarios under difference emissions levels in 2050 and 2100" (Source, NHCRHC)

Groundwater rise

In coastal areas, groundwater flows from recharge areas to discharge areas along the shoreline. As sea-level rises, the groundwater levels near the coast also rise until a new equilibrium is established between aquifer recharge and groundwater discharge to the sea. Modeling shows that groundwater rise driven by sea-level rise may cause flooding in areas where groundwater levels are already high, not only along the coast but also at significant distances inland (htt28).

Human activities, such as disruption of natural protective coastal features (dunes, wetlands, etc.) and the lowering of land to create better drainage, have aggravated the coastal flooding hazard in some areas. Roads directly parallel to the coastline, such as New Hampshire Route 1A, are prone to splash over when storms combine with high tide, which can compromise transportation routes. Further, roads that cross tidal marshes can be flooded under similar circumstances, creating potential impacts to egress, in the event of the need to evacuate. This problem is often exacerbated by undersized culvert infrastructure that is inadequate to pass storm flows.

Extent

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.

Diagram of a hurricane and associate storm surge causes (Source, COMET MetEd Program, NOAA)

Storm events along the coast, such as tropical cyclones and Nor'easters, create storm surge which poses the greatest threat to life and property. Storm surge occurs when water is pushed onshore by the force of winds of a storm moving onshore, with the most severe storm surge occurring when the winds blow onshore perpendicular to the angle of the beach. Storm surge is very complex and challenging to forecast, as any slight change in storm intensity, movement, speed, size, angle of approach to the coast, and central pressure can affect the severity of the surge along the coast (National Hurricane Center, n.d.).

Where tidal gauges are present, the magnitude of flooding is ranked, and area specific forecasts are created using a flood scale that ranges from the Action Stage to Major Flood Stage. The National Weather Service characterizes flood severity to effectively communicate the impact of flooding as follows (Abshire & Mullusky, 2019):

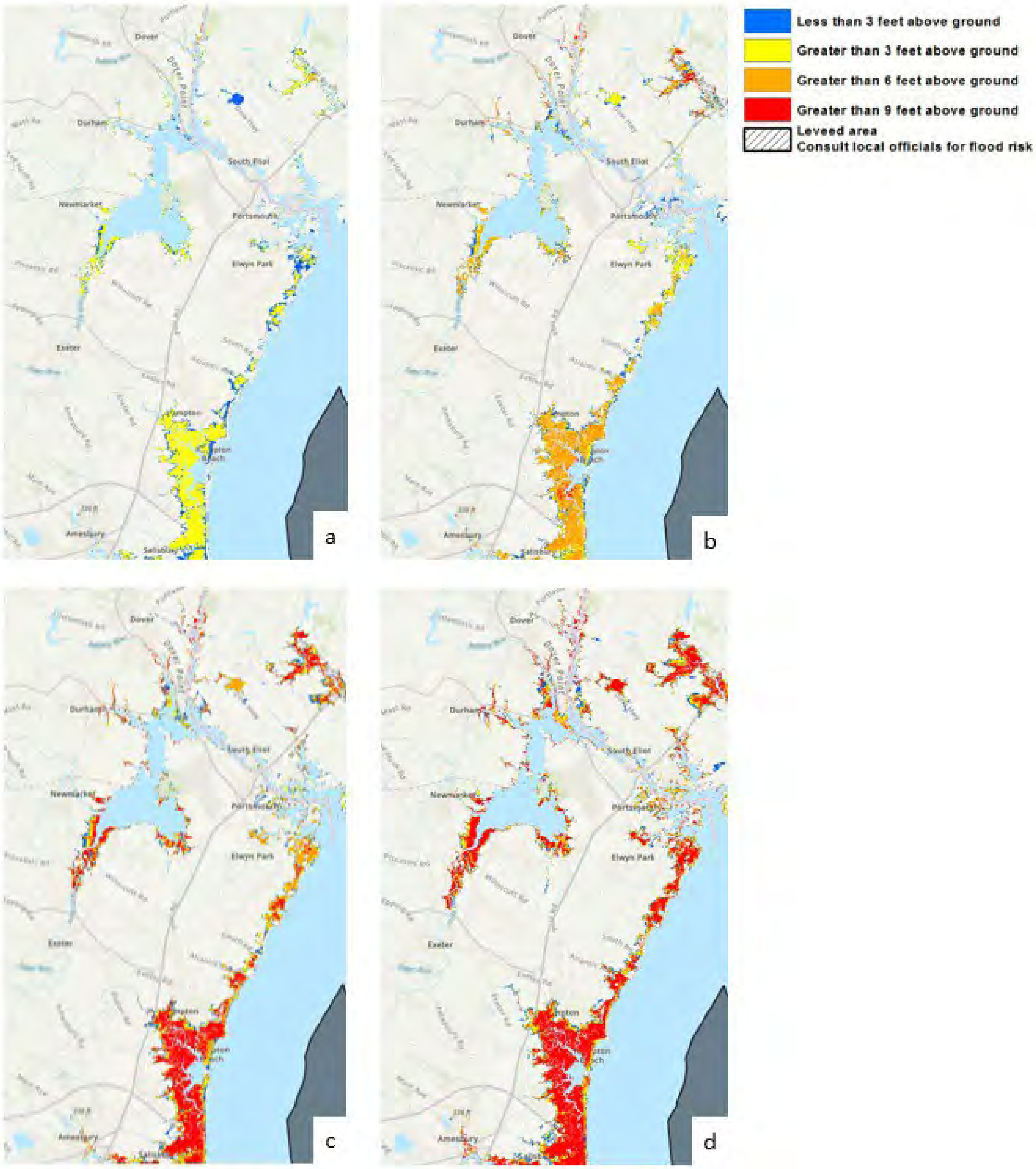
- Action Stage – Water source is rising, and actions must be taken in preparation of potential signification hydrologic activity. There are no impacts at this stage.
- Minor Flood Stage – Minimal or no property damage, but possibly some public threat (e.g., inundation of roads)
- Moderate Flooding – Some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations
- Major Flooding – Extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.

There are two tidal gauges along the coastline of New Hampshire to enhance flood forecasts and monitor the severity and frequency of coastal flooding. These tidal gauges are located at Hampton Harbor and are maintained by the Northeast Regional Association of Coastal Ocean Observing Systems (NERACOOS) and National Oceanic and Atmospheric Administration's

National Ocean Service (NOAA NOS), respectively. The impacts of floods vary locally. For each NWS forecast location, flood stages associated with each of the NWS flood severity categories are established in cooperation with local officials. The flood stage for minor flooding at the Fort Point, New Hampshire tide gauge is 11.5 feet while the minor flood stage at the Hampton, New Hampshire tide gauge is 11.0 feet above Mean Lower Low Water (MLLW).

NOAA uses the Sea, Lake, and Overland Surge from Hurricanes (SLOSH) model to generate storm surge predictions using a computer. Meteorologists and emergency management personnel are able to utilize the SLOSH computer model to create storm surge inundation maps that are based on Maximum Envelopes of Water (MEOWs) and the Maximum of MEOWs (MOMs) that take into account different storm intensities to show, approximately, how much flood waters will inundate the land along the coast (Weather Underground, 2023). This technique is currently regarded as the best approach for determining potential storm surge and is based solely on the direction of motion, forward speed, and intensity of a hypothetical tropical cyclone. It is worth noting here that the scenarios generated by the SLOSH model assume a direct hit by the storm to the modeled location.

Emergency management officials utilize tools such as SLOSH modeling and HURREVAC, evacuation decision support guidance based on Hurricane Evacuation Studies (HES), and National Hurricane Center (NHC) forecast products to determine the potential impacts of tropical cyclones—namely storm surge— by using real time track information from an incoming tropical cyclone. During incidents, this information can be used to determine which evacuation zones to issue an evacuation order. Before and after incidents, the information contained in historical data can be used to identify previously impacted areas to identify mitigation opportunities based upon previous extent of inundation.



NOAA NH Surge Storm Risk Maps for (a) Category 1, (b) Category 2, (c) Category 3, and (d) Category 4 (Source, NOAA)

Screenshot from HURREVAC software depicting the storm track of Hurricane Sandy. From the NOAA forecast information, this software can display estimated rainfall amounts and areas, estimated wind amounts and areas, estimated flood surge areas and extent, as well as help plan for time of impacts and evacuations if necessary. (Source, HURRREVAC)

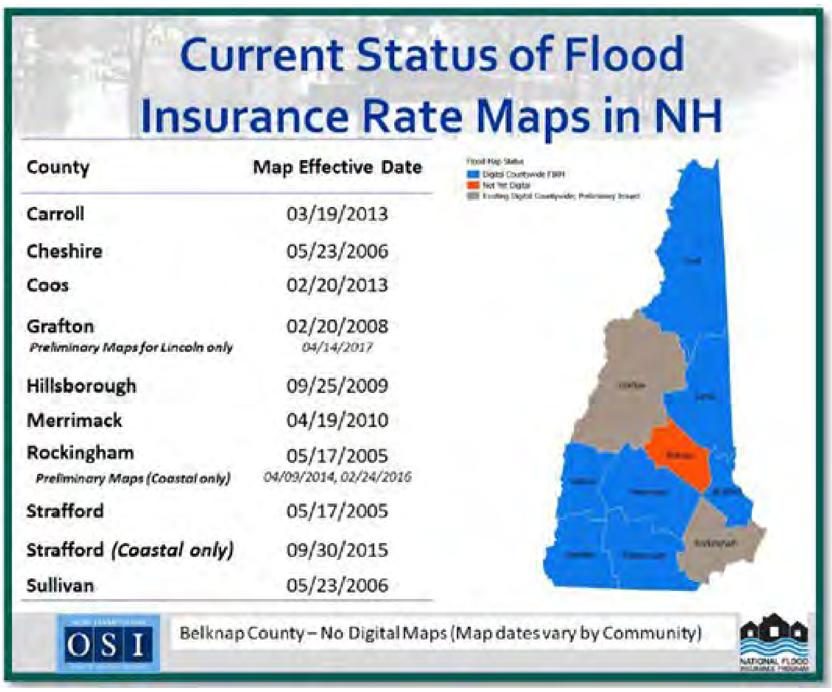
FEMA's Flood Insurance Rate Maps (FIRMs) show the areas of 1% annual chance flood. Coastal areas of Rockingham and Strafford Counties recently received updated FIRMs that incorporated higher resolution LiDAR data and a new coastal flood hazard mapping methodology that includes storm surge and wave run-up analyses. FEMA finalized the updated coastal maps for communities in Strafford County in 2015 and for communities in Rockingham County in 2021. The Table below shows the status of the FIRMs in New Hampshire as of December 2022.

Current Effective Date of Flood Insurance Rate Maps in NH	
County	**Map Effective Date**
Carroll	03/19/2013
Cheshire	05/23/2006
Coos	02/20/2013
Grafton	02/20/2008
Hillsborough	09/25/2009
Merrimack	04/19/2010
Rockingham	05/17/2005
Rockingham *(Coastal only)*	01/29/2021
Strafford	05/17/2005
Strafford *(Coastal only)*	09/30/2015
Sullivan	05/23/2006

*Digital Flood Insurance Rate Maps are not available in Belknap County.
Source: New Hampshire Office of Planning and Development. (n.d.) Rockingham County. https://www.nh.gov/osi/planning/programs/fmp/coastal-mapping- project/rockingham-county.htm

Impacts

Coastal hazards associated with coastal storms, surge, sea-level rise, and extreme precipitation events can be devastating to human health and safety, public and private structures and facilities, natural resources, and the economies of coastal communities. Coastal New Hampshire was fortunate to experience minimal damage from Tropical Storm Irene in 2011 and Superstorm Sandy in 2012. Nevertheless, the impacts of these storms on neighboring states and the more extreme local impacts from storms such as the Mother's Day storm of 2006, the Patriots' Day storm of 2007, and other historical events have reinforced our knowledge that strong storm systems can cause immense damage in areas on or near the coast. New Hampshire's coastal exposure to current and future flood risks is significant. As of 2016, the state's 17 coastal municipalities are home to approximately 11 percent of the state population, host over 100,000 jobs, and generated a 2014 Gross Regional Product of approximately $11 billion.



Current status of New Hampshire County Flood Insurance Rate Maps (FIRMS) as of May 2018

Total Estimated Potential Losses for Flood Event Scenarios in Coastal NH Communities

		Total Estimated Potential Losses[1] for Flood Event Scenarios in Coastal New Hampshire Communities								
	Total Inventory	10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized ($/yr)
	Estimated Value	Dollar Losses	Loss Ratio[3]	Dollar Losses	Loss Ratio[3]	Dollar Losses	Loss Ratio[3]	Dollar Losses[2]	Loss Ratio[3]	Dollar Losses[2]
Dover	$6,102,080,00	$37,537,000	1%	$50,368,000	1%	$57,940,000	1%	$82,621,000	1%	$4,752,00
Durham	$2,357,650,00	$14,739,000	1%	$19,526,000	1%	$22,385,000	1%	$28,103,000	1%	$1,802,00
Exeter	$3,100,191,00	$33,085,000	1%	$47,861,000	2%	$56,031,000	2%	$58,874,000	2%	$4,304,00
Greenland	$484,973,00	$2,469,000	1%	$3,123,000	1%	$3,083,000	1%	$4,517,000	1%	$294,00
Hampton	$4,343,390,00	$49,146,000	1%	$57,688,000	1%	$82,019,000	2%	$116,756,000	3%	$5,876,00
Hampton Falls	$546,407,00	$1,906,000	<1%	$2,655,000	<1%	$2,962,000	1%	$4,253,000	1%	$262,00
Madbury	$338,761,00	$142,000	<1%	$243,000	<1%	$276,000	<1%	$429,000	<1%	$21,00
New Castle	$290,321,00	$7,945,000	3%	$13,186,000	5%	$15,047,000	5%	$19,440,000	7%	$1,103,00
Newfields	$341,218,00	$333,000	<1%	$334,000	<1%	$433,000	<1%	$699,000	<1%	$39,00
Newington	$802,827,00	$2,668,000	<1%	$3,523,000	<1%	$3,828,000	<1%	$5,237,000	1%	$315,00
Newmarket	$1,490,058,00	$2,170,000	<1%	$3,397,000	<1%	$4,599,000	<1%	$7,276,000	<1%	$312,00
North Hampton	$1,066,530,00	$1,668,000	<1%	$1,988,000	<1%	$2,510,000	<1%	$3,237,000	<1%	$194,00
Portsmouth	$6,996,817,00	$94,501,000	1%	$137,829,000	2%	$152,566,000	2%	$197,823,000	3%	$11,980,00
Rollinsford	$418,273,00	$1,680,000	<1%	$2,233,000	1%	$3,316,000	1%	$4,285,000	1%	$221,00
Rye	$1,427,941,00	$36,948,000	3%	$49,390,000	3%	$54,095,000	4%	$68,887,000	5%	$4,531,00
Seabrook	$1,740,448,00	$12,973,000	1%	$15,823,000	1%	$21,625,000	1%	30,294,000	2%	$1,578,00
Stratham	$1,704,096,00	$1,573,000	<1%	$3,117,000	<1%	$4,477,000	<1%	$5,493,000	<1%	$251,00
TOTAL	**$33,551,981,000**	**$301,483,000**	**<1%**	**$412,284,000**	**1%**	**$487,192,000**	**1%**	**$638,224,000**	**2%**	**$37,835,000**

[1] Total Loss = Total Building / Contents[4] + Business Disruption[5]

[2] Losses shown are rounded to nearest $10,000 for values under $100,000 and to the nearest $100,000 for values over $100,000.

[3] Loss ratio = Dollar Losses ÷ Estimated Value. Loss Ratios are rounded to nearest integer percent.

[4] Total Building / Contents Loss = Residential Building / Contents Loss + Commercial Building / Contents Loss + Other Building / Contents Loss.

[5] Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

Total Hazus estimated flood losses for the 17 coastal zone communities summarized
(FEMA, 2016)

Personal properties (houses, outbuildings, etc.), businesses, industrial complexes, housing units, roads, flood control devices (culverts, etc.), bridges, railroads, power and utility lines, seawalls, and contents of properties are all examples of assets that can be damaged during a coastal flooding event. After the primary damages from coastal flooding have passed, additional damage may occur over time as impacted structures rot and degrade. Coastal flooding events with combined strong surge and high wave action not only cause inundation, but are strong enough to physically move large debris, such as boulders and cement seawalls, and also knock homes and other structures off their foundations.

Coastal flooding can result in a multitude of environmental impacts. Storm-induced high tides can inundate tidal marshes causing damage to the fragile habitat and reducing the high biodiversity typically located in the marshes. Extensive coastal flooding also introduces salty seawater into adjacent lands and can cause saltwater intrusion into the groundwater table if such flooding occurs to a significant distance inland. Beaches and sand dunes are subject to significant erosion during coastal flood events, which can reduce the ability of these features to buffer lands directly inland from the power of the ocean. This is of particular concern when another storm or high tide occurs shortly after to the initially damaging one, exacerbating flooding just inland. An example of this was seen in March of 2018 when back-to-back coastal storms, the first of which coincided with one of the highest astronomical high tides of the year, significantly damaged the seawall and caused other severe impacts in many coastal towns. These events led to a federally declared disaster for the State.

Paid National Flood Insurance Program Losses

Coastal Participation in The National Flood Insurance Program (NFIP) is a regulatory framework that employs floodplain management techniques to identify existing flood vulnerabilities and reduce the negative impacts of flooding on the built environment. All 17 coastal zone municipalities participate in the NFIP, but many communities have only adopted the NFIP minimum standards, which offer structures some protection from flood damage. Additionally, Seabrook Beach Village District located in the Town of Seabrook and the Village of Little Boar's Head located in the Town of North Hampton also participate as their own communities in the program. A few communities have adopted higher standards, including the Cities of Dover and Portsmouth and the Towns of Durham and Rye, which have instituted a 2-foot freeboard requirement, and the Towns of Hampton, Exeter, and Madbury, which has instituted a 1-foot freeboard requirement.

As of December 2022, there were a total of 2,513 NFIP flood insurance policies in effect in New Hampshire's 17 coastal zone communities and two village areas, which accounts for approximately 40 percent of the State's total policies. Of those coastal zone communities, Hampton holds 60 percent of total policies, followed by Rye with 11 percent. Since 1978, there have been a total of over 1,455 losses, totaling over $13.2 million in NFIP paid losses in the coastal zone municipalities. Hampton has 55 percent of those losses followed by Rye with 18 percent. Additionally, there have been a total of 383 repetitive losses, totaling over $7.2 million in repetitive loss payments to the coastal zone communities.

Currently, none of the 17 coastal zone communities or two village areas participate in the NFIP Community Rating System (CRS), which is a voluntary incentive program that encourages communities to adopt and enforce floodplain regulations and activities that go beyond the minimum requirements.

While these communities are all at risk of coastal flooding, some of the claims data is likely associated with freshwater flooding (referred to as inland flooding in this plan) incidents. It is also important to recognize that not all coastal flood damage is captured by NFIP paid losses data, and, therefore, additional coastal flood damage and associated costs to property not covered by flood insurance or unclaimed under the NFIP were also incurred during this period.

Coastal flooding is expected to worsen over time due to a combination of rising sea levels that result from a changing climate, a growing population in areas with beaches, and increased development along coastlines. Sea-level rise in tandem with an increase in the intensity and frequency of coastal storms will exacerbate coastal flooding events in the future. In addition, there may be increased vulnerability to flora and fauna; and it is not clear if some of our natural protections (such as salt marshes) will be able to keep up with sea-level rise. Salt marshes and wetlands serve to provide a transition zone between the ocean and dry land. The natural inland migration of these natural protections as a response to sea-level rise are hindered by coastal development, effectively bringing ocean waters closer to developed areas on a more regular basis. More information on potential future impacts of sea-level rise and increased severity and frequency of storm surge events is discussed in the Climate Change Chapter of this plan.

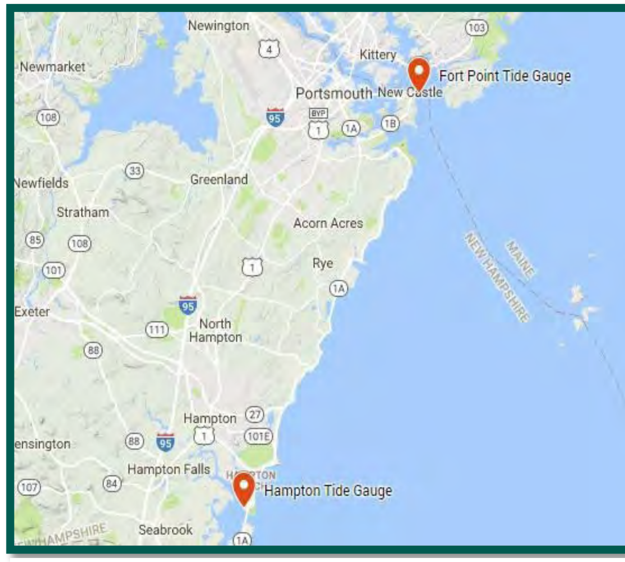
Safety and Security	Food, Water, Shelter	Health and Medical	Energy (Power & Fuel)	Communications	Transportation	Hazardous Materials
Government facilities may be unusable due to flood waters. Water rescue operations may be necessary.	Shelter and feeding operations will require assistance from ARC, coordinated by the state. Normal supply lines to coastal areas will can be impacted, requiring alternate supply lines. The State Commodity Distribution Plan can be utilized if needed. Long term housing solutions may be required. Local agriculture may not be able to sustain operations.	Long-term care facilities may require evacuation for those in areas susceptible to coastal flooding. Local medical facilities will also be impacted due to flood waters. Inability to travel may impact staffing. Census levels will rise due to injuries.	Flooding will damage infrastructure limiting regular operations for citizens, businesses and government. Fuel delivery through NH Port may be impacted due to infrastructure damage, requiring alternate delivery routes. Seabrook Station's location on the coast opens it to flood damage which will impact energy distribution throughout the state.	Flooding can cause damage to underground communication lines. Sirens in the seacoast area are designed to withstand flooding impacts.	Transportation routes immediately along the coast will be impacted; Major highways are mor. e susceptible to flash floods due to rain. Local ports will sustain damage, and may not be functional. Railways would not be impacted by coastal flooding, mass transit is by bus, which could be impacted by damaged roads, but could be relocated ahead of floods to allow use in evacuations.	Seabrook Station will require close monitoring. Local wastewater treatment plants may be without power causing sewage contamination. Local businesses storing hazardous materials may require specialized clean up. Local water sources may become contaminated, and require alternative source of water for consumption.

New Hampshire coast lines are normally susceptible to spill over during higher than normal astronomical tide cycles. Strong storms during higher than normal ties pose additional risk.

Previous Occurrences: History of Coastal Flooding Events in New Hampshire

According to NOAA's Centers for Environmental Information, New Hampshire experienced 46 coastal flood events between 1950 and 2017. While no deaths due to coastal flood events were reported during that period, 37 of the events resulted in property damage (NOAA, 2023).

New Hampshire has a high tidal range that varies at different locations around the coastal zone. At the Fort Point tide gauge, between April 2007 and October 2017, mean high water averaged 9.3 feet above mean lower low water (NOAA, 2023). Between 2013 and 2017, the Fort Point, New Hampshire tide gauge registered 18 events that exceeded the minor flood stage of 11.5 feet. Five notable high tides and dates are listed below for the Fort Point tide gauge referenced to mean lower low water. The Hampton, New Hampshire tide gauge was installed in 2013, and historical data at this site has been recorded since 2018. The highest tide in recent years was recorded by the Hampton Tide gauge at 13.24 feet on January 4, 2018 during winter storm Grayson.



New Hampshire Tide Gauge Locations
(Source: Google)

Maximum Tides at Fort Point Tide Gauge since 2007 (Source: NOAA)	
Event Month	**Fort Point Maximum Tide (highest first)**
January 2010	12.277 ft
January 2014	12.257 ft
April 2007	12.159 ft
June 2012	12.156 ft
May 2017	12.113 ft

Several coastal storm and flood events that occurred between 1938 and 2018 are described in the table below (National Weather Service, n.d.) (Cannon, 2018). This table does not capture all major coastal flooding that has occurred in coastal New Hampshire communities. Some instances of coastal flooding by hurricanes are captured in the Tropical and Post-Tropical section of this Plan.

Previous Occurrences: History of Coastal Flooding Events in New Hampshire				
Event Date	**Event Description**	**Impacts**	**Location**	**Additional Information**
September 1938	Hurricane	Few records of damage exist. Heavy damage along the coast with significant flooding.	Statewide	The flood of September 1938 occurred when a hurricane struck New England after a week of almost continuous rain. The hurricane itself produced another 4-8” of rain in New Hampshire.
December 1959	Nor’easter	Damage was heaviest along the coast.	New Hampshire Coast	A Nor’easter brought tides exceeding maximum tidal flood levels in Portsmouth.
March 1972	Severe Coastal Storm	Damage was extensive along the coast.	New Hampshire Coast	The Coastal Area was declared a National Disaster Area because of the devastating effects of a severe coastal storm.
February 1978	“The Blizzard of ‘78”	The hardest hit area was the coastline, with wave action and floodwaters destroying homes. Roads all along the coast were breached by waves flooding over to meet the rising tidal waters in the marshes.	Statewide	A Nor’easter brought strong winds and precipitation to the entire State.
December 1986	Storm	Ocean Boulevard closed Route 51 to High St. Flooding on Ashworth Ave. and Brown Ave. in Hampton, NH. Floating pier lost at Portsmouth U.S. Coast Guard Station. Boats sank in Rye Harbor.	New Hampshire Coast	• 12.75’ tide (Portland, ME) with • 1.14’ of storm surge and 17’ waves. • Highest water at Hampton Beach in six years.
January 1987	Storm	Several miles of Route 1A from Hampton to Little Boars Rd. closed. Seawall partially collapsed in Rye. Hampton Police Station surrounded by water knee deep.	New Hampshire Coast	• 13.14’ tide (Portland, ME) with • 1.79’ storm surge and 10’+ waves.

October 1990	Storm	Southern end of Hampton seawall was damaged. Hampton Policy Station and Island Path were flooded with 2’ of water.	New Hampshire Coast	• 13.26’ tide (Portland, ME) with • 1.64’ storm surge and 14’ waves.
October 1991	“The Perfect Storm”	Hampton Police and Fire Stations flooded with 2’ of water. One house in Seabrook was swept away. Significant damage to Rye Harbor. Street flooding on Route 1A in Rye. $5.6 million in property damage.	New Hampshire Coast	• 12.73’ tide (Portland, ME) with • 2.89’ storm surge and 28’ waves. • Tidal surge of approximately 3.5’.
December 1992	Storm	Seaweed forced up the filter of the cooling system at the Seabrook Nuclear Power Plant, shutting it down. Waves carried heavy boulders and sand onto roads, over seawalls.	New Hampshire Coast	• 12.14’ tide (Portland, ME) with • 1.31’ storm surge and 18’ waves.
October 1996	Storm	Significant damage was caused along the coast.	New Hampshire Coast	• The coastal areas were declared disaster areas after receiving 14 inches of rain. • High tides coincided with a 500-year precipitation event.

May 2006	"Mother's Day Flood"	Homes and businesses were damaged extensively, primarily in inland tidal communities. Many roads were washed out and impassible. Some bridges were damaged or destroyed. Several evacuations and rescues took place during the flood event. Two dams on the Salmon Falls River were being monitored because they were at risk for overflowing. Damage costs were $10 million but this is for public damage only. There were no deaths or injuries reported.	New Hampshire Coast	A Nor'easter created flooding through the State.
April 2007	"Patriot's Day Storm"	Statewide public damage costs were $8 million. The beaches, especially North Beach, suffered the worst erosion in decades. Seawalls in Rye were destroyed. Water and waves flooded roads at Hampton Beach. No deaths or injuries were reported.	New Hampshire Coast	• A major Nor'easter fueled waves that reached over 30'. • Astronomical high tides reached 12.5' at the Fort Point tide gauge (newly installed in 2007) with 2.02' of storm surge. • Flooding continued over a three-day period.

February and March 2010	Storms	Numerous roads were flooded and culverts were blown-out. Disaster declarations were made for two of the storms.	New Hampshire Coast	The seacoast area received three, 50-year precipitation events in a 35-day period.
October and November 2012	Superstorm Sandy	Flooding occurred in usual areas in Hampton back bay area.	New Hampshire Coast	Tropical storm Sandy reached the NH Seacoast with a moderate astronomical high tide and storm surge of approximately 2'. Seas eventually reached 20' in height with wave action.
January 2018	Grayson	Hampton Police and Fire Station parking area was flooded and inaccessible for 90 minutes. Fire Department completed several rescues. Fire trucks were damaged by salt water. Damage to homes and vehicles was reported in Hampton. Route 1A was closed briefly through Rye. Mechanic St. in Portsmouth was also closed due to flooding.	New Hampshire Coast	• Nor'easter snowstorm occurred during a 10.5' tide • Additional 2.74' of storm surge, • Reaching 13.24' at the Hampton tide gauge.
March 2018	Sequential Coastal Storms	Rockingham County sustained widespread damages to State and local infrastructure, including seawall damage in four communities.	New Hampshire Coast	A combination of high tide levels and large waves caused by the storm resulted in severe damage to route 1A, the temporary closure of three dozen roadways due to debris, and significant damage to three miles of shale seawall.
December 2022	Severe Winter Storm and Coastal Flooding	Damage to Seawall, major roadway closures. Astronomically High Tide and storm landfall increased impact.	New Hampshire Coast	DR-4693 for inland counties, but not coastal communities

Impact of Climate Change on Hazard	
Climate Change Projection	**Impact on Hazard**
Increase in Sea Level	Climate change will potentially increase the number of tidal and coastal flooding events due to storm surge and costal erosion during the severe weather events. This will impact marsh migration, a loss and subsidence of wetlands, along with saltwater intrusion, which can contaminate water supplies as well.
Increase in Precipitation	An increase of precipitation will lead to additional coastal flash flooding, potentially overload culverts and drainage systems, stagnant water, episodic drought, and degradation of stream channels and wetlands.
Increase in Temperature	Increase of temperature may cause additional severe weather events; that will lead to additional instances of more pronounced coastal flooding events.
Increase in Severe Weather	N/A

Individuals/ Communities Disproportionately Impacted by Hazard	
Individual/Community	**Description of Increased Impact**
Socially Vulnerable Populations (due to income, education, health care access, and housing)	• May live in locations that are prone to climate-related health hazards • May have greater rates of existing medical conditions, • May live in poorly maintained or aging infrastructure that may not be able to handle climate-related event • May struggle to access resources and care • May experience limited financial resources or cultural, language, or citizenship barriers that restrict their access to health care, social services, and safe, nutritious food
Children	• Their developing bodies can make them more vulnerable to hazards like heat and poor air quality. • Children breathe at a faster rate, increasing their exposure to dangerous air pollutants. • Spending more time outdoors than adults, increases their exposure to heat and cold, rain and snow, outdoor allergens, and insect bites. • Higher water intake can increase exposure to certain contaminants in recreational waters and the risk of developing gastrointestinal or other illnesses. • Children can experience mental health impacts from extreme events that are expected to increase with a changing climate. • Dependance on others for care increases vulnerability

Individuals Aged ≥ 65 Years	• Older people are less able to compensate for the effects of certain environmental hazards, such as air pollution. • Older adults are more likely to have health conditions that make them more sensitive to climate hazards like heat and air pollution, which can worsen their existing illnesses. • Limited mobility, increasing their risks before, during, and after an extreme weather event. • Some medications can change the body's ability to respond to heat, increasing risk for heat illnesses and death as the climate warms. • Aging can impact the immune systems, increasing risk for extreme reactions related to heat, insect- and tick-related diseases, and water-related illnesses. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with a Disability/Disabilities	• Decisionmakers may not fully consider people with disabilities in their planning. One reason for this is that climate change effects on people with disabilities have not been studied as much as other vulnerable populations. • Emergency warnings and other important messages may not be available in formats that are accessible to individuals with certain disabilities (such vision or blindness, hearing loss, or mobility issues). • Necessary medical care may be disrupted before, during, and after an event, including due to evacuations, transportation system or health infrastructure damages, or power outages. • Increased likelihood that they may have additional social and economic risk factors, such as poverty and unemployment, that put them at greater risk. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with Pre-existing or Chronic Health Conditions (including behavioral health)	• Chronic medical conditions may increase risk of illness and death, particularly exposure to heat, extreme weather events, water-related illnesses, and poor air quality. • Necessary medical care may be disrupted before, during, and after an event, including due to evacuations, transportation system or health infrastructure damages, or power outages. • Some medications can affect the body's response to heat, increasing risk for heat illnesses. • Some conditions/medications compromise the immune system, increasing risk for extreme reactions related to heat, insect- and tick-related diseases, and water-related illnesses. • Individuals with chronic behavioral health conditions may be more vulnerable to trauma from extreme weather events, as well as disruptions to support networks and mental health care. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.

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6.3 HAZARD: DROUGHT

Hazard Overview: Drought	
HIRA Risk	Low
Future Probability	Medium
Counties at Risk	All

Definition

A drought is a period of dryness in a region that occurs as a result of below-average precipitation received. Droughts can be further classified as follows:

- Meteorological drought: a deficit in precipitation over a period-of-time compared to some historical norm.
- Agricultural drought: when crops become affected by drought conditions.
- Hydrological drought: the occurrence of below normal stream flows, surface water levels, and groundwater levels as a result of meteorological drought.
- Socioeconomic drought: when economic supply and demand is negatively impacted by drought (NOAA, n.d.).

Location

The entire State of New Hampshire is at risk for experiencing drought. Drought conditions may exist simultaneously over several states or be confined to a small area or areas within a single state. The severity or effects of drought may have considerable spatial variability due to a variety of factors, such as unequal distribution of rainfall, differences in topography and soil, varying drainage patterns, and differing geologic formations.

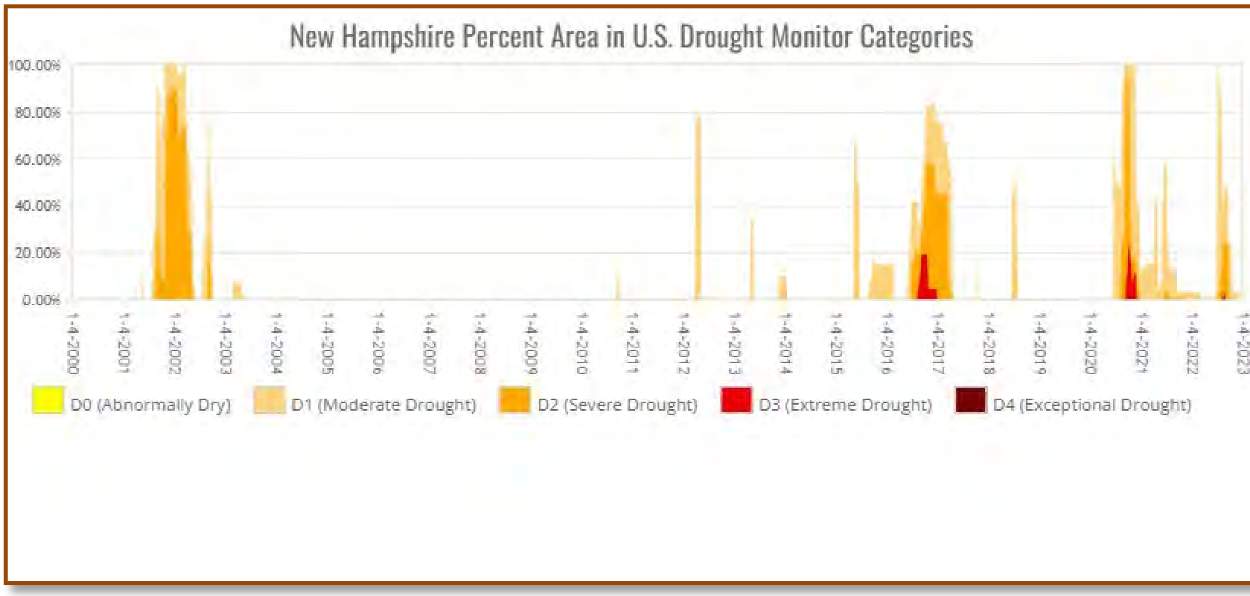
The below locations are examples which were highlighted through a combination of efforts which included a survey completed by the RPCs and NH HSEM field staff, historical data, and the National Risk Index.

In 2016, the Town of Alexandria (Grafton County) was impacted by an extreme drought leaving many residents wells dry. The Town of Haverhill (Grafton County) was impacted by the same drought in 2016 which caused stress to local farmers because of slow crop germination due to dryness. The estimated loss for the Town of Haverhill based on 0 – 1% risk ($0 to $3,138,191) reflects the potential for not only lost woodlands and crops and the potential for wildfire but also the economic impact on the town.

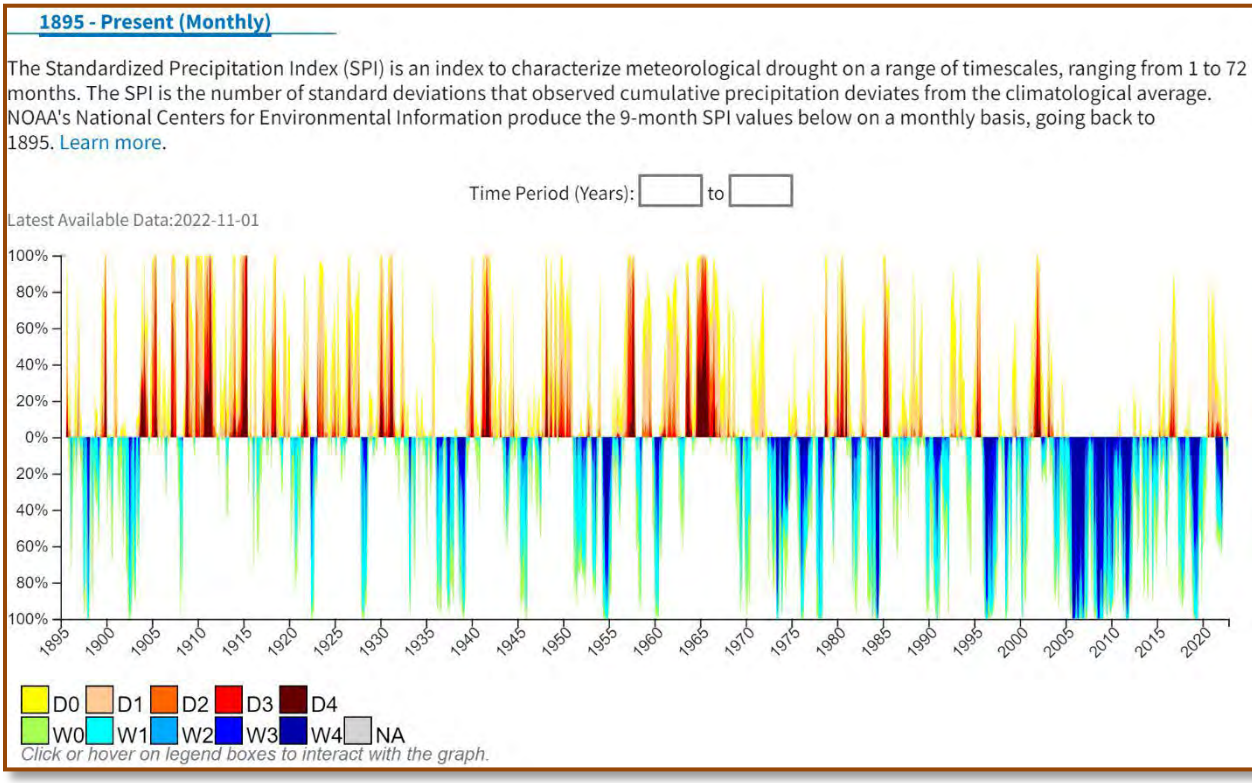
In Acworth (Sullivan County), a long drought would be expected to cause damage to crops and dry up wells. There is no cost estimate for this hazard in the community. It is anticipated that future drought conditions in Unity (Sullivan County) would affect the entire town. The damage will depend upon the crops being grown at the time of the drought. No cost has been assigned to residential wells going dry though new wells may have to be dug or drills.

Background and Evolving Hazard Information

Drought is a normal, recurrent feature of climate in New Hampshire. According to the U.S. Drought Monitor, between 2000 and 2022, New Hampshire experienced three significant droughts which occurred in 2001/2002, 2016/2017, and 2020-2022 (US Drought Monitor, 2023).



While the U.S. Drought Monitor was not established until 2000, historical climatic data further shows the frequent occurrence of drought over the 20th century (NOAA, 2023).



Four droughts of significant extent and duration were evident in New Hampshire during this time. The drought of 1929-1936 coincided with severe drought conditions in large areas of the central and eastern United States. The most severe drought recorded in New Hampshire occurred from 1960 to 1969. This drought encompassed most of the northeastern United States.

According to the 2021 New Hampshire Climate Assessment, the frequency of short-term drought has decreased over the past 30 years compared to the early 20th century and precipitation has increased by 12% over the past 120 years. Despite this trend, the additional rainfall is not expected to occur in the summer and summer temperatures are increasing, which means it is likely that state will experience more frequent rapid onset, short-term summer droughts (Lemcke-Stampone, Wake, & Burakowski, 2022).

Resiliency of NH's Water Resources

Although New Hampshire is often thought of as a water-rich State, it may be even more susceptible to drought than other states due to its geology. During a drought, water stored in aquifers and surface reservoirs becomes increasingly important to offset the precipitation deficit, but New Hampshire has limited storage. New Hampshire's aquifers are constrained in both areal extent and potential yield by the State's underlying geology (USGS, 1996). New Hampshire's stratified drift aquifers make up only 14% of our subsurface deposits, are composed of unconsolidated sand and gravel, and are typically less than 100 feet thick (NHDES, 2008). Other than these stratified drift aquifers, groundwater is storage is limited to bedrock fractures, which generally do not produce as much water as stratified drift aquifers. In addition to New Hampshire's restricted groundwater storage, the State's surface water impoundments are mainly targeted towards recreation and flood control, but also provide a mechanism for managing water supply, though with limited surface storage (NHDES, 2008). Thus, with New Hampshire's limited long-term water storage, even short-term precipitation deficits can have serious consequences for the State's water use.

Drought Designation

The New Hampshire Drought Management Team (NHDMT) references the U.S. Drought Monitor map (USDM) for drought designation and to inform drought response pursuant to the New Hampshire Drought Management Plan (NH Department of Environmental Services, 2016). Additionally, the United States Department of Agriculture relies on the U.S. Drought Monitor map to activate programs that help agricultural producers impacted by drought. This includes the fast tracking of Secretarial disaster designation. When a county experiences 8 weeks of continuous severe drought (D2), extreme drought (D3), or exceptional drought (D4) a Secretarial disaster designation may be requested by the governor. If declared, a disaster designation triggers emergency low-interest loans offered through the USDA Farm Service to the primary counties that designation was sought and contiguous counties (US Department of Agriculture). Secretarial disaster designation due to drought has been declared in counties in New Hampshire many times. Most recently, a Secretarial disaster designation was declared across every county in the state in 2020, and various counties in 2021 and 2022 (US Department of Agriculture , 2022).

	WATCH D0 Abnormally Dry	**ALERT D1** Moderate	**WARNING D2** Severe	**EMERGENCY D3** Extreme	**DISASTER D4** Exceptional
Conditions to be used by NH Drought Management Team as basis for recommendations to the US Drought Monitor					
PRECIPITATION					
1-month SPI	<0.0	Not Applicable	Not Applicable	Not Applicable	Not Applicable
3-month SPI	Not Applicable	<0.0	<-1.0	Not Applicable	Not Applicable
6-month SPI	Not Applicable	Not Applicable	Not Applicable	<-1.0	Not Applicable
12-month SPI	Not Applicable	Not Applicable	Not Applicable	Not Applicable	<-1.0
STREAMFLOW 28-day streamflow 65% normal	Up to 1 Month	1-3 Months	3-6 Months	6-9 Months	>9Months
PALMER INDEX PDSI	Not Applicable	<0.0	<-1.0	<-2.0	<-3.0
GROUNDWATER	Not Applicable	Monthly Levels Drop Below Mean	Monthly Levels Persist Below Monthly Mean		Not Quantified

The USDM, established in 1999, is a weekly map of drought conditions that is produced jointly by NOAA, the US Department of Agriculture, and the National Drought Mitigation Center (NDMC) at the University of Nebraska-Lincoln. The U.S. Drought Monitor website is hosted and maintained by the NDMC. U.S. Drought Monitor maps are released every Thursday morning at 8:30 Eastern Time, based on data through 7 a.m. Eastern Standard Time (8 a.m. Eastern Daylight Time) the preceding Tuesday. The map is based on measurements of climatic, hydrologic, and soil conditions as well as reported impacts and observations from more than 400 contributors around the country, including the NHDMT. Several partners from the joint organizations take turns serving as the lead author each week. The authors examine all the data and use their best judgment to reconcile any differences in what different sources are saying (US Drought Monitor, 2023).

The severity of a drought is assessed using the US Drought Monitor's intensity scale:

Category	Description	Possible Impacts	Palmer Drought Index	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Short and Long-term Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered	-1.0 to -1.9	21-30	21-30	-0.5 to -0.7	21-30
D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water- use restrictions requested	-2.0 to -2.9	11-20	11-20	-0.8 to -1.2	11-20
D2	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed	-3.0 to -3.9	6-10	6-10	-1.3 to -1.5	6-10
D3	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions	-4.0 to -4.9	3-5	3-5	-1.6 to -1.9	3-5
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less	0-2	0-2	-2.0 or less	0-2

Extent

Drought Impacts

While in New Hampshire drought is common, it is the severity and length of a drought that determines impacts to surface water and groundwater supplies, agriculture, the economy, and the well-being of residents. Historically, droughts in New Hampshire have had limited effect because of the plentiful water resources and sparse population, but conditions have changed. Since the drought of the 1960s, the worst on record in the state, the population has more than doubled, which has increased demand for the state's water resources (New England Historical Society , 2022). Additionally, because of climate change, temperatures are increasing at an accelerated rate, which can increase the severity of drought. Since 2000, New Hampshire has experienced three significant droughts and while not as extreme as the drought in the 1960s, drinking water supplies, agricultural production, and fire danger were impacted.

Drinking Water

Approximately half of the state's population relies on one of the 700 public community water systems in the state for its drinking water supply, while the other half relies on private wells. Generally, those relying on a public water supply are less susceptible to drought impacts on domestic supply, as public water suppliers are better prepared to provide a continued level of service during dryer periods. Public water systems are subject to regulations that require sources to be capable of producing more than the design standard and many systems are required to have redundant sources for backup. Storage tanks can be relied upon to provide water during high use periods to give wells time to rest and recharge and water suppliers can impose water restrictions on customers. Also, after the 2001/2002 drought, to better mitigate drought conditions, water suppliers began to diversify sources and seek out emergency connections. Additionally, public water systems have resources available to them on a yearly basis, such as grants and loans, to fund system upgrades that add to the resiliency of the system. Despite these factors, there are public water systems that have experienced water shortages during the 2016/2017 drought and the 2020-2022 drought. Water bans are implemented. Water is trucked in and if possible, temporary emergency sources are approved. While these systems work to implement long-term solutions, lack of high producing wells in the area or another system to connect to, poor water quality, and lack of funding can be barriers.

Private well owners do not have the backup supplies or other resources public systems have; therefore, those relying on private wells are more susceptible to drought. Private well owners have been greatly impacted by more recent drought conditions. During the drought of 2016-2017, hundreds of private wells across New Hampshire dried up. Many homeowners had to wait weeks to months for well drilling services due to backlogs, while others did not have the financial resources to address the problem and relied heavily on neighbors and public emergency water access stations. When wells fail, the homeowner must spend roughly $5,000-$30,000 dollars to modify existing wells or drill new wells. In 2020, the state was able to support low-income private well owners by providing financial assistance to remedy water shortage issues related to the current drought. The Drought Assistance Program (DAP) was funded by the New Hampshire Drinking Water and Groundwater Trust Fund (DWGTF). NHDES coordinated the distribution of 1.75 million dollars to fund replacement of 109 residential private wells. The funding for DAP sunset in early 2022, but the Water Assistance for Natural Disasters Program (WAND) was funded in the summer of 2022 by the DWGTF. WAND was established to financially assist low-income well owners whose water supply is impacted by a natural disaster, such as drought. In the summer of 2022, NHDES coordinated the distribution of $655,000 to fund replacement of 26 private residential wells. While these programs have been successful, there is no guarantee that the funding will continue.

Agriculture

Agriculture and its associated socioeconomics often suffer as a result of drought conditions. There are approximately 4,100 farms in New Hampshire operating over 430,000 acres. Agriculture in New Hampshire, especially dairy farmers, is most vulnerable to the impacts of drought. Dairy farmers, who typically grow their own feed for the cows, may not be able to produce enough feed for their livestock during drought conditions. This requires dairy farmers to purchase feed, raising the cost of production in a market where farmers already have very little control over their cost of production or the price they receive for their product. Crop farmers are also impacted by drought conditions. They are eligible to purchase drought insurance, but many entities in New Hampshire do not.

Fire Danger

The number of woodland fires in New Hampshire increased by over 200% during the 2016-2017 drought (htt9). The persistent dry conditions resulted smaller, more local water resources to dry up. This forced first responders to travel further to find firefighting water sources. Additionally, the excessively dry conditions caused the forest bed to be drier at deeper levels, making them difficult to extinguish. These fires often "go underground" and resurface days after they were thought to be extinguished, putting further strain on firefighting resources. The following are factors that lead to a potential for increased woodland fires during a drought:

- The average length of snowpack has decreased by 12 days over the last 50 years, causing bare ground to be exposed longer and forests to be more susceptible fires during a drought.
- Warmer temperatures are allowing disease and insects to move north, killing trees which provide more fuel for fires.
- Other extreme weather events, such as windstorms or ice storms, are downing more trees adding fuel for fires during a drought.

Impacts

Economic Impacts

- Destruction of crops affecting farmers and consumers driving up food costs for consumers
- Cost of irrigation and drilling new wells
- Farmers spending more money on water and feed for animals
- Businesses that rely on farming, such as tractor and feed suppliers, may lose income
- Timber industry workers may be affected if wildfires exacerbated by drought destroy timber
- Businesses that sell boating and fishing equipment may lose business due to dried up water sources
- Power companies that utilize hydroelectric may have to spend money on other fuel sources and customers may also have to pay more for power
- Barges and ships may have difficulty navigating bodies of water due to the ships draft (water depth required for boat to be able to operate) being greater than the depth of the body of water
- Water companies and private well owners having to spend money on new or additional water supplies

Environmental Impacts

- Loss or destruction of fish and wildlife habitat
- Lack of food and drinking water for wild animals
- Increased stress on and possible extinction of endangered species
- Lower water levels in reservoirs, lakes, and ponds
- Loss of wetlands
- More frequent wildfires—the number of wildfires in 2016 increased over 250% from 2015 with a total of 351 fired reported and 1,090 acres burned
- Wind and water erosion of soils
- Poor soil quality

Social Impacts

- Anxiety or depression about economic losses caused by drought
- Health problems related to poor water quality or lack of water
- Health problems related to dust and pollen
- Loss of life
- Threat to public safety from an increased number of wildfires
- Reduced incomes
- People may have to relocate or close farms
- Fewer recreational activities

The number of woodland fires in New Hampshire increased by over 200% during the 2016-2017 drought. The persistent dry conditions resulted smaller, more local water resources to dry up. This forced first responders to travel further to find firefighting water sources. Additionally, the excessively dry conditions caused the forest bed to be drier at deeper levels, making them difficult to extinguish. These fires often “go underground” and resurface days after they were thought to be extinguished, putting further strain on firefighting resources. The following are factors that lead to a potential for increased woodland fires during a drought:

- The average length of snowpack has decreased by 12 days over the last 50 years, causing bare ground to be exposed longer and forests to be more susceptible fires during a drought.
- Warmer temperatures are allowing disease and insects to move north, killing trees which provide more fuel for fires.
- Other extreme weather events, such as windstorms or ice storms, are downing more trees adding fuel for fires during a drought.

Overall, the Northeast, including New Hampshire, will likely continue to see an overall increase in extreme events, including drought. The transient climate has shown that temperatures and the length of the growing season are increasing in New Hampshire. This indicates that future droughts will likely be more severe in the future.

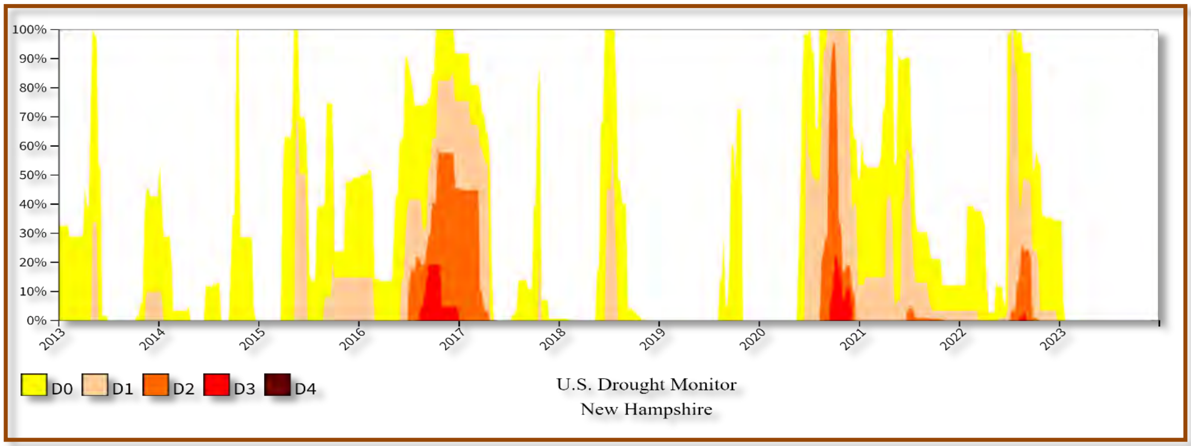
Safety and Security	Food, Water, Shelter	Health and Medical	Energy (Power & Fuel)	Communications	Transportation	Hazardous Materials
Government facilities may be unusable due to flood waters. Water rescue operations may be necessary.	Shelter and feeding operations will require assistance from ARC, coordinated by the state. Normal supply lines to coastal areas will can be impacted, requiring alternate supply lines. The State Commodity Distribution Plan can be utilized if needed. Long term housing solutions may be required. Local agriculture may not be able to sustain operations.	Long-term care facilities may require evacuation for those in areas susceptible to coastal flooding. Local medical facilities will also be impacted due to flood waters. Inability to travel may impact staffing. Census levels will rise due to injuries.	Power restoration to areas with significant flooding will take longer to restore. Fuel points may be flooded, and fuel delivery may be impacted due to road conditions.	Power outages can contribute to commercial communications, public safety communications may also see degradation due to outages, requiring assistance from neighboring providers. Flooding can cause damage to underground communication lines	Transportation routes in flood prone areas will be impacted; Major highways are more susceptible to flash floods due to rain. Railways could be impacted by inland flooding. NH has 443 miles of working railway. The tracks in flood prone areas would restrict commodity transit.	Potential for ground water contamination (wells & aquifers), wastewater treatment plants damaged in flood prone areas.

In-land flooding is caused by a variety of factors, in any season. Flooding can be caused by heavy rain over multiple days, ice jams, tropical cyclones and infrastructure failures. While weather forecasts can indicate regions to expect flooding, but we are not able to drill down to specific towns or streets, unless the area is known to flood during weather events.

Previous Occurrences: History of Drought Events in New Hampshire (htt12)

Event Date	Event Description	Impacts	Location	Additional Information
1775	Drought	No specific impacts available	Statewide	In Hopkinton – "all the cattle of the township were collected upon the banks of the Contoocook River and kept till the dryness abated" (htt11).
1840	Drought	No specific impacts available	Statewide	In Hopkinton – "Conditions were so dry that there was not a green blade of grass [on Gould's hills] ..." "...trees were lopped in the pastures to supply leaves for food for the stock".
1882	Drought	No specific impacts Available	Statewide	No specific details available
1910s	Drought	No specific impacts Available	Statewide	Significant Drought Conditions
1929-1936	Regional Drought	No specific impacts Available	Statewide	10 to >25yr recurrence interval
1939-1944	Regional Drought	No specific impacts Available	Statewide	10 to >25yr recurrence interval, severe in southeast and moderate elsewhere.
1947-1950	Moderate Drought	No specific impacts Available	Statewide	10-25yr recurrence interval

1960-1969	Severe Regional Drought	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.	Statewide	>25yr recurrence interval. Regional longest recorded continuous spell of less than normal precipitation. President Johnson ordered a study to find out what could be done to help New England.
1999	Drought	Water systems and private wells were adversely impacted by the drought. Impacts to agricultural crops also occurred.	Statewide	Water systems in Salem and Hampton/North Hampton were in danger of running out of water.
2001-2002	Severe Drought	Numerous forest fires. Water systems and private wells were adversely impacted by the drought. Impacts to agricultural crops also occurred.	Statewide	Water systems in Salem and Seabrook were in danger of running out of water. Hundreds of private wells failed.
2016-2017	Extreme Drought	Water systems and private wells were adversely impacted by the drought. Impacts to agricultural crops also occurred. Hundreds of private wells failed.	Statewide	Areas of the state between D1-D3. 19 of the State's 120 dairy farms closed. The State had lost 10 farms over the previous four years combined. This was the first time that an Extreme drought had been declared for New Hampshire since the National Drought Monitor became operational in 2000. Conditions in 2016 were similar to that of droughts observed in 1995, 1978, and 1964. See graphic below showing severity of this drought in comparison to conditions between 2013 and 2018.
2020-2023	Extreme Drought	Water systems and private wells were adversely impacted by the drought. Impacts to agricultural crops also occurred. Hundreds of private wells failed.	Statewide	In 2020, the entire state experienced D1-D3 drought designation. While 2020, was widespread, drought re-emerged in 2021 and persisted in the north and re-emerged again in 2022 and persisted in the south.



Impact of Climate Change on Hazard	
Climate Change Projection	**Impact on Hazard**
Increase in Sea Level	N/A
Increase in Precipitation	Drought in New Hampshire will be impacted by an increase in precipitation. While an increase in precipitation sounds like it may be a very good thing for drought status, it could potentially have negative impacts as well. A severe storm with a large amount of precipitation in a short amount of time will create an excessive amount of runoff due to the ground not being able to absorb the precipitation quickly enough. This runoff could impact the water used to supply drinking water to residences throughout the state. This excess of runoff could also create instances of stagnant water, which could then lead to an increase in pests and vector-borne diseases.
Increase in Temperature	Increase in temperature will exacerbate drought statuses throughout the state due to high heat becoming warmer and lasting for longer periods of time. This will also impact changes in snow to rain ratios and will change the extent and duration of snow coverage in the state.
Increase in Severe Weather	Severe weather events, such as storms that include lightening, will pose a much greater risk when the state is in a period of drought. Lightening from severe storms could ignite dangerous fires both in the forest, and in cities where there could be an increase of building fires which could increase both loss of valuable property and/or life.

Individuals/ Communities Disproportionately Impacted by Hazard	
Individual/Community	**Description of Increased Impact**
Socially Vulnerable Populations (due to income, education, health care access, and housing)	• May live in locations that are prone to climate-related health hazards. • May have greater rates of existing medical conditions. • May live in poorly maintained or aging infrastructure that may not be able to handle climate-related event. • May struggle to access resources and care. • May experience limited financial resources or cultural, language, or other barriers that restrict their access to health care, social services, and safe, nutritious food.
Children	• Their developing bodies can make them more vulnerable to hazards like heat and poor air quality. • Children breathe at a faster rate, increasing their exposure to dangerous air pollutants. • Spending more time outdoors than adults, increases their exposure to heat and cold, rain and snow, outdoor allergens, and insect bites. • Higher water intake can increase exposure to certain contaminants in recreational waters and the risk of developing gastrointestinal or other illnesses. • Children can experience mental health impacts from extreme events that are expected to increase with a changing climate. • Dependance on others for care increases vulnerability
Individuals Aged ≥ 65 Years	• Older people are less able to compensate for the effects of certain environmental hazards, such as air pollution. • Older adults are more likely to have health conditions that make them more sensitive to climate hazards like heat and air pollution, which can worsen their existing illnesses. • Limited mobility, increasing their risks before, during, and after an extreme weather event. • Some medications can change the body's ability to respond to heat, increasing risk for heat illnesses and death as the climate warms. • Aging can impact the immune systems, increasing risk for extreme reactions related to heat, insect- and tick-related diseases, and water-related illnesses. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.

Individuals with a Disability/Disabilities	• Emergency warnings and other important messages may not be available in formats that are accessible to individuals with certain disabilities (such vision or blindness, hearing loss, or mobility issues). • Increased likelihood that they may have additional social and economic risk factors, such as poverty and unemployment, that put them at greater risk. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with Pre-existing or Chronic Health Conditions (including behavioral health)	• Chronic medical conditions may increase risk of illness and death, particularly exposure to heat, extreme weather events, water-related illnesses, and poor air quality. • Some medications can affect the body's response to heat, increasing risk for heat illnesses. • Some conditions/medications compromise the immune system, increasing risk for extreme reactions related to heat, insect- and tick-related diseases, and water-related illnesses. • Individuals with chronic behavioral health conditions may be more vulnerable to trauma from extreme weather events, as well as disruptions to support networks and mental health care. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.

ENDNOTES – HAZARD: DROUGHT

[1.] New England Historical Society. (2022). *The 1965 Drought, New England's Worst Ever*. Retrieved from New England Historical Society: http://www.newenglandhistorical society.com/1965-drought-new-englands-worst- ever/

[2.] NH Department of Environmental Services. (2016). *Drought Management Plan.* New Hampshire Department of Environmental Services. Retrieved from https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/drought-managementplan.pdf

[3.] NOAA. (2023). *Current U.S. Drought Monitor Conditions for New Hampshire*. Retrieved from National Integrated Drought Information System: https://www.drought.gov/states/new-hampshire

[4.] NOAA. (n.d.). *Defining Drought*. Retrieved from National Integrated Drought Information System: https://www.drought.gov/what-is-drought/drought-basics

[5.] US Department of Agriculture. (n.d.). *What Is The US Drought Monitor.* Retrieved from National Drought Mitigation Center: https://www.climatehubs.usda.gov/sites/default/files/USDA-USDM- 2pager- web.pdf

[6.] US Drought Monitor. (2023). *Time Series* . Retrieved from U.S. Drought Monitor: https://droughtmonitor.unl.edu/DmData/TimeSeries.aspx

[7.] US Drought Monitor. (2023). *What is the USDM*. Retrieved from U.S. Drought Monitor: https://droughtmonitor.unl.edu/About/WhatistheUSDM.aspx

6.4 HAZARD: EARTHQUAKE >4.0

Hazard Overview: Earthquake >4.0	
HIRA Risk	Low
Future Probability	Medium
Counties at Risk	All

Definition

The United States Geological Survey (USGS) defines an earthquake as the shaking of the surface of the Earth caused by the release of energy from a sudden slip on a fault. Tectonic plates are always slowly moving but can get stuck on edges due to friction. When the stress on the plates overcomes the friction, there is an earthquake that releases an energy wave that travels through the earth's crust.[1] The earthquake hazard is anything associated with an earthquake that may affect the normal activities of people, such as, surface faulting, ground shaking, landslides, tsunamis, structural damage, etc.[2] The underground point of origin of an earthquake is called its focus; the point on the surface directly above the focus is the epicenter. There are two primary ways in which earthquakes are measured, magnitude (the size of the earthquake) and intensity (measure of the shaking and damage, which can vary from location to location). Magnitude is measured in the Moment Magnitude (MM) scale (based off the obsolete Richter scale). The Modified Mercalli Intensity (MMI) classifies the perceived feeling of the earthquake. It is possible for earthquakes to occur away from plate boundaries, in intraplate areas, such as New Hampshire.[3]

For the purposes of this plan, the SHMPC determined that since minor earthquakes are a common occurrence in New Hampshire, the focus of this section should be on those earthquakes which have the potential to harm life, property, and the environment. After reviewing the Modified MMI Scale and the MM scale, the committee determined that earthquakes that are greater than or equal to a 4 on either the MMI or MM scale have the greatest potential to affect life, property, and the environment.

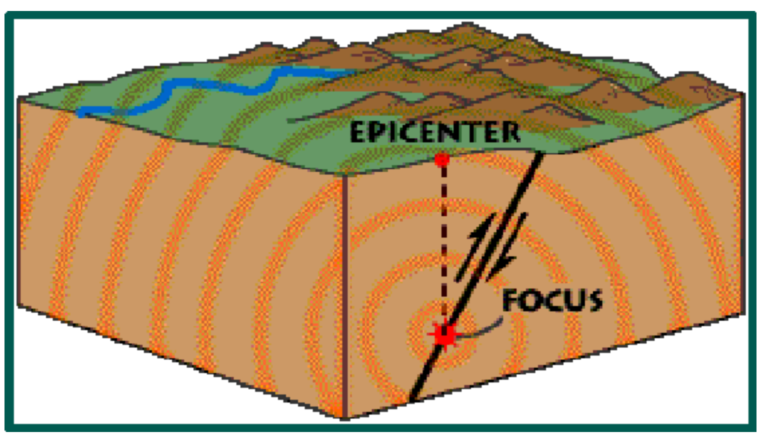
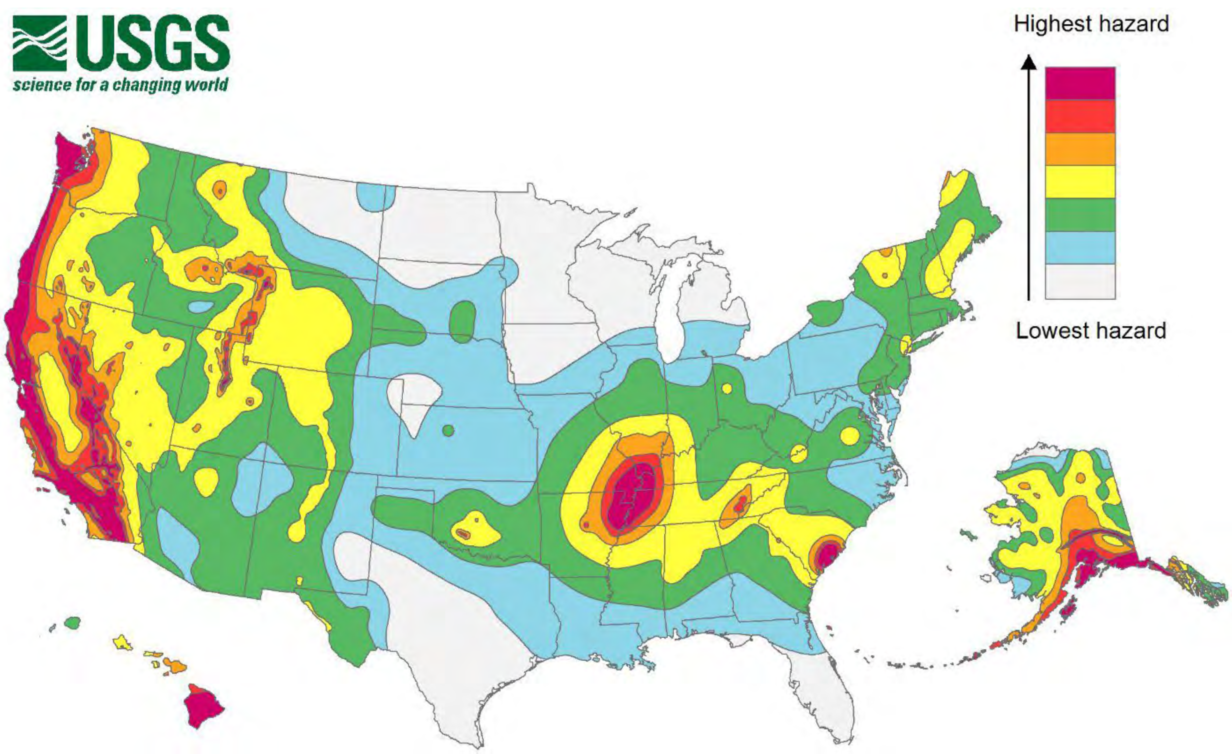


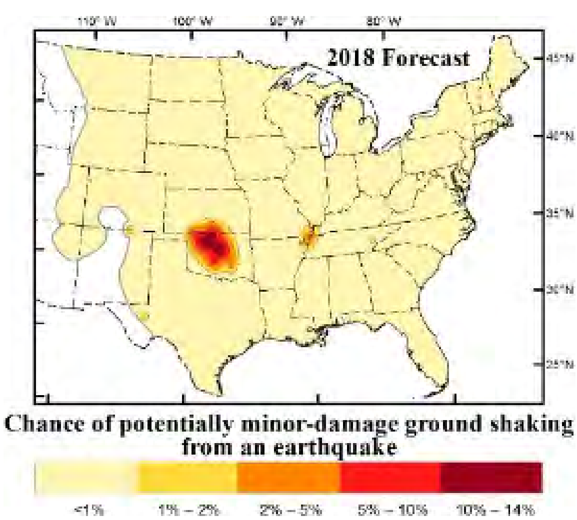
Diagram of a fault line depicting the locations of the focus and epicenters of the fault. (Source: USGS)

Location

The entire State of New Hampshire is at risk for earthquakes. There is no typical season for earthquakes, they can occur at any time.



The USGS updated the *Long-term model of Earthquake Hazards Across the United States* in 2018. This represents an assessment of the best available science in earthquake hazards and incorporates new findings on earthquake ground shaking, faults seismicity, and geodesy. This map is used in seismic provisions of building codes, insurance rate structures, risk assessments, and other public policy. *(Source: USGS)*

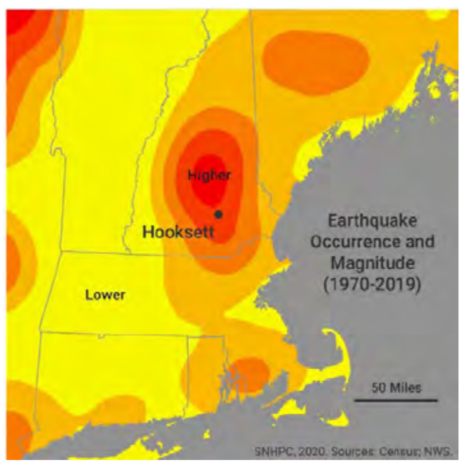


The USGS periodically develops a *One-Year Seismic Hazard Forecast for the Central and Eastern United States from Induced and Natural Earthquakes*. Previous years data is fed into the models to continue to improve the forecasting model. This map represents the possibility of receiving a damaging earthquake from 2018. (Source: USGS)

The below locations are examples which were highlighted through a combination of efforts which included a survey completed by the RPCs and NH HSEM field staff, historical data, and the National Risk Index.

In the Town of Gorham (Coos County), though earthquakes are a low risk they can cause buildings and bridges to collapse, disrupt gas, electric, and phone lines, and are often associated with landslides and flashfloods. Since 1982, three earthquakes with a magnitude of 4.0 have occurred in the state. Two of the three occurred in Berlin (Coos County) one in 1988 (4.0) and another in 1989 (4.1). Based on the risk associated and the potential loss of 1 to 5%, there is approximately $3,501,835 to $17,508,182 in damages.

All areas in the Town of Hooksett (Merrimack County) have the potential to be affected by an earthquake. While earthquakes are generally mild, there is a relative hotspot of activity located in central New Hampshire which affects the Town of Hooksett. From 1728 to 1989, there were 270 earthquakes in New Hampshire which translates to about one per year. The most recent earthquake in Merrimack County was in the Town of Andover on May 31, 2023, with a magnitude of 2.2 on the Richter scale.



Source: Town of Hooksett LHMP

Overall, the Central NH Region is seismically active, and earthquakes are regularly felt from area epicenters. In the City of Concord (Merrimack County), locations with high density population or potential gather sites to evacuate including downtown and village areas including Penacook, schools, multi-unit housing, manufactured home parks, congregate care facilities, and municipal buildings are at an increased risk for damage. Damage to utility poles and wires, roads and infrastructure could be significant. Aboveground utility poles, underground electrical lines, underground water, sewer, and natural gas lines could be susceptible. Multiple above and below ground fuel storage locations throughout the city that have hazardous contents. There are many old and historic public and nonpublic buildings within the community too.

Background and Evolving Hazard Information

New Hampshire is considered to be an area of moderate seismic hazard. There is about a 1 in 10 (or 10%) chance that, in any 50-year period of time, that earthquake vibrations that are potentially damaging will occur in New England, including New Hampshire (Kafka, 2004). The State typically experiences two or three earthquakes per year registering magnitude 2.0 to 3.5 and numerous other smaller ones, based on an examination of New Hampshire data available from Weston Observatory, which the New Hampshire Geological Survey (NHGS) has as a GIS shapefile.


DAMAGE HERE SLIGHT IN 'QUAKE

Hollis Tot Killed By Milk Truck

NASHUA TELEGRAPH

WARSHIPS POUR DEATH ON VALONA

Albanian Port In

(Source: Nashua Telegraph, December 1940)

According to NH HSEM and the US Geological Survey, the overall earthquake risk to the State is high.[4] Many structures in the State (e.g., buildings, homes, bridges, and highways) are old or not built to modern earthquake standards. Hence, they may be damaged by moderate to severe earthquake vibrations. New Hampshire has had, and will continue to experience, large damaging earthquakes; however, the recurrence interval between such events are longer in New Hampshire than in high seismic hazard areas. For the purposes of this plan, the overall risk to New Hampshire is low from the perspective of identifying earthquakes that are of magnitude 4.0 or greater.

Many faults are mapped in New Hampshire as well as in the rest of New England. New Hampshire is in the low attenuation of seismic waves zone in the eastern United States. No earthquake focus (point of origination inside the Earth's crust) in New Hampshire can be directly correlated to any structural feature on the surface, such as a fault. Observations along mapped faults in the State show that the faults have probably not been active for perhaps 90 million years or more. In short, the earthquakes record in New Hampshire is clear and short-based; but the cause is still unknown.[5]

There is a general rule that the longer an earthquake waits to happen (as the strain builds up), the more powerful the earthquake will be. There is also a corresponding observation that the deeper in the crust the focus of the earthquake is, the more powerful it will be. With that information in mind, it is clear that New Hampshire is vulnerable to destructive earthquakes; however, it is impossible to calculate the probability accurately because the seismic record (less than three centuries) is of relatively short duration.

The earthquakes felt in New Hampshire do not necessarily relate to epicenters within the State. Epicenters in other surrounding states, Canada, and on the Atlantic seafloor have contributed to the record. The crystalline rocks of the northeastern United States and Canada are relatively cooler in crustal context and propagate seismic energy as much as ten times further than, for comparison, the crustally warmer rocks of the California coast. It is important to point out that the strongest quakes to hit the State had external epicenters.

The record is complete enough to allow seismologists to compute occurrence probabilities for earthquakes in New England ranging from magnitude 4.6 to 6.0. Thus, earthquakes will continue to occur in New Hampshire with at least the same frequency and magnitude as in the past.

After a damaging earthquake, it can be expected that there will be widespread damage due to aging infrastructure. There are many un-reinforced masonry structures still in use and much of our transportation and utility infrastructure, including bridges and many of our gas and waterlines, are very vulnerable to earthquake vibrations. Older and historic structures should be a primary concern, but many of our newer structures are not built to any seismic design codes and therefore are also vulnerable.

Damages from an earthquake generally fall into two categories: Structural and Nonstructural.

- Structural Damage is any damage to the load-bearing components of a building or other structure.
- Nonstructural Damage is any portion not connected to the superstructure. This includes anything added after the frame is complete, such as lighting fixtures, bookcases, utilities, etc.

The term "built environment" is used by seismologists to characterize the works of man. Earthquake protection has been designed into only a few New Hampshire buildings, public works, or utilities, leaving the majority of structures particularly vulnerable. The built environment on artificial fill and stratified glacial deposits (sand, gravel, silt, and clay) is particularly vulnerable because of the magnified amplification of earthquake energy by these deposits producing locally increased ground motion. By contrast, buildings built on bedrock and glacial till are less vulnerable.[6]

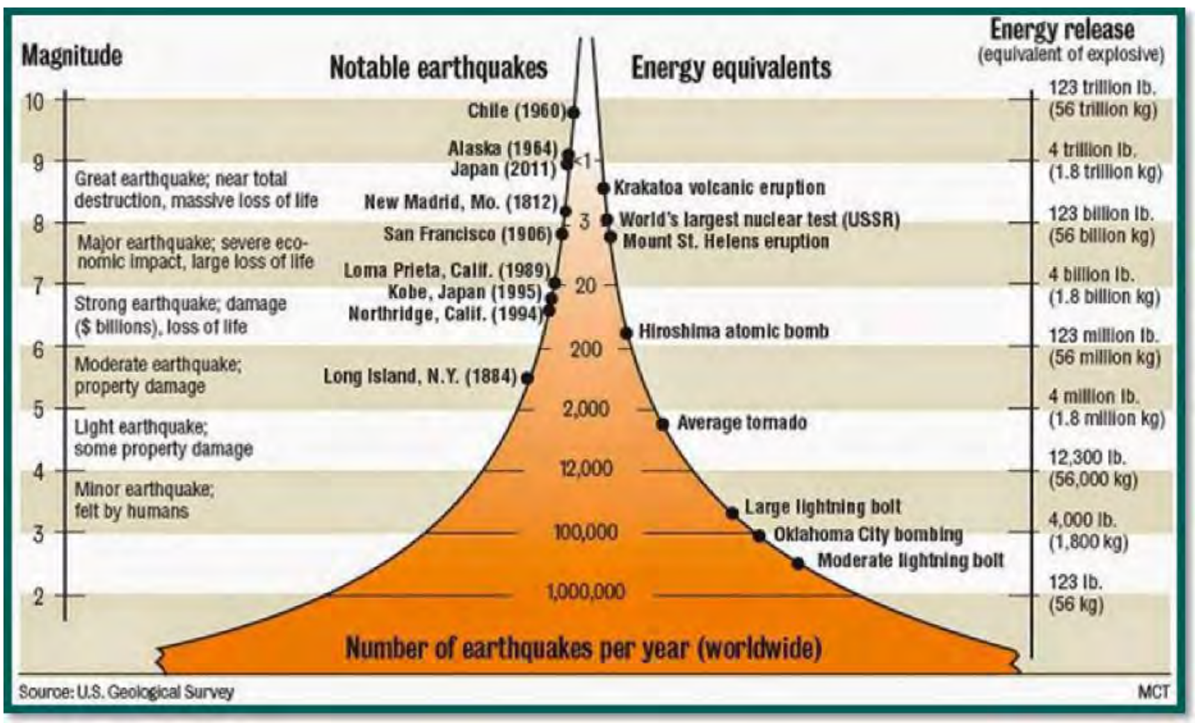
Attenuation is a term in physics that means the slow loss of intensity of flow through any kind of medium. Seismic waves can cover an area 4 to 40 times greater here than they do in the west because of the cold hard rock geology of New Hampshire. The importance of this to emergency planning and response is that damages can be expected to be spread over a much greater area, and an earthquake's location does not have to be close to a point to cause damage. Brick buildings, because of their brittle nature, are subject to damage unless they are reinforced. Buildings not attached to their foundation are also especially vulnerable. Historical records show that post and beam structures built upon any medium are especially stable because of their inherent flexibility.

An earthquake with a magnitude greater than 6.5 would produce an emergency that would be comparable to that produced by a tornado or hurricane. In addition, bridges and dams would likely fail, and fuel storage tanks and water and gas mains would probably rupture. Strong earthquake motion on the sea floor near New Hampshire can generate tsunamis (tidal waves) that could produce damage and risk to life along the coastline.

No warning system for earthquakes is presently possible for New Hampshire, but seismometers constantly record activity.

Extent

The extent of earthquakes is expressed in terms of the magnitude (the size of the earthquake) and the intensity (measure of the shaking and damage, which can vary from location to location). One of the first scales developed to express the extent of earthquakes was the Modified Mercalli Intensity Scale. This scale was a subjective intensity measurement of how an earthquake felt to people but could not provide a scientific comparison between earthquakes (based upon historical documents that information was able to be converted to MMI measurements). In the mid-1930s, the Richter Scale, which measures earthquake magnitude, was developed and adopted as a logarithmic scale based on the amplitude of the seismic waves as measured on a seismograph at a standard distance. In the 1970s the Richter Scale was supplanted by the Moment Magnitude Scale, which uses more variables to calculate the energy released from an earthquake which increases the precision of measurement. An increase of 1 on the magnitude scale represents an earthquake that has 10x the energy than an earthquake of the previous magnitude.



Multi-Scale Depicting the Magnitude of an Earthquake and its Associated Energy. Significant earthquakes from across the world added for reference. (Source: USGS)

Modified Mercalli Intensity Scale		
Magnitude	**Value**	**Description**
1.0-3.0	I	Not felt except by a very few under especially favorable conditions.
3.0-3.9	II	Felt only by a few persons at rest, especially on upper floors of buildings.
3.0-3.9	III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
4.0-4.9	IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
4.0-4.9	V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
5.0-5.9	VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
5.0-5.9	VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
6.0 and higher	VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
6.0 and higher	IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
7.0 and higher	X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
7.0 and higher	XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
7.0 and higher	XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Impacts

Magnitude and location of a damaging earthquake are the key factors in determining the possible impact as well as a cascade of effects that may occur.

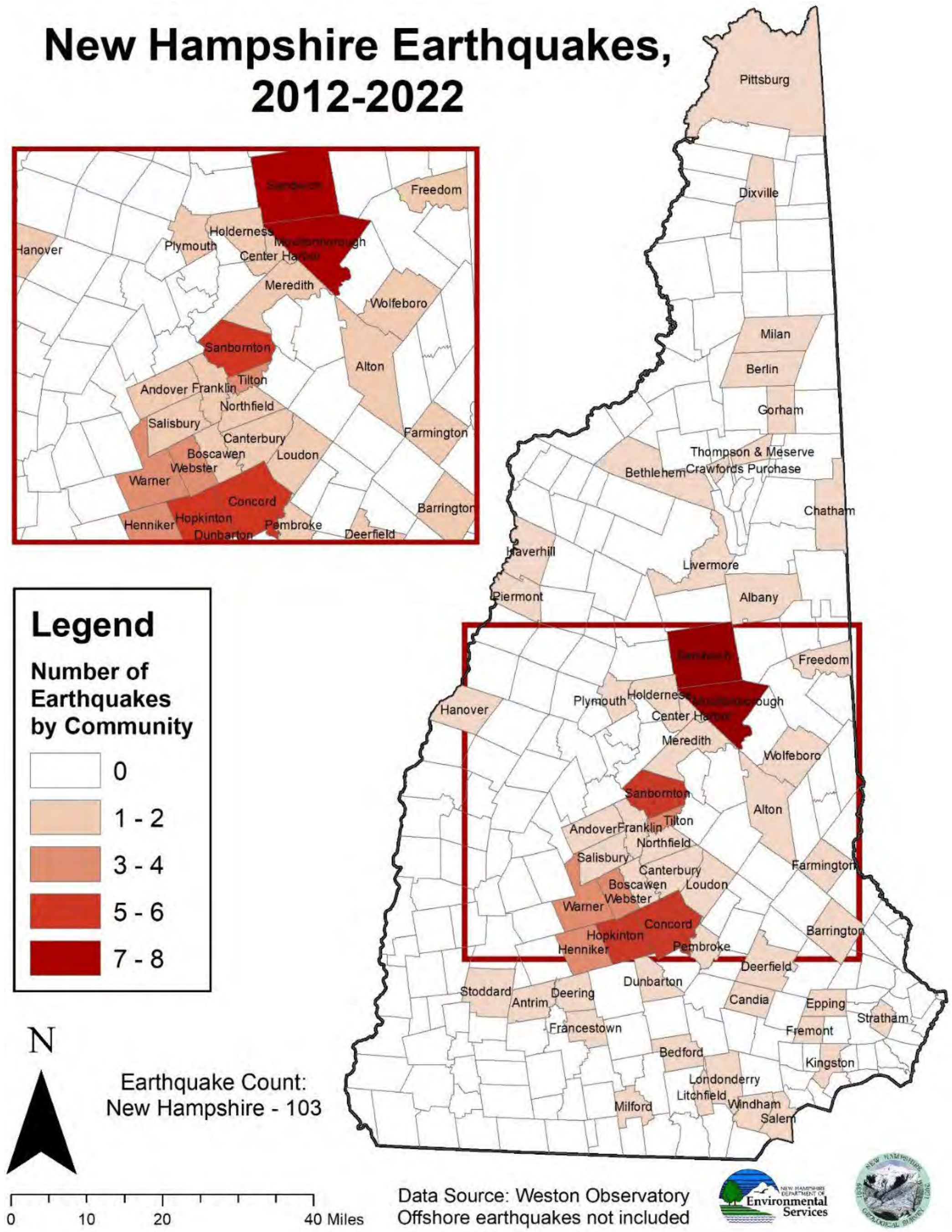
Though there have been more than 200 earthquakes in and closely adjacent to NH since 1900, the vast majority are less than 2.5 on the Richter Scale. Such events produce limited ground accelerations and associated structure damage. Regardless, safety standards in place for the design of high hazard dams includes the need to estimate frequency and assess impacts. Earthquakes can cause structural failure, causing impacts to those located within identified inundation areas.

Examples of potential and cascading impacts include:

Safety and Security	Food, Water, Shelter	Health and Medical	Energy (Power & Fuel)	Communications	Transportation	Hazardous Materials
Infrastructure damages will impact local fire, police and EMS buildings. Government facilities may be unusable due to earthquake damage.	Food distribution will be impacted by road damages. Potable water shortages due to contamination and broken pipes will require additional sources of drinking water. Shelters may be rendered inoperable due to structural damage.	Mass casualties probable due to numerous structures in NH not built to seismic codes. Emergency Services, included healthcare facilities will be impacted throughout the state.	Power outages will occur due to infrastructure damage in areas closest to the epicenter. Fuel distribution will be hampered due to road damages; gas stations will feel the impact of power outages, making delivery difficult.	Communications infrastructure will feel negative impacts causing outages of public communication methods. Government communication systems will also be impacted by outages. Delays in broadcasting and receiving critical information will be felt around the state.	An impactful earthquake will damage roads and bridges. Potential impacts at airports may be present, and rail lines would be damaged as well.	Hazardous Materials incidents probable due to broken pipelines, structural damage to storage facilities and spills due to seismic activity.

Previous Occurrences: History of Earthquakes >4.0 in New Hampshire				
Event Date	**Magnitude**	**Impacts**	**Location**	**Additional Information**
10/16/2012	4.7		SE Maine	VI MMI
04/06/1989	4.1		15KM NE of Berlin	
11/20/1988	4		5KM NE of Berlin	
01/19/1982	4.0	Minor Damage	W of Laconia	This earthquake caused a chimney fire that destroyed one building, and it was felt strongly throughout central New Hampshire.7
12/20/1940	5.5-5.8		Ossipee	VII MMI - many chimneys were damaged, plaster was cracked, tombstones were rotated, some furniture was broken, and many items were thrown from shelves.8
12/24/1940	5.5-5.8		Ossipee	VII MMI
11/10/1936	Unknown		Laconia	V MMI
03/18/1926	Unknown		New Ipswich	V MMI
11/09/1925	4		Ossipee	VI MMI
08/30/1905	Unknown		Rockingham Cty.	V MMI
03/05/1905	Unknown		Lebanon	V MMI
12/19/1882	Unknown		Concord	V MMI
07/23/1823	4.1		Off Hampton	IV MMI
11/10/1810	4		Portsmouth	V MMI - was felt as far away as Boston, MA9
11/18/1755	5.8	Damage to Structures	Off Coastline	Cape Ann Earthquake
10/29/1727	6.0-6.3	Damage to Structures	Off Coastline	Weekly News-Letter of Boston, MA described the event as “"The night after the last Lord's Day about 40 minutes after 10, in a calm & serene hour, the town was ... [suddenly] extremely surprised with the most violent shock of an earthquake that has been known among us. It came with a loud noise like thunder. The earth reel'd & trembled to a great degree. The houses rock'd & crackl'd as if they were tumbling into ruins. Many of the inhabitants were wakened out of their sleep, with the utmost astonishment: and others affrighted run into the

				streets for safety. Thro' the Goodness of GOD, the shock continued but about 2 or 3 minutes: and tho' some damage was done in the houses; yet none of the people received any bodily injury. For several times in the morning, there were heard some distant rumblings; and some fainter shocks were felt. But since that, the Earth, has been quiet; and tho' the minds of the people are yet greatly and justly affected."10
06/11/1638	6.5	Unknown	Central NH	The location and damage levels are very uncertain because settlements were sparse, and reports were few. Shaking was felt strongly along the St. Lawrence River in Canada and in Boston. Aftershocks were felt for 20 days in Massachusetts.


New Hampshire Earthquakes, 2012-2022
Legend
Number of Earthquakes by Community
0
1 - 2
3 - 4
5 - 6
7 - 8
N
Earthquake Count: New Hampshire - 103
0
10
20
40 Miles
Data Source: Weston Observatory
Offshore earthquakes not included
Pittsburg
Dixville
Milan
Berlin
Gorham
Thompson & Meserve
Crawfords Purchase
Bethlehem
Chatham
Haverhill
Livermore
Piermont
Albany
Freedom
Hanover
Plymouth
Holderness
Meredith
Wolfeboro
Sanbornton
Alton
Andover
Franklin
Tilton
Northfield
Salisbury
Canterbury
Farmington
Boscawen
Webster
Loudon
Warner
Concord
Barrington
Henniker
Hopkinton
Pembroke
Deerfield
Dunbarton
Stoddard
Antrim
Deering
Candia
Epping
Stratham
Francestown
Fremont
Bedford
Kingston
Londonderry
Litchfield
Windham
Salem
Milford

Impact of Climate Change on Hazard	
Climate Change Projection	**Impact on Hazard**
Increase in Sea Level	N/A
Increase in Precipitation	N/A
Increase in Temperature	N/A
Increase in Severe Weather	N/A

Individuals/ Communities Disproportionately Impacted by Hazard	
Individual/Community	**Description of Increased Impact**
Socially Vulnerable Populations (due to income, education, health care access, and housing)	• May live in poorly maintained or aging infrastructure that may not be able to handle climate-related event • May struggle to access resources and care • May experience limited financial resources or cultural, language, or citizenship barriers that restrict their access to health care, social services, and safe, nutritious food
Children	• Children can experience mental health impacts from extreme events. • Dependance on others for care increases vulnerability
Individuals Aged ≥ 65 Years	• Limited mobility, increasing their risks before, during, and after an extreme weather event. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with a Disability/Disabilities	• Decisionmakers may not fully consider people with disabilities in their planning. One reason for this is that climate change effects on people with disabilities have not been studied as much as other vulnerable populations. • Emergency warnings and other important messages may not be available in formats that are accessible to individuals with certain disabilities (such vision or blindness, hearing loss, or mobility issues). • Increased likelihood that they may have additional social and economic risk factors, such as poverty and unemployment, that put them at greater risk. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with Pre-existing or Chronic Health Conditions (including behavioral health)	• Chronic medical conditions may increase risk of illness and death, particularly exposure to heat, extreme weather events, water-related illnesses, and poor air quality. • Necessary medical care may be disrupted before, during, and after an event, including due to evacuations, transportation system or health infrastructure damages, or power outages. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.

ENDNOTES – HAZARD: EARTHQUAKE

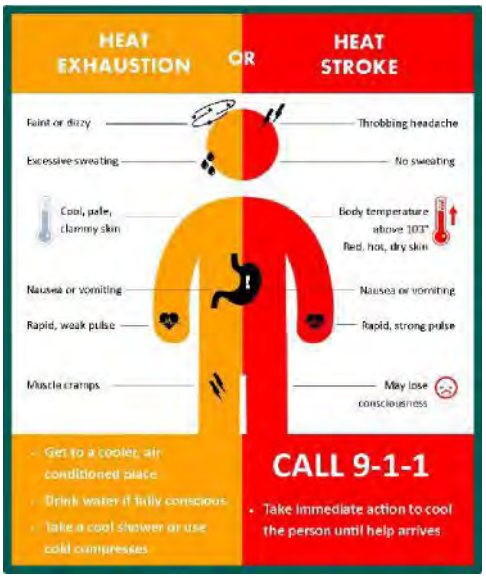
[1] https://www.usgs.gov/faqs/what-earthquake-and-what-causes-them-happen
[2] https://www.usgs.gov/programs/earthquake-hazards/what-are-effects-earthquakes
[3] Kafka, A.L. (2022, November 28). Why Does the Earth Quake in New England? The Science of Unexpected Earthquakes. Boston College, Weston Observatory. (2004) http://aki.bc.edu/why_quakes.html
[4] https://www.nh.gov/safety/divisions/hsem/NaturalHazards/index.html
[5] https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/geo-3.pdf
[6] https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/geo-3.pdf
[7] https://earthquake.usgs.gov/earthquakes/search/
[8] http://nesec.org/new-hampshire-earthquakes/
[9] https://pubs.usgs.gov/fs/fs-0006-01/fs-0006-01.pdf
[10] http://www.celebrateboston.com/disasters/boston-earthquake-1727.htm

6.5 HAZARD: EXTREME TEMPERATURES

Hazard Overview: Extreme Temperatures	
HIRA Risk	Low
Future Probability	High
Counties at Risk	All

Definition

Extreme temperatures are a period of prolonged and/or excessive hot or cold that presents a danger to human health and life.



Heat exhaustion and heat stroke symptoms. (Source- NOAA)

Extreme Heat events occur as a result of above normal temperatures, which often coincide with high relative humidity, that increase the likelihood of heat disorders with prolonged exposure or strenuous activity. This risk comes from the heat and humidity preventing the human body from adequately cooling itself using natural methods; this can result in heat disorders and, if untreated, unconsciousness and eventually death. Heat related disorders include heat cramps, heat exhaustion, and heat stroke.[1] Populations at risk, such as the young and elderly, are more likely to experience a heat related disorder during a heat event. Humidity exacerbates how the human body experiences heat when hazy, damp air is trapped near the ground. Certain relative humidity percentages can render the body's natural ability to cool itself by sweating ineffective. These meteorological conditions can lead to heat stroke, which is an immediate medical emergency.[2]

Extreme Cold events occur during meteorological cold waves, also known as cold snaps that are caused by the southern transport of arctic airmasses into the Northeast. These events occur during the winter months and increase the likelihood of cold disorders in humans and animals that have prolonged exposure to low ambient temperatures. This effect is exacerbated when there are winds present that effectively lower the temperature that is perceived by the human body, known as the wind chill. The risk comes from when the body is losing heat faster than it can produce it. Wind acts to carry heat away from the body, therefore amplifying the perceived temperature by the human body and reducing the body's core temperature. Cold disorders can include frostbite and hypothermia. Frostbite occurs when uncovered skin/extremities are exposed to extreme cold and the body tissue is either injured or killed. Hypothermia is when the body is unable to heat itself at the rate it is being cooled and the body's core temperature begins to drop below normal values. A normal core body temperature is considered to be 98.6°F; mild hypothermia occurs when core body temperature drops between 90-95°F and severe hypothermia occurs at core body temperatures of below 90°F. If left untreated, hypothermia can result in unconsciousness and eventually death. Extreme cold can also damage or kill crops and animals (wild, farm, or domesticated), potentially presenting a risk to the economy.[34]

Location

The entire State of New Hampshire is at risk for extreme temperatures. The hazard is very season dependent: summer months present the greatest hazard for extreme heat events, while winter months present the greatest threat of extreme cold.

It is not impossible for individuals to experience extreme heat or extreme cold related illnesses year-round. For example, during the summer it is possible for people to experience hypothermia if they are swimming or submerged in a body of water for a long period of time that is cooler than their body temperature.[5]

Water Temperature		Expected Time Before Exhaustion or Unconsciousness	Expected Time of Survival
(°F)	(°C)		
32.5°	0.3°	< 15 minutes	45 minutes
32.5–40°	0.3–4.4°	15 – 30 minutes	30 – 90 minutes
40–50°	3.3–10°	30 – 60 minutes	1 – 3 hours
50–60°	10–15.6°	1 – 2 hours	1 – 6 hours
60–70°	15.6–21.1°	2 – 7 hours	2 – 40 hours
70–80°	21.1–26.7°	3 – 12 hours	3 hours – indefinite
> 80°	> 26.7°	Indefinite	Indefinite

Water temperature and associated survival times.
(Source-The Personal Flotation Device Manufacturers Association)

Background and Evolving Hazard Information

A recent study by the New Hampshire Department of Health and Human Services, Division of Health and Human Services, explored heat and its effects on health on 15 New England communities within New Hampshire, Rhode Island, and Maine[6]. Heat index is a combined measure of heat and humidity that reflects what the weather feels like to the human body. High humidity values create conditions that feel warmer than the ambient air temperature during hot weather because the humidity reduces the body's effectiveness to cool down by sweating. This is because evaporation decreases as relative humidity increases, so the moisture that collects on the body by sweating does not evaporate. It is this evaporation of sweat that allows the body to cool. With this information in mind, the study found that emergency department visits and deaths increase by 7.5 and 5.1 percent, respectively, on days when the heat index reached 95 degrees when compared to data from days with a maximum heat index of 75 degrees. This new study is the first of its kind to relate heat and health in New England. The State epidemiologist indicated that the data showed increased impacts to public health on days with a heat index greater than or equal to 95 degrees and highlighted the enhanced risk to vulnerable populations, such as seniors, young children, and people with chronic health conditions.

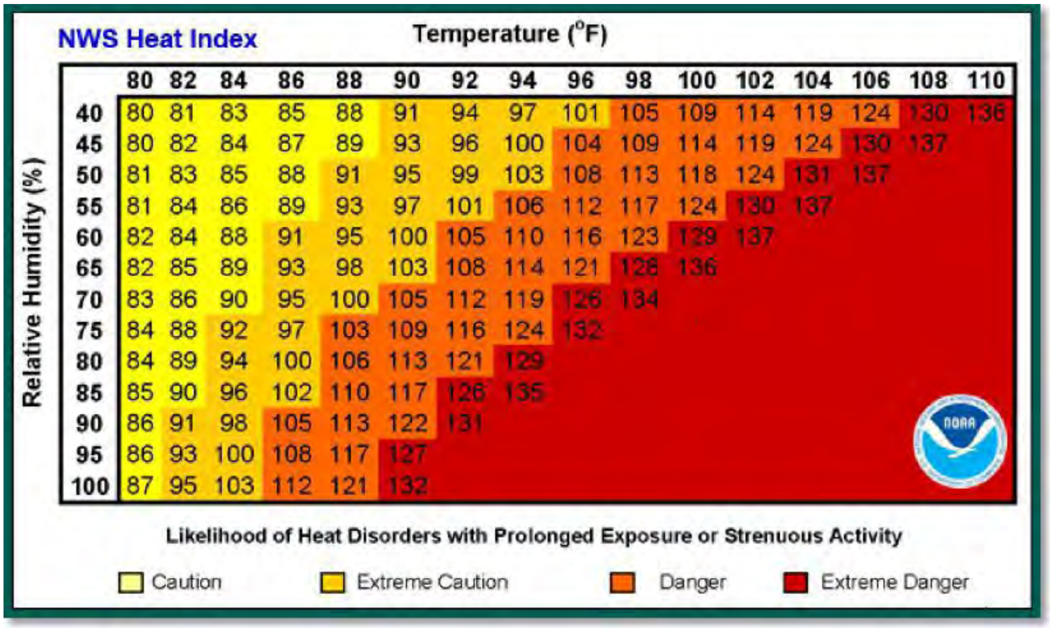
Currently, New Hampshire experiences between two and ten days per year where the heat index reaches 95 degrees. According to Climate Solutions at the University of New Hampshire, it is predicted that the number of days per year where the heat index is over 95 degrees will increase by 12 days in northern New Hampshire and 22 days in southern New Hampshire by the year 2070. As a result of this information and the findings of the study, the National Weather Service (NWS) elected to lower the threshold for issuing heat advisories in December 2016. Due to the State's relatively low yearly average temperatures, New Hampshire residents are not as acclimatized to heat as people in other areas of the Country and are therefore not as prepared to deal with its effects. Additionally, New Hampshire citizens, and many other New England residents, do not have air conditioning in their homes and/or do not have the means to.

Extent

Since temperatures, humidity, and wind are all based upon existing scientific scales (Fahrenheit, Relative Humidity % [comparison of ambient temperature and dew point], and miles per hour [or knots], respectively), the data is already comparative to each other. Severity/magnitude of these events relates to how extreme the temperature is, how long it is expected to remain at an extreme, and any exacerbating factors (such as humidity or wind). The National Weather Service has created charts and alert criteria to signal when temperatures are extreme:

Extreme Heat (excerpted from the National Weather Service)[7]
Note: Some of these values are specific to the Northeastern Forecast Region—New Hampshire is located in this area.

- Heat Advisory—Two or more consecutive hours of Heat Index values of 95-99 degrees Fahrenheit for two or more days *OR* any duration of Heat Index values of 100-104 degrees Fahrenheit. A Heat Advisory is issued within 36 hours of the onset of extremely dangerous heat conditions.
- Excessive Heat Warning—Two or more hours with Heat Index values of 105 degrees Fahrenheit or greater. An Excessive Heat Warning is issued within 36 hours of the onset of extremely dangerous heat conditions.
- Excessive Heat Watches—Heat watches are issued when conditions are favorable for an excessive heat event in the next 24 to 72 hours. A Watch is used when the risk of a heat wave has increased but its occurrence and timing is still uncertain.
- Excessive Heat Outlooks—Issued when the potential exists for an excessive heat event in the next 3-7 days. An Outlook provides information to those who need considerable lead-time to prepare for the event.



NWS Heat Index

Temperature (°F)

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

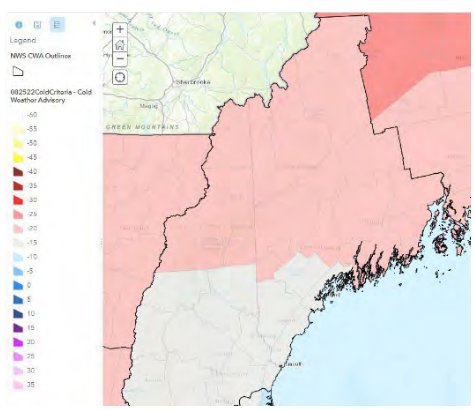
Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

Caution | Extreme Caution | Danger | Extreme Danger

Heat index chart. (Sources-NOAA)

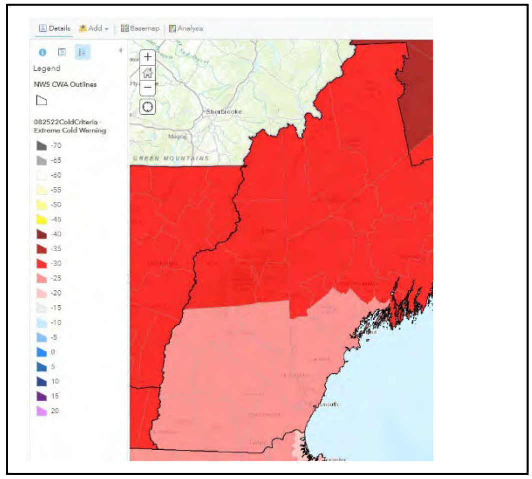
Extreme Cold (excerpted from the National Weather Service)[8] Note: Some of these values are specific to the Northeastern Forecast Region—New Hampshire is located in this area.

- Wind Chill Watch: NWS issues a wind chill watch when dangerously cold wind chill values are *possible*. Residents need to take action to protect themselves, animals, and their property.
- Wind Chill Advisory: NWS issues a wind chill advisory when seasonably cold wind chill values, but not extremely cold values are expected or occurring. A Wind Chill Advisory is issued for New Hampshire is wind chill values are expected to be -20°F to -29°F and winds are greater than 5 mph.



(Source, NOAA)

- Wind Chill Warning: NWS issues a wind chill warning when dangerously cold wind chill values are expected or occurring. A Wind Chill Advisory is issued for New Hampshire is wind chill values are expected to be -30°F and winds are greater than 5 mph.

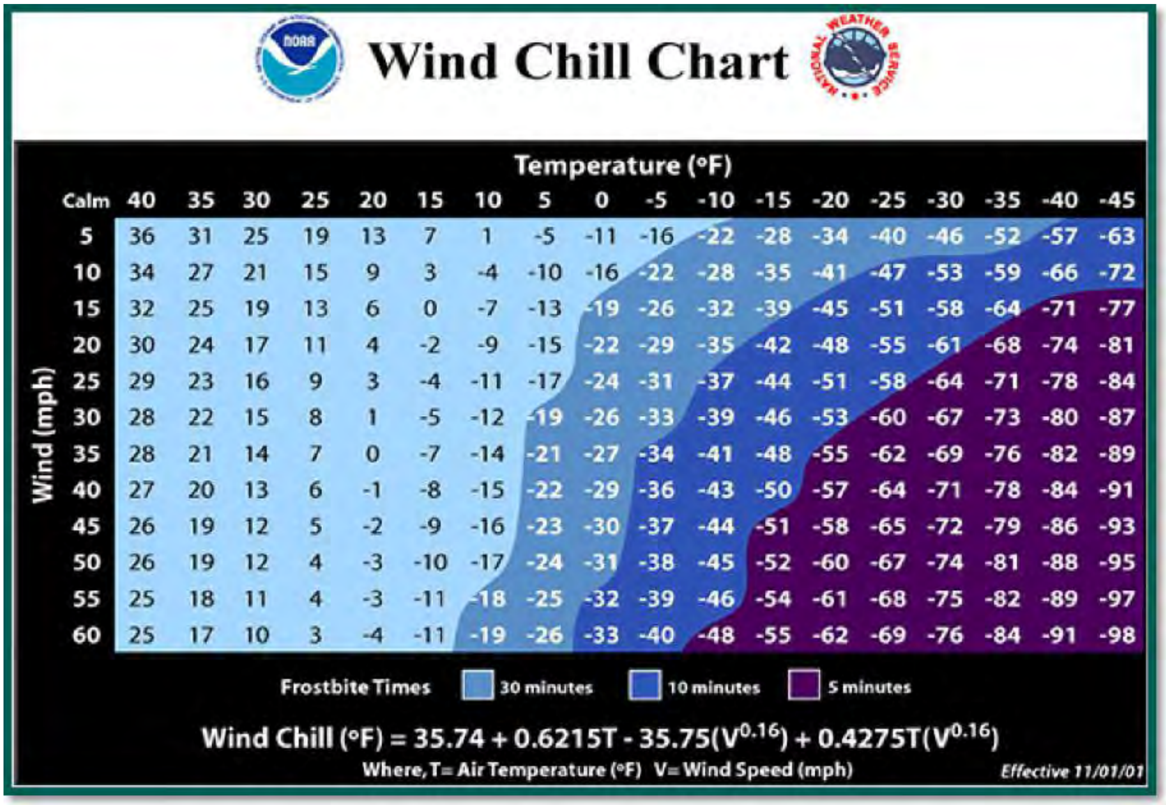


- Freeze Watch: NWS issues a freeze watch when there is a potential for significant, widespread freezing temperatures within the next 24-36 hours. A freeze watch is issued in the autumn until the end of the growing season and in the spring at the start of the growing season.

- Frost Advisory: Be Aware: A frost advisory means areas of frost are expected or occurring, posing a threat to sensitive vegetation.

- Freeze Warning: When temperatures are forecasted to go below 32°F for a long period of time, NWS issues a freeze warning. This temperature threshold kills some types of commercial crops and residential plants.

- Hard Freeze Warning: NWS issues a hard freeze warning when temperatures are expected to drop below 28°F for an extended period of time, killing most types of commercial crops and residential plants.



Wind Chill Chart

Temperature (°F)

Wind (mph)	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes, 10 minutes, 5 minutes

Wind Chill (°F) = $35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$

Where, T = Air Temperature (°F) V = Wind Speed (mph)

Effective 11/01/01

Wind Chill Chart. (Source, NOAA)

Impacts

Extreme Heat[9]

- Health Impacts
  - o Risk of heat related injury or death to humans, pets, and livestock
  - o Particular risk to the elderly, especially those who do not have air conditioning
  - o Risk to other individuals with functional needs
  - o Risk to individuals who work outdoors or who already work in hot environments
  - o Risk to athletes and outdoor recreationalist
- Transportation Impacts
  - o Highway and Road Damage
    - ▪ Asphalt roads soften
    - ▪ Concrete roads can explode
  - o Cars and Trucks
    - ▪ Increased stress on vehicle cooling systems
    - ▪ Increased potential for mechanical failure
    - ▪ Refrigerated goods experience a significantly greater rate of spoilage
  - o Rail
    - ▪ Increased stress on locomotive cooling systems
    - ▪ Train rails may develop kinks and distort

    - Air
        - Aircraft lose lift at high temperatures (The airport in Phoenix Arizona has, in the past, closed, or restricted certain aircraft [such as CRJs] from taking off or landing
- Agriculture
    - Livestock and birds can be severely impacted and killed
    - Milk production and cattle reproduction also slows down during heat waves
    - Crop production can be slowed, damaged, or destroyed during extreme heat events
- Energy
    - The demand for electricity increases because of more air conditioning and more power required by components
    - Demand on electricity heats up power lines causing transmission and distribution lines to sag
    - Sagging powerlines can short out causing power outages and brownouts
- Water Resources
    - The demand for water increases as a result of increased human and animal needs as well as the need for water to cool equipment and structures
    - The demand for water can also negatively impact firefighting operations due to lack of amount or pressure of water.
    - Rise in water temperature can result in lower water quality and can affect fish populations and the death of other organisms.

Extreme Cold[10]

- Health Impacts
    - Risk of cold related injury or death to humans, pets, and livestock
    - Particular risk to the elderly, especially those who do not have adequate heating sources or already live in cold buildings.
    - Risk to individuals with functional needs
    - Risk to individuals who work or recreate outdoors.
- Transportation
    - Vehicles, batteries, and fuels can become stressed and/or damaged.
    - Roads and bridges can become damaged due to freezing or wind.
- Agriculture
    - A freeze or frost early or late in the growing season can quickly become an agriculture disaster driving up the cost of product and economically impacting farmers.
    - Livestock can be affected if not properly protected from cold temperatures.
- Energy
    - Energy use can also rise significantly in extreme cold.

- Water Resources
    - o Extreme temperatures can freeze water resources, pipes, and systems, which not only stops people and animals from getting to water, but also can significantly damage water infrastructure.

This table provides a snapshot of temperature records set in certain areas of the State. Extreme temperatures occur on a near annual basis across the State. That said, these events are tracked by the National Weather Service (NWS) only under certain circumstances. Extreme heat events are only logged into the NWS database when there is at least one fatality, and extreme cold is only recorded when the temperature or wind chill value is -35°F or lower. Furthermore, climatological data in New Hampshire is only reported select locations in the State of New Hampshire by the NWS office in Gray, Me. Due to these criteria, there is limited information available in the NWS online database for extreme temperature events in New Hampshire. The location description will say “statewide” even though the reporting location is generally the capital of Concord, as extreme temperature events tend to across the State and not at a single point.

Safety and Security	Food, Water, Shelter	Health and Medical	Energy (Power & Fuel)	Communications	Transportation	Hazardous Materials
Extreme cold can damage response equipment and extreme temperatures in either direction can impact the health of EMS Providers.	Warming and cooling centers will be required to assist those with limited heating and cooling abilities. Frozen pipes in freezing conditions can lead to lack of potable water and damage to structures. Crop damage can occur, and livestock require additional resources during extreme temperatures.	Extreme temperatures result in increased urgent medical needs. Vulnerable Populations require additional medical support in impacted areas. Jurisdictions without adequate shelters will be required to find alternatives.	Energy resources are in high demand and can lead to rolling blackouts or outages in areas without redundancy or back up supply.	Power outages will impact communication resources without generators.	Extreme temperatures reduce the ability for maintenance staff to work on bridges and roadways. Roads can be damaged by heat and cold. Air traffic may be reduced or stopped due to heat and cold impacts on airport systems and personnel. Rail lines may distort, requiring repairs prior to operation.	Extreme temperatures impact mechanical systems, increasing the potential for failure, leading to hazardous material spills.

Event Date	Event Description	Impacts	Location	Additional Information
July 1911	Heat Wave	Record high temperatures set in Concord, New Hampshire	Statewide	Extreme heat was recorded from July 3rd through July 5th, with high temperatures ranging from 101-102°F in Concord on these days.14 These three days account for three of the top 10 hottest days on record for Concord, New Hampshire.
January 12, 1998	Extreme Cold/Wind Chill	Cold temperatures created problems for the 11,000 customers, an estimated 25,000 people, in New Hampshire that remained without power from the previous week's ice storm. The cold temperatures created worries about the potential for frozen pipes and caused some residents to move from their homes to emergency shelters. In addition, the cold temperatures made power restoration efforts more difficult, especially for out-of-state crews that were not accustomed to working in cold conditions.	Belknap, Carroll, Coos, Grafton, Merrimack, Rockingham, Strafford, and Sullivan Counties	Minimum temperatures on Monday morning, January 12, ranged from near 0 degrees F in northern New Hampshire to 5 to 15 degrees F above zero in central areas, to the mid-teens in southern areas.
January 14, 1998	Extreme Cold/Wind Chill	The cold wind chill temperatures hampered power restoration efforts and increased the risk of frostbite or hypothermia to the crews working outside to restore power.	Belknap, Carroll, Coos, Grafton, Merrimack, Rockingham, Strafford, and Sullivan Counties	A cold front which passed through the state on the 13th marked the leading edge of arctic air which invaded the state Tuesday night and Wednesday, the 14th. Gusty winds and cold temperatures caused dangerously cold wind chill temperatures across the state. Wind chill temperatures generally dropped to near -25 in the northern part of the state and to near zero along the coast.

Event Date	Event Description	Impacts	Location	Additional Information
January 14-15, 1998	Extreme Cold/Wind Chill	More than 2000 customers, an estimated 5000 people remained without power Wednesday morning. The cold temperatures further aggravated the emergency conditions caused by the previous week's ice storm. These cold temperatures increased the threat of burst water pipes in those homes still without power and/or heat and caused some residents to move from their homes to emergency shelters.	Belknap, Carroll, Coos, Grafton, Merrimack, Rockingham, Strafford, and Sullivan Counties	The arctic air behind a cold front that passed through the state on Tuesday, the 13th, brought very cold temperatures to New Hampshire from early Wednesday morning through Thursday morning. Temperatures Wednesday morning had dropped to near zero in the north and mountains, to the single digits or teens elsewhere. During the day Wednesday, with strong, gusty winds, temperatures warmed only to the single digits in the north and mountains, to the teens in central areas, and into the 20s in southern parts of the state. Minimum temperatures Thursday morning dropped below zero in the north and mountains and to the single digits over most of the remainder of the state.
March 27, 28, & 31, 1998	Unseasonably Mild	In Concord, each of the last five days were above 70 degrees with daily record high temperatures being set on the 27th (76°), 28th (86°), and 31st (89°).	Belknap, Carroll, Coos, Grafton, Merrimack, Rockingham, Strafford, and Sullivan Counties	A west to southwesterly flow of unseasonably mild air brought record or near-record warmth to New Hampshire during the last five days of the month. The high temperature of 89° on the 31st set a new record for the month of March. A cold front dropping down from the north brought an end to the unseasonable warmth late on the 31st.
December 7, 1998	Unseasonably Mild	Maximum temperatures for the day ranged from the lower 70s in the southeastern part of the state to the 60s elsewhere. At the airport in Concord, the temperature reached 73 degrees during the late morning just before the cold front passed through.	Belknap, Carroll, Coos, Grafton, Merrimack, Rockingham, Strafford, and Sullivan Counties	A southwesterly flow of very mild air ahead of an approaching cold front brought an unusually warm December day to the state. This temperature set a new all-time December maximum temperature record for Concord. It also marked the first time in the history of observations at Concord that the temperature reached 70 degrees or higher in December.
December 22-23, 1998	Extreme Cold/Wind Chill	Wind chill temperatures dropped to 25 to 30 degrees below zero across northern New Hampshire	Coos County	Strong northwesterly winds of 20 to 30 mph brought in cold air from Canada.

Event Date	Event Description	Impacts	Location	Additional Information
December 30-31, 1998	Extreme Cold/Wind Chill	Wind chill temperatures dropped to 30 to 45 degrees below zero across New Hampshire.	Belknap, Carroll, Coos, Grafton, Merrimack, Rockingham, Strafford, and Sullivan Counties	Strong northwesterly winds of 15 to 25 mph brought arctic air into the area following the passage of a cold front.
January 1, 1999	Extreme Cold/Wind Chill	Wind chill temperatures dropped to between 30 and 50 degrees below zero across New Hampshire.	Belknap, Carroll, Coos, Grafton, Merrimack, Rockingham, Strafford, and Sullivan Counties	Strong northwesterly winds brought arctic air into the state following the passage of a cold front on New Year's Day. In northern New Hampshire, wind chill temperatures generally dropped to about 50 degrees below zero, while central and southeastern New Hampshire had wind chill temperatures near 35 degrees below zero. Along the immediate coast, where winds remained stronger, extremely cold wind chill temperatures persisted through most of the day on the January 2nd.
January 13-14, 1999	Extreme Cold/Wind Chill	Wind chill temperatures ranged from about 35 to 40 degrees below zero.	Belknap, Carroll, Coos, Grafton, Merrimack, Rockingham, Strafford, and Sullivan Counties	Strong north to northeasterly winds and cold temperatures caused wind chill temperatures to reach extreme levels across as an arctic dome of high pressure built in from Canada. While the extreme wind chill temperatures ended during the morning of the 14th over most of the state, they continued for most of the day in coastal areas.
February 22, 1999		Wind chill temperatures dropped briefly to around 25 degrees below zero in many parts of the state.	Belknap, Carroll, Coos, Grafton, Merrimack, Strafford, and Sullivan Counties	Strong winds and extremely cold wind chills developed briefly over northern and central New Hampshire as an area of low pressure moved into the Canadian Maritimes and an area of arctic high pressure built eastward from central Canada.

Event Date	Event Description	Impacts	Location	Additional Information
January 13-15, 2000	Extreme Cold/Wind Chill	Wind chill temperatures dipped to between -25 and -45 across the state.	Belknap, Carroll, Coos, Grafton, Merrimack, Rockingham, Strafford, and Sullivan Counties	Strong winds ushered in cold air as an intense area of low pressure moved east of New England and high pressure built southeastward from southern Canada. The combination of the wind and cold air produced extreme wind chill temperatures across the state.
January 16-18, 2000	Extreme Cold/Wind Chill	Wind chill temperatures dipped to between -40 and -55 across the state.	Belknap, Carroll, Coos, Grafton, Merrimack, Rockingham, Strafford, and Sullivan Counties	Low pressure moving eastward from southern Quebec intensified near Nova Scotia, then slowly moved northeastward as high pressure moved eastward from south-central Canada. The pressure gradient between the low and high caused strong, northerly winds to develop over the area bringing in cold air from Canada. The combination of the wind and cold air produced extreme wind chill temperatures across the state.
January 21-22, 2000	Extreme Cold/Wind Chill	Wind chill temperatures dipped to between -40 and -50 across much of the northern, central, and southeastern sections of the state.	Belknap, Carroll, Coos, Grafton, Merrimack, Rockingham, Strafford, and Sullivan Counties	Low pressure in the Gulf of Maine intensified rapidly as it moved slowly northward through the Canadian Maritimes. The pressure gradient between the low and a ridge of high pressure over the central and eastern U.S. caused strong, northerly winds to develop over northern New England, bringing in cold air from Canada. The combination of the wind and cold temperatures produced extreme wind chill temperatures across the state.

Event Date	Event Description	Impacts	Location	Additional Information
January 28, 2000	Extreme Cold/Wind Chill	Wind chill temperatures dipped to between -25 and -35 across much of the northern, central, and southeastern part of the state.	Belknap, Carroll, Coos, Grafton, Merrimack, Rockingham, Strafford, and Sullivan Counties	Low pressure moved slowly northward from just south of Nova Scotia on the morning of the 27th to the Gulf of St. Lawrence by the morning of the 28th. The pressure gradient between the low and an area of high pressure over the upper Mississippi Valley caused strong, northerly winds to develop over northern New England, bringing in cold air from eastern Canada. The combination of the wind and cold temperatures produced extreme wind chill temperatures across the state.
December 25-26, 2000	Extreme Cold/Wind Chill	The combination of the strong winds and the cold temperatures on the 25th and 26th caused wind chill temperatures to drop to 35 to 45 degrees below zero in the mountains and 25 to 35 degrees below zero over the remainder of central and southeastern New Hampshire.	Carroll, Coos, Grafton, Merrimack, Rockingham, Strafford, and Sullivan Counties	Low pressure moving northeast and intensifying off the New England coast caused strong winds to develop over the state. The strong northwest winds brought arctic air into the area Christmas day.
February 10-11, 2001	Extreme Cold/Wind Chill	The combination of wind and cold temperatures caused wind chill temperatures across northern, central, and southeast New Hampshire to drop to 25 to 40 degrees below zero in most places.	Carroll, Coos, Grafton, Merrimack, Rockingham, Strafford, and Sullivan Counties	Strong winds developed across the state as a deep low-pressure center moved eastward through the Canadian Maritimes and an arctic dome of high pressure dropped southeastward from central Canada.
February 18-18, 2001	Extreme Cold/Wind Chill	Wind chill temperatures in many locations across northern and eastern New Hampshire dropped to 20 to 35 degrees below zero.	Carroll, Coos, Merrimack, Rockingham, and Strafford Counties	The combination of wind and cold temperatures behind an arctic cold front caused wind chill temperatures in many locations across northern and eastern New Hampshire to drop to 20 to 35 degrees below zero.
January 8-10, 2004	Extreme Cold/Wind Chill	Wind chill values of 20 to 49 degrees below zero were recorded at the peak of the outbreak which lasted from Jan. 7 to Jan. 10.	Belknap, Carroll, Coos, Grafton, Merrimack, Rockingham, Strafford, and Sullivan Counties	Low pressure over Eastern Canada funneled arctic air into Northern New England.

Event Date	Event Description	Impacts	Location	Additional Information
January 13-16, 2004	Extreme Cold/Wind Chill	Wind chill values of 33 to 50 degrees below zero were recorded during the peak of this outbreak on the morning of Jan. 15.	Belknap, Carroll, Coos, Grafton, Merrimack, Rockingham, Strafford, and Sullivan Counties	An arctic cold front moved through Northern New England on the afternoon of Jan. 13. Arctic high pressure settled southeast from Central Canada Jan. 14 through Jan. 16.
January 24-25, 2004	Extreme Cold/Wind Chill	Wind chill values of 22 to 42 degrees below zero were recorded across the region on the morning of Jan. 25.	Belknap, Carroll, Coos, Grafton, Merrimack, Rockingham, Strafford, and Sullivan Counties	A strong area of low pressure over Eastern Canada resulted in strong northwest winds and bitter temperatures as arctic air spilled into the Northeast on Jan. 24 and Jan. 25.
January 18, 2005	Extreme Cold/Wind Chill	Central and Northern New Hampshire from midnight to 3:00 pm on the 18th of January	Belknap, Carroll, Coos, Grafton, Merrimack, and Sullivan Counties	Wind chills of 14 to 29 below zero affected much of Southwest...
January 21, 2005	Extreme Cold/Wind Chill	Wind chills of 15 to 29 below zero	Belknap, Carroll, Grafton, Merrimack, Rockingham, Strafford, and Sullivan Counties	Wind chills of 15 to 29 below zero affected Southeast and Central New Hampshire from 1:00 am to 1:00 pm on the 21st of January.
January 23-24, 2005	Extreme Cold/Wind Chill	Wind chills of 15 to 29 below zero	Carroll, Coos, and Grafton Counties	Wind chills of 15 to 29 below zero affected much of Northern New Hampshire from 7:00 pm on the 23rd to 5:00 am on the 24th of January.
July 6-7, 2010	Extreme Heat	Heat index values at the Manchester Airport (KMHT) Automated Surface Observing System and the Nashua Boire Field (KASH) Automated Weather Observing System were 100 to 104 degrees.	Hillsborough County	A strong ridge built into Southern New England resulting in temperatures nearing 100 with high humidity. Heat index values ranged from 100 to 106 for most of Southern New England on the 6th and again on the 7th in a more limited area, generally the Connecticut River Valley.

Event Date	Event Description	Impacts	Location	Additional Information
July 21, 2011	Extreme Heat	The Automated Weather Observation System at Boire Field Airport in Nashua (KASH) recorded heat indexes of 105 over a two-hour period.	Hillsborough County	A strong upper-level ridge brought very hot temperatures to Southern New England. A moist southwest low-level flow increased humidity levels such that heat index values rose above 105 degrees for a period of a few hours.
March 2012	Heat Wave	Record high temperatures set in Concord, New Hampshire	Statewide	High temperature records in Concord, New Hampshire were broken for 5 consecutive days, with the hottest day being 84°F.
September 2017	Heat Wave	High temperature records set across New Hampshire	Statewide	Mount Washington set record a daily high temperature records for four consecutive days. Manchester, Concord, and other areas across the State and New England also saw daily temperature records broken.[15]
December 2017	Cold Wave	Record low temperatures set across New Hampshire	Statewide	Record low temperatures were set across the State as a result of a cold wave. Portsmouth saw a low of -1°F and Mount Washington saw a low of -33°F (with a wind chill of -51°). Wind Chill Advisories were posted in central and southern New Hampshire, and Wind Chill Warnings were posted for northern New Hampshire.
February 2018	One Day Winter Heat Wave	High temperature records set across New Hampshire	Statewide	Exceptionally strong high-pressure ridge in place across the Eastern Seaboard. Record high temperatures were broken across the State.[16]
August 2022	**RECORD HOT MONTH IN CONCORD**	Multiple heatwaves occurred during the month with numerous high temperature records **BEING SET**	Statewide	Concord tied the hottest August on record with an Avg temp of 73.5°. Daily record high temperatures will set on Aug 4th and 8th. In addition, Concord recorded 8 consecutive days of high temperatures above 90s degrees which **WAS THE SECOND LONGEST ON RECORD.**

Impact of Climate Change on Hazard	
Climate Change Projection	Impact on Hazard
Increase in Sea Level	Extreme temperatures will increase severe storms which will have the potential to increase tidal and coastal flooding. This can potentially have a negative impact on coastal erosion, marsh migration, and a loss of coastal wetlands.
Increase in Precipitation	Potential increase in flash, coastal flooding events, which can lead to drainage system impacts (natural and man-made), and this can lead to stagnant water, and degradation of coastal streams channels and wetlands.
Increase in Temperature	Increase in extreme temperatures will create ecosystem stress based on more intense heat waves and more extreme cold weather waves. The increase in more intense heat/cold waves will create additional health impacts due to high heat/extreme cold exposure, and poor outdoor air quality during extreme heat events. Heat waves can exacerbate droughts and wildfire, which can lead to negative impacts on the agriculture sector.
Increase in Severe Weather	Increase in frequency and intensity of extreme weather events, which will result in greater damage to natural resources, property, and infrastructure. This increase in severe weather will also pose an increased potential loss of life.

Individuals/ Communities Disproportionately Impacted by Hazard	
Individual/Community	**Description of Increased Impact**
Socially Vulnerable Populations (due to income, education, health care access, and housing)	• May live in locations that are prone to climate-related health hazards • May have greater rates of existing medical conditions, • May live in poorly maintained or aging infrastructure that may not be able to handle climate-related event • May struggle to access resources and care • May experience limited financial resources or cultural, language, or other barriers that restrict their access to health care, social services, and safe, nutritious food
Children	• Their developing bodies can make them more vulnerable to hazards like heat and poor air quality. • Children breathe at a faster rate, increasing their exposure to dangerous air pollutants. • Spending more time outdoors than adults, increases their exposure to heat and cold, rain and snow, outdoor allergens, and insect bites. • Higher water intake can increase exposure to certain

	contaminants in recreational waters and the risk of developing gastrointestinal or other illnesses. • Children can experience mental health impacts from extreme events that are expected to increase with a changing climate. • Dependance on others for care increases vulnerability
Individuals Aged ≥ 65 Years	• Older people are less able to compensate for the effects of certain environmental hazards, such as air pollution. • Older adults are more likely to have health conditions that make them more sensitive to climate hazards like heat and air pollution, which can worsen their existing illnesses. • Limited mobility, increasing their risks before, during, and after an extreme weather event. • Some medications can change the body's ability to respond to heat, increasing risk for heat illnesses and death as the climate warms. • Aging can impact the immune systems, increasing risk for extreme reactions related to heat, insect- and tick-related diseases, and water-related illnesses. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with a Disability/Disabilities	• Decisionmakers may not fully consider people with disabilities in their planning. One reason for this is that climate change effects on people with disabilities have not been studied as much as other vulnerable populations. • Emergency warnings and other important messages may not be available in formats that are accessible to individuals with certain disabilities (such vision or blindness, hearing loss, or mobility issues). • Necessary medical care may be disrupted before, during, and after an event, including due to evacuations, transportation system or health infrastructure damages, or power outages. • Increased likelihood that they may have additional social and economic risk factors, such as poverty and unemployment, that put them at greater risk. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with Pre-existing or Chronic Health Conditions (including behavioral health)	• Chronic medical conditions may increase risk of illness and death, particularly exposure to heat, extreme weather events, water-related illnesses, and poor air quality. • Necessary medical care may be disrupted before, during, and after an event, including due to evacuations, transportation system or health infrastructure damages, or power outages. • Some medications can affect the body's response to heat, increasing risk for heat illnesses. • Some conditions/medications compromise the immune system, increasing risk for extreme reactions related to heat,

	insect- and tick-related diseases, and water-related illnesses. • Individuals with chronic behavioral health conditions may be more vulnerable to trauma from extreme weather events, as well as disruptions to support networks and mental health care. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.

ENDNOTES – HAZARD: EXTREME TEMPERATURE

[1] http://www.nws.noaa.gov/om/heat/heat_index.shtml
[2] http://www.nws.noaa.gov/om/heat/heat-illness.shtml
[3] http://www.nws.noaa.gov/om/cold/index.shtml
[4] https://www.travelers.com/resources/workplace-safety/stay-warm-during-severe-cold-weather.aspx
[5] https://www.wmtw.com/article/maine-game-wardens-to-search-for-possible-drowning-victim-tomorrow/34545488
[6] https://www.ncbi.nlm.nih.gov/pubmed/28499499
[7] http://www.nws.noaa.gov/om/heat/ww.shtml
[8] http://www.nws.noaa.gov/om/cold/ww.shtml
[9] http://www.nws.noaa.gov/om/cold/wind_chill.shtml
8 http://sciencepolicy.colorado.edu/socasp/weather1/adams.html

6.6 Hazard: Infectious Disease

Hazard Overview: Infectious Disease	
HIRA Risk	**Low**
Future Probability	**High**
Counties at Risk	**All**

Definition

Infectious diseases are illnesses caused by organisms such as bacteria, viruses, fungi, or parasites. Many organisms live in and on our bodies. They are normally harmless or even helpful, but under certain conditions, some organisms may cause disease. Some infectious diseases can be passed from person to person, some are transmitted by bites from insects or animals, and others are acquired by ingesting contaminated food or water or being exposed to organisms in the environment. Signs and symptoms vary depending on the organism causing the infection, but often include fever and fatigue. Mild infections often get better on their own without treatment, while some life-threatening infections may require hospitalization (Mayo Clinic, n.d.).

Some diseases are consistently present in a community and, according to the United States Centers for Disease Control and Prevention (CDC), the "baseline" or "endemic level" for these diseases is the number of people normally infected in an underlying population. This number may be more cases than is desired, but it is the typical amount observed in the population. Without intervention to reduce the amount of disease, the disease may continue to occur at this level indefinitely. Thus, the baseline level is often regarded as the expected level of the disease. While some diseases are so rare in each population that a single case warrants an epidemiologic investigation (e.g., anthrax, rabies, plague, polio), there are other diseases that occur more commonly so that only deviations from the norm (i.e., seeing more cases than expected) warrants investigation or could be an indicator of an exposure event(s) or ongoing exposure (e.g., legionella) (CDC, n.d.).

Epidemics occur when an agent (the organism) and susceptible hosts are present in adequate numbers, and the agent can be effectively passed from a source to the susceptible people (similar to dose – response relationship). More specifically, an epidemic may result from[125]:

- A recent increase in amount of virulence of the agent,
- The recent introduction of the agent into a setting where it has not been before,
- An enhanced mode of transmission so that more susceptible persons are exposed,
- A change in the susceptibility of people's response to the agent, and/or
- Factors that increase exposure or involve introduction through new portals of entry.

Epidemics that are caused by infectious diseases, are typically transmitted through food, water, the environment, person-to-person or animal-to-person (e.g., zoonotic infections). Epidemics can also be caused by noninfectious diseases, such as a chemical exposure, that cause increased rates of illness. Infectious diseases that may cause an epidemic can be broadly categorized into the following groups:

- Foodborne (e.g. Salmonellosis, Escherichia coli)
- Water (e.g., Cholera, Giardiasis, legionellosis)
- Vaccine Preventable (e.g., Measles, Mumps)
- Sexually Transmitted (e.g., Human Immunodeficiency Virus, Syphilis)
- Person-to-Person (e.g., Tuberculosis, meningitis)
- Healthcare associated (e.g., some opportunistic fungal infections and antimicrobial resistant infections).
- Vector borne disease (e.g., Lyme, West Nile Virus, Powassan Virus)
- Zoonotic (e.g., Rabies, Psittacosis, avian influenza)
- Opportunistic fungal and fungal infections (e.g., 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 aerosolizing (inhalation of small infectious disease particles).

Regarding foodborne and waterborne outbreaks, the epidemic hazard involves the safety of the food and water supply. This food and water safety may be jeopardized because of a fire, flood, hurricane, earthquake, or other natural, technological or man-made disaster (e.g., construction and water pipe damage perpetuating growth of legionella bacteria)

Location

The entire State of New Hampshire is at risk for Infectious Diseases. The prevalent diseases can change based on the time of year, such as the influenza virus in the winter and foodborne disease in the summer. Congregate settings such as schools, daycares, nursing homes, or other areas where people congregate may increase risk of acquiring person-to-person infections.

This was evident during COVID-19 when many outbreaks were identified in these settings and is particularly concerning in settings where the patient population may be more susceptible to illness.

The below locations are examples which were highlighted through a combination of efforts which included a survey completed by the RPCs and NH HSEM field staff, historical data, and the National Risk Index.

The Town of Bedford (Hillsborough County), experienced impacts from infectious disease most recently due to the COVID-19 pandemic. All residents in Bedford are susceptible to an infectious disease outbreak. The COVID-19 pandemic of 2020 (DR-4516) had significant impacts on the Town departments and residents. For example, town offices were operational and open to the public but often limited the building capacity. Additionally, public meetings were streamed online, and the public has the option to participate remotely utilizing a video conference platform. There is no financial cost estimate of damages within the most recent plan update.

In the City of Concord (Merrimack County), the most vulnerable to infectious disease include congregated populations, older and younger residents, medical care facilities, and social settings. Local stores and eateries increase the risk of exposure to and transfer of food-borne illness. Other types of public health concerns include tick and mosquito born illnesses, waterways and beaches, and vehicle pollution from I-93.

The City of Franklin (Merrimack County) was impacted by COVID-19 resulting in a hybrid work environment for both city officials and educators within the school system. Franklin had nearly 3,000 cases of COVID-19. Though the discussion around infectious disease in most communities is limited to the example of COVID-19, public health incidents may occur suddenly or with a slow onset and have an unlimited impact as far as location of transmission.

Background and Evolving Hazard Information

Every year New Hampshire experiences a variety of outbreaks, some of which lead to an epidemic. In 2012, for example, an acute care hospital in New Hampshire experienced a large outbreak of Hepatitis C virus infections. The outbreak was caused by a Hepatitis C virus-infected healthcare worker that diverted narcotic medications in a way that put patients at risk for acquiring his infection. Food borne outbreaks are also common in New Hampshire and, on average prior to 2018, occur 5-10 times each year. Others that regularly occur in New Hampshire include outbreaks and/or epidemics of gastrointestinal illness, respiratory illness, and rash. The causal agent often differs, and the severity of the outbreak is dependent on a variety of factors such as virulence of the agent, susceptibility of the population at risk, and the mode of transmission.

During the 2009 H1N1 pandemic between late April 2009 and February 2010, New Hampshire saw an elevated number of novel influenza A (H1N1)-related hospitalizations (754) and deaths (10). This was classified as a Category 1 pandemic by the World Health Organization. The ongoing COVID-19 pandemic is a drastic example how large-scale pandemic can cause substantial illness, hospitalizations, death and disrupt functions of everyday society. As of February 2023, there were over 375,000 cases, over 9,000 hospitalizations, and nearly 3,000 deaths in NH due to COVID-19. During the peak of COVID-19 in winter 2021-2022, over 5,000 cases were reported in one day which is approximately the volume of reports submitted in a year to NH DPHS as required under RSA 151. Theoretically, New Hampshire's entire population is vulnerable to the hazard of an epidemic. However, epidemics often occur among a specific age group or a group of individuals with similar risk factors and types of exposure. For example, the Hepatitis A epidemics of 2005 and 2019 occurred primarily among those using illicit drugs. Similarly, Pertussis (whooping cough) outbreaks most often occur among school-aged children. Many times, congregate settings, such as child-care facilities and schools, offer the opportunity for increased person-to-person transmission because of the proximity of individuals within those settings (e.g., as experienced during COVID-19).

When the source of an outbreak is contaminated food or water, it is non-discriminatory and can affect any individual who eats the food, drinks the water, or is exposed to droplets. Bioterrorist events are also non-discriminatory in that the agents involved may cause illness in anyone exposed. Immuno-compromised individuals, such as the elderly, infants, or severely ill, are often at increased risk because their natural defenses to fight illness may be weakened. Some diseases occur seasonally or regionally, which allows some predictability in preparing for outbreaks and epidemics. For example, influenza most often occurs in the winter months while West Nile Virus or tickborne diseases occur in the summer months. Therefore, appropriate resources may be designated for those applicable seasons (e.g., areal response for mosquito control).

Rates of illness, duration of disease, and the ability to treat or prevent illness once the causative agent is identified are just a few factors that will further determine the vulnerability of the population. Epidemics have the potential to cause a significant loss of life and/or widespread illness throughout the State. The threat of a pandemic influenza or novel coronaviruses (e.g., COVID-19, MERS, SARs) exemplify a devastating situation where there may be an extreme shortage of essential service workers, a rapid transmission of disease from person-to-person, and no or limited effective vaccination to prevent the illness. Vaccination or therapeutic interventions may also be delayed for novel diseases as medical countermeasures require development, FDA approval, and distribution. Additional vulnerabilities that may influence the NH DHHS response to an epidemic include those within the Food Protection Section (FPS), the New Hampshire Public Health Laboratories (PHL), the Bureau of Emergency Preparedness, Response, and Recovery (EPRR), and the Bureau of Infectious Disease Control (BIDC). Each of these units may have specific vulnerabilities that can be categorized into three main areas: staffing, equipment, and supplies. However, each unit has also developed specific skills or capacities to respond to and mitigate a potential threat or event given these potential gaps.

During the COVID-19 pandemic, an enormous strain was placed on resources within the Division of Public Health Services, including personnel, equipment (i.e., laboratory), and office supplies. During this time frame, the demand for testing by the New Hampshire Public Health Laboratories significantly increased. As more tests became widely available and the demand for testing grew, the PHL eventually limited the specimens it would accept. Similarly, during H1N1 or MPOX, the NH PHL narrowed a subset of testing. For example, during H1N1, the PHL only tested influenza-like Illness (ILI) cases among hospitalized patients, healthcare workers, patients of ILINet providers, or persons who were part of a respiratory outbreak investigation. All these events highlight the large strain on the broader public health and health care system throughout New Hampshire.

Extent

The magnitude and severity of infectious diseases are described by their 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 (CDC, n.d.):

- 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
- 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

Impacts

Public health incidents and infectious diseases may occur suddenly or with a slow onset. Incidents that occur suddenly may have extraordinary and/or overwhelming medical resource needs. Incidents that occur with a slow onset and/or with advance warning will allow for a more coordinated response. During sudden onset incidents, many victims may reach healthcare facilities on their own without the use of Emergency Medical Services (EMS), which means that victims may arrive to find unprepared or inadequate facilities.

Incidents may be insidious or obvious, and both have unique impacts. Insidious incidents (such as diseases that have a longer incubation/onset period where infection can be spread without knowing) can result in a much higher infection rate (e.g., COVID-19), eventually overwhelming existing medical resources and resulting in higher morbidity and mortality. Incidents that are more obvious are more recognizable and can result in a more accurate healthcare response, but this may also result in much higher social complications such as fear, anxiety, unnecessary social distancing. For example, the average person may be more afraid of Ebola than influenza or COVID-19; however, the latter is much more likely to occur in the US. Having proper surveillance systems to recognize public health and infectious disease incidents is critical to being able to limit impacts.

The duration of the incident can also cause unique impacts. In a short duration incident, there may be a medical surge at the beginning which tapers off as the incident goes on and may not result in significant disruption to everyday life. However, longer duration incidents may have significant impacts not only on the public health response but also for business/industry and the economy. As identified with COVID-19, this has been a long duration response and contributed to burnout among staff in public service and healthcare sectors.

Terrorism also has unique impacts when compared to an endemic infectious disease, because of the significantly higher fear factor that causes increased emotional stress and anxiety. There could be a significant surge on healthcare, even by those who were unaffected, because of this fear. This is in addition to any morbidity or mortality that occurs directly or indirectly from the attack. This was the case with the 1995 Tokyo subway sarin attack or anthrax attack in 2001.

According to NH DHHS's 2007 Influenza Pandemic Public Health Preparedness and Response Plan, it is estimated that an influenza pandemic will cause nearly 16,000 hospitalizations and nearly 4,000 deaths (Flu and Pandemic Resources, n.d.). The estimated morbidity and mortality may vary due to many factors. In addition, the timing of the pandemic assessment may impact estimates in hospitalizations and deaths (e.g., the spread of virus may be restricted to particular geographic area in focal clusters or severity may vary depending on the initial data of symptoms and outcomes)

Safety and Security	Food, Water, Shelter	Health and Medical	Energy (Power & Fuel)	Communications	Transportation	Hazardous Materials
Staffing shortages will impact response times. Gradual or sudden onset will impact response times and staffing.	Distribution of food and water impacts will be felt through supply chain shortages and delays. Illness will decrease staffing, social distancing will require consideration	Medical facilities will experience medical surge and staffing shortages. Crisis Standards of Care may be required. Additional mortuary services may be required. Mental Health services will be needed	Staffing shortages will impact delivery of services. Staffing shortages may slow response times to outages.	Staffing shortages may slow response times to outages.	Staffing shortages will cause delays; potential supply impacts may hinder travel and repair of infrastructure.	Minimal impacts to material shortages. Staffing shortages may slow response time to spills.

Previous Occurrences: History of Infectious Disease Events in New Hampshire

Event Date	Event Description	Impacts	Location	Additional Information
2005	Hepatitis A	82 cases	Statewide	82 cases were reported; 30% higher than previous four years.
2009	H1N1 Influenza	754 Hospitalizations and 10 Deaths	Statewide	WHO Level 1 Pandemic "swine flu" Division of Public Health Services processed 4,192 specimens and 786 cases.
2009	Anthrax	Individual infected with gastrointestinal anthrax	Durham	A woman was sickened by a naturally occurring strain of anthrax that was on an African drum she was playing in a community drumming circle.128
2012	Hepatitis C	32 patients infected with Hepatitis C virus, thousands tested and interviewed	Exeter Hospital	Patients became infected with Hepatitis C virus when a healthcare worker diverted injectable narcotics intended for patients.
2012	Fungal meningitis and other infections	14 patients infected in NH and 753 nationally and 64 deaths	Statewide/ National	Patients became infected with fungal infections following medications compounded at one pharmacy: https://www.cdc.gov/hai/outbreaks/meningitis.html
August 2013	Hepatitis A	2 hepatitis A virus-infected foodservice workers, ~ 1,200 exposed people vaccinated	Contoocook	A part-time bartender at the American Legion and Covered Bridge Restaurant in Contoocook was diagnosed with Hepatitis A resulting in the potential exposure of patrons of those establishments resulting in two points of dispensing (PODs) being activated: the first in Hopkinton and the second, due to the occurrence of the Hopkinton Fair, was held in Bow.

Fall 2014	Enterovirus D-68	>40 ill children in New Hampshire, some with paralysis	Statewide	A rare strain of enterovirus resulted in debilitating infections in children Nationwide
Fall 2014-Feb 2016	Ebola virus disease	>100 people in New Hampshire monitored for potential Ebola virus symptoms	Statewide	New Hampshire residents were monitored for symptoms of Ebola virus disease after travelling to West Africa during the unprecedented outbreak of Ebola virus. No actual cases of Ebola virus occurred in New Hampshire.
2018	Legionella	49 persons probable or suspect	Statewide	2 deaths and 22 hospitalizations
2017-2018	Seasonal Influenza Outbreak	As of April 2018, 63 adult influenza related deaths had been identified in New Hampshire	Statewide	A particularly virulent flu season impacted the region. The overall effectiveness of the flu vaccine during this flu season was estimated at 36%.129
2019-2020	Hepatitis A	339 cases, 210 hospitalizations, and 3 deaths in NH. Nationally, there have been 44,779 cases, 27,342 hospitalizations, and 421 deaths.	Statewide/ National	Since March 2017, multiple state and local health departments experienced hepatitis A outbreaks, spread primarily through person-to-person contact.
2020-2023	Coronavirus	Over 375,000 cases of COVID-19 in New Hampshire, and nearly 3,000 deaths	Statewide	Coronavirus disease 2019 (COVID-19) was first identified in China in December 2019, and in March 2020 the WHO declared it a global pandemic
2022	Mpox	35 cases in New Hampshire	Statewide	Cases of Mpox started appearing in countries where it is not endemic in May 2022, and quickly spread to the U.S., with the CDC declaring it a public health emergency in August 2022
Annually	Foodborne outbreaks	Ill individuals associated with outbreaks	Statewide	Approximately 5-10 outbreaks per year in state and 15-30 cases identified as associated with national outbreaks*
Annually	Influenza and other respiratory virus outbreaks	Ill individuals associated with outbreaks	Statewide	Approximately 25-50 outbreaks per year primarily occurring in long-term care facilities and schools *

Annually	Norovirus and other gastrointestinal virus outbreaks	Ill individuals associated with outbreaks	Statewide	Approximately 60-80 outbreaks per year primarily occurring in long-term care facilities and schools*

*Annual case counts vary depending on severity of season (e.g., influenza), circulating strain, and other external factors (e.g., COVID-19 pandemic and mitigation measures that reduced transmission of other infections)
Note: Case counts for outbreaks may not be comprehensive due to under reporting and limited tracking during COVID-19 pandemic due to staffing resources being deployed for pandemic response.

Impact of Climate Change on Hazard	
Climate Change Projection	**Impact on Hazard**
Increase in Sea Level	N/A
Increase in Precipitation	Public health impacts from an increase in precipitation include increased incidents of flooding, which will lead to increased impacts from mold within affected areas, including homes, businesses, and other personal property assets (vehicles, campers, sheds, etc.) An increase in flooding may also lead to an increase of stagnant water, which may lead to an increase in vector-borne diseases.
Increase in Temperature	Climate change impacts from an increase in temperature include poor outdoor air quality, an increase in heat exposure, energy brownouts from high energy demands, and additional ecosystem stress.
Increase in Severe Weather	An increase in severe weather events due to climate change will result in greater damage to natural resources, property, and critical infrastructure.

Individuals/ Communities Disproportionately Impacted by Hazard	
Individual/Community	**Description of Increased Impact**
Socially Vulnerable Populations (due to income, education, health care access, and housing)	• May live in locations that are prone to climate-related health hazards • May have greater rates of existing medical conditions, • May live in poorly maintained or aging infrastructure that may not be able to handle climate-related event • May struggle to access resources and care • May experience limited financial resources or cultural, language, or other barriers that restrict their access to health care, social services, and safe, nutritious food
Children	• Their developing bodies can make them more vulnerable to hazards like heat and poor air quality. • Children breathe at a faster rate, increasing their exposure to dangerous air pollutants. • Spending more time outdoors than adults, increases their exposure to heat and cold, rain and snow, outdoor allergens, and insect bites. • Higher water intake can increase exposure to certain contaminants in recreational waters and the risk of developing gastrointestinal or other illnesses. • Children can experience mental health impacts from extreme events that are expected to increase with a changing climate. • Dependance on others for care increases vulnerability
Individuals Aged ≥ 65 Years	• Older people are less able to compensate for the effects of certain environmental hazards, such as air pollution. • Older adults are more likely to have health conditions that make them more sensitive to climate hazards like heat and air pollution, which can worsen their existing illnesses. • Limited mobility, increasing their risks before, during, and after an extreme weather event. • Some medications can change the body’s ability to respond to heat, increasing risk for heat illnesses and death as the climate warms. • Aging can impact the immune systems, increasing risk for extreme reactions related to heat, insect- and tick-related diseases, and water-related illnesses. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with a Disability/Disabilities	• Decisionmakers may not fully consider people with disabilities in their planning. One reason for this is that climate change effects on people with disabilities have not been studied as much as other vulnerable populations. • Emergency warnings and other important messages may not be available in formats that are accessible to individuals with certain disabilities (such vision or blindness, hearing loss, or

	mobility issues). • Necessary medical care may be disrupted before, during, and after an event, including due to evacuations, transportation system or health infrastructure damages, or power outages. • Increased likelihood that they may have additional social and economic risk factors, such as poverty and unemployment, that put them at greater risk. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with Pre-existing or Chronic Health Conditions (including behavioral health)	• Chronic medical conditions may increase risk of illness and death, particularly exposure to heat, extreme weather events, water-related illnesses, and poor air quality. • Necessary medical care may be disrupted before, during, and after an event, including due to evacuations, transportation system or health infrastructure damages, or power outages. • Some medications can affect the body's response to heat, increasing risk for heat illnesses. • Some conditions/medications compromise the immune system, increasing risk for extreme reactions related to heat, insect- and tick-related diseases, and water-related illnesses. • Individuals with chronic behavioral health conditions may be more vulnerable to trauma from extreme weather events, as well as disruptions to support networks and mental health care. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.

END NOTES – HAZARD: INFECTIOUS DISEASE

[1] (n.d.). Retrieved from Flu and Pandemic Resources: HTTPS://WWW.CDC.GOV/FLU/PANDEMIC-RESOURCES/NATIONAL-STRATEGY/RISK-ASSESSMENT.HTM

[2] *CDC*. (n.d.). Retrieved from https://www.cdc.gov/csels/dsepd/ss1978/lesson1/section11.html

[3] *Mayo Clinic*. (n.d.). Retrieved from http://www.mayoclinic.org/diseases-conditions/infectious- diseases/home/ovc-20168649

[4] Public Health Emergency. (2012, February 14). *Mass Casualty and Mass Effect Incidents: Implications for Healthcare Organizations*. Retrieved from Public Health Emergency: https://www.phe.gov/Preparedness/planning/mscc/healthcarecoalition/chapter1/Pages/implications.aspx

6.7 HAZARD: INLAND FLOODING

Hazard Overview: Inland Flooding	
HIRA Risk	High
Future Probability	High
Counties at Risk	All

Definition

Flooding, inclusive of inland flooding, is generally defined as a high flow, overflow, or inundation by water, which causes or threatens damage.[1] Flooding results from the overflow of rivers, their tributaries, and streams throughout the State, primarily from high precipitation events. Flash flooding is defined as a flow with a rapid rise in water level and extreme velocities in a river or stream, beginning within six hours of the causative event (e.g., intense rainfall, dam failure, ice jam). Ongoing flooding can intensify to flash flooding in cases where intense rainfall results in a rapid surge of rising flood waters. Because of New Hampshire's steep terrain in the headwaters of watersheds, particularly outside of the coastal plain, flash floods also lead to riverbank and bed erosion. Extreme precipitation events in recent years, such as Tropical Storm Irene, or slow-moving summer thunderstorms over steep terrain, have led to buildings on the edges of streambanks becoming at risk to river erosion, or culvert failures.

The National Flood Insurance Program (NFIP) has a more specific definition of flooding, which can also be considered and used when looking at floodplain and floodplain mapping. The NFIP 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:[2]

1. Overflow of inland or tidal waters; or
2. Unusual and rapid accumulation or runoff of surface waters from any source; or
3. Mudslides (i.e., mudflows) which are proximately caused by flooding and are akin to a river of liquid and flowing mud on the surfaces of normally dry land areas, as when earth is carried by a current of water and deposited along the path of the current.; or
4. Collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above.

Location

All counties of New Hampshire have areas which are at risk for flooding.

The below locations are examples which were highlighted through a combination of efforts which included a survey completed by the RPCs and NH HSEM field staff, historical data, and the National Risk Index.

In Tilton (Belknap County), the critical facilities most likely to be impacted by inland flooding are Clement Dam, Lochmere Village Water District, evacuation routes, the Liberty Utilities facility, and a half dozen road segments. The town of Tilton actively participates in the NFIP and there are currently 20 flood insurance policies in force. 11 of the NFIP-insured structures are in “A” (High Risk) Zones, while nine are in the B, C, or X (Moderate Risk) Zones. Since 1975, there have been 11 losses paid out for a total of $138,283; two-thirds of the paid claims have been on structures outside the A-Zone. Assuming a total of 1%-2% chance, damage to structures might be as high as $5.1 to $10.2 million.

For the Town of Barnstead (Belknap County), the extent of damage caused by any flood depends on the depth and duration of flooding, the topography of the area flooded, velocity of flow, rate of rise, and the amount and form of development in the floodplain. Most of the past flooding events result in erosion and damage to culverts on roadways throughout town. April 30 – May 2, 2023, heavy rain caused flooding in the community. Province Road had a washout of 10 to 12 feet deep in places for about a mile. Local estimates were about four inches of rain in a 48-hour period. Over the last two decades, the town has been impacted significantly by more than a half dozen other flooding incidents.

Due to heavy rainfall and snowmelt, the precipitation levels create flood levels that impact infrastructure, community lifelines, populations, and structures throughout Hillsborough County, especially those within the floodplain. Hillsborough County contains some of the most densely populated areas along the Merrimack River, including the City of Manchester. The City of Manchester has over 500 structures located within the special flood hazard areas (100-year flood plain) alone. Additionally, the City of Manchester historically has had issues with localized flooding occurring after storms in specific areas of their city due to drainage and runoff overload. Many communities also have critical infrastructure within in areas that may cause additional concern with inland flooding. The Towns of Antrim, Hillsborough, and Goffstown contain at least one High Hazard Potential Dam within their community that impacts their vulnerability if inland flooding were to occur. All of four of these communities also have additional aging critical infrastructure such as roads, evacuation routes, bridges and stormwater infrastructure that are especially vulnerable to potential impacts on their community lifelines and populations as flood levels rise.

New Hampshire has more than 23,000 miles of rivers and streams, based upon the National Hydrography Dataset, combined with work in White Mountain National Forest to identify additional streams from LiDAR. Communities developed and encroached into the floodplains and along waterways which provided mills with power and transportation. Because of this development pattern, the floodplains of the State were rapidly settled. The shift to industrialization during the mid-nineteenth century compounded the problem with residents moving to the floodplains of the cities and larger villages. Floodplains are integrated with watercourses and have evolved to carry runoff water and sediment naturally downstream, so that water may be stored and slowly released to the main channel of a river or stream as the flood passes.

Riverine flooding is the most common disaster event in the State of New Hampshire. Areas that have been identified as part of the 1% annual chance floodplain in support of the National Flood Insurance Program simply represent those areas for which mapping has been performed. With sufficient rainfall, snowmelt, or through the result of ice jam formation, or in the event of dam failure, all areas that are floodplain adjacent to rivers and streams in New Hampshire are prone to flood inundation.

Locations within floodplains downstream of large dams are susceptible to flood and erosion damage in the event of dam failure. The Dam Bureau at the New Hampshire Department of Environmental Services (NHDES) can provide information regarding areas at risk to flood inundation downstream of dams that have formal Emergency Action Plans. Such dams are those classified as Significant or High Hazard whose failure could result in loss of life and significant damage to property and critical infrastructure.

The United States Army Corps of Engineers is also responsible for six recreation and flood-risk management dams in New Hampshire. These include:

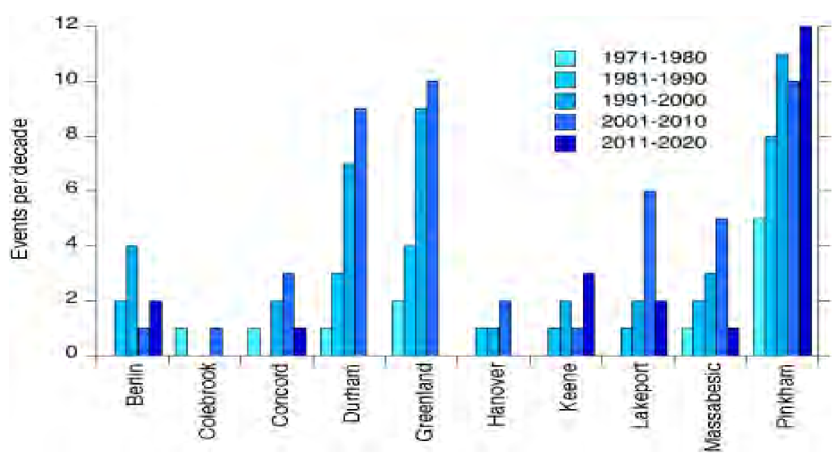
- Blackwater Dam (Webster)
- Edward MacDowell Lake (Peterborough)
- Hopkinton-Everett Lakes (Contoocook)
- Franklin Falls Dam (Franklin)
- Otter Brook Lake (Keene-Roxbury)
- Surry Mountain Lake (Surry)

Urban areas within New Hampshire are susceptible to poor drainage flooding during episodes of heavy rain that falls within a short duration. Such flooding is the result of the concentration of impervious surfaces where the amount of concrete, asphalt, rooftops, and other minimally or non-porous materials concentrates flow to urban stormwater systems that, during heavy rain, cannot always handle the input, causing flooding conditions on streets and parking lots.

Outside of the coastal lowlands of southeastern New Hampshire, the headwaters of streams in watersheds are often contained within narrow valleys in steep terrain. Stream channels in such physiographic conditions can reach capacity very quickly, and with minimal floodplain available for water to spread and dissipate flow energy, heavy precipitation events can lead to high velocity water moving downstream given the steep terrain, creating situations of not only inundation, but riverbed and bank erosion and culvert failures. Examples of this in recent years have included locations in the Keene area in 2013 and 2014, and in Grafton County in July 2019. In the White Mountains, larger rivers can also be susceptible to bank erosion and river channel migration given the steeper gradients located there, combined with the historically straightened nature of many rivers. Examples include rivers such as the Baker River in Warren, the East Branch Pemigewasset River in Lincoln, or the Peabody River in Gorham.

Given its cold climate, New Hampshire rivers are also prone to ice jams. Ice jams and related flooding occur most often during mid-winter or spring thaws, notably when snowmelt and rainfall result in elevated streamflow. The combination of high flow and an ice jam can result in rapid and unexpected flooding both above and below the ice jam. Ice jams are most common at bends in the river, along bridge abutments or pylons, and junctions with a tributary. In 2017, the State engaged with a Silver Jackets project to examine ways to better predict the location of ice jam formation, given events on the Gale River at Sugar Hill (2011 and prior) and Franconia (2016). The ability to predict the locations of ice jam formation, and therefore, locations of inundation upstream of them is a science still in its infancy. However, one factor in the location of ice jam formation is river channel morphology, particularly locations where a river channel narrows, has constrictions caused by sharp meandering, has shallow reaches with bottom bars, and the locations of stream channel confluences.[3] There are other meteorological factors (e.g., preceding air and water temperature regime) that influence formation. From a geomorphological perspective, locations in New Hampshire where the above factors are most likely to occur together are in steeper terrain outside of the coastal plain.

The impacts of climate change are and will continue to influence the frequency, timing, location, and extent of inland flooding. In 2017, results of the state-wide modelling analysis by USGS to simulate hydrologic response to climate change during the 21st century indicated an overall increase in streamflow across the State with especially large increases in streamflow during the late fall, winter, and early spring.[3] The *New Hampshire Climate Assessment 2021* predicts an increase in total annual precipitation, as well as the frequency and intensity of extreme precipitation events.[4] Generally, the greatest changes are projected for the northern portion of the state.[5] As sea-level rises, the groundwater levels near the coast also rise until a new equilibrium is established between aquifer recharge and groundwater discharge to the sea. According to the 2019 New Hampshire Coastal Flood Risk Summary, “modeling shows that groundwater rise driven by sea-level rise may cause flooding in areas where groundwater levels are already high, not only along the coast but also at significant distances inland.”[6] Additionally, increasing storm surge in coastal New Hampshire will impact inland flooding.[7]



Days with greater than four inches of precipitation in 48 hours, per decade (Source: Lemcke-Stampone, 2022)

Background and Evolving Hazard Information

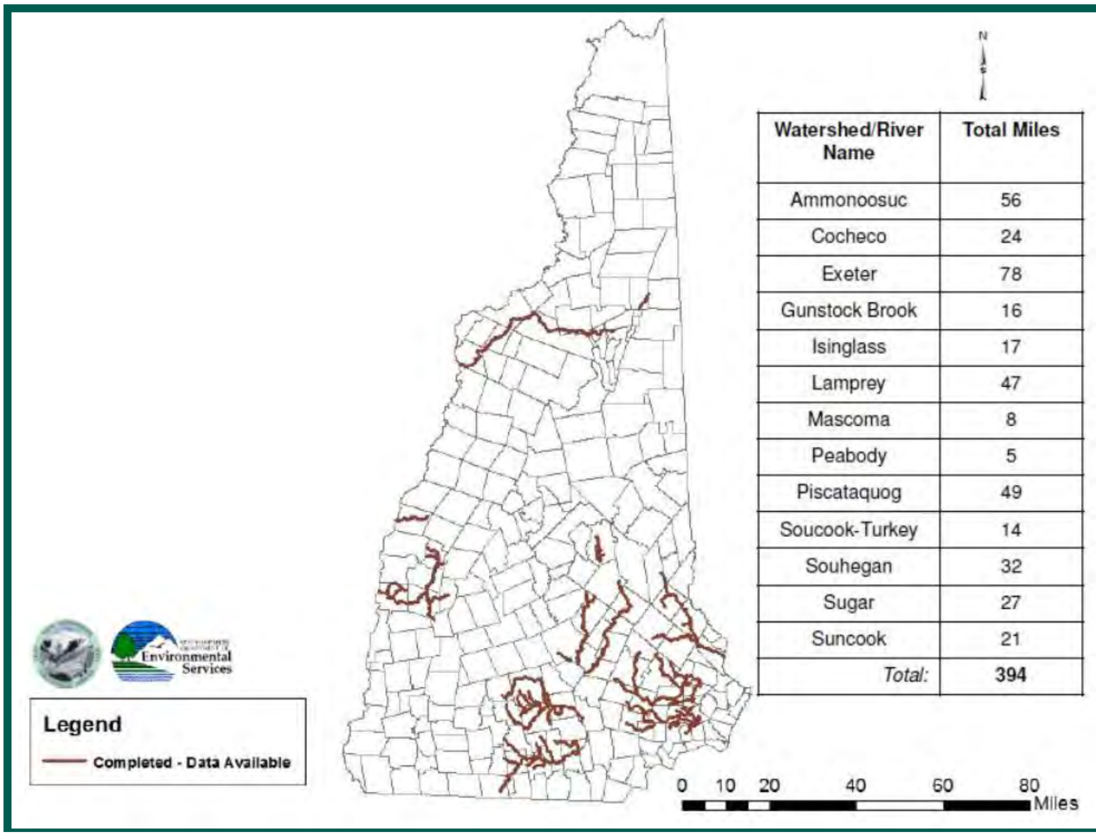
New Hampshire has experienced several significant flood events since 2006 that have washed out culverts, undermined bridges and roads, and washed away streambanks. Such events have occurred within an overall trend of an increasing frequency and intensity of flood events during the past few decades.[8] More recent events have included the Mother's Day flood (2006), additional statewide flooding in 2007, Tropical Storm Irene (2011), thunderstorm induced flash flooding in the Connecticut River Valley (2013 and 2014), and most recently, thunderstorm induced flash flooding in Grafton County (2017 and 2019). Since that time, multiple agencies in the State of New Hampshire have developed programs, plans and procedures to better respond to, and mitigate, flood risks. While considerable background on the locations and mechanisms that can cause flooding in New Hampshire are described in the preceding "Location" section, the State has taken actions to work toward the long-term goal of flood risk reduction in flood-prone areas, as a result of the effects of the flood events in the mid-2000s. These include:

- Established a statewide state-federal interagency flood risk management team (Silver Jackets), comprised of 14 state and federal agencies to increase communication in support of the mitigation of, and recovery from, flood events in the state.
- Incorporated updated rainfall-runoff values into Alteration of Terrain permitting within NHDES.
- Established a statewide multi-agency stream crossing assessment program and database to identify culverts at risk for failure during flood events, a collaborative effort between NHDES, NH HSEM, NHDOT and New Hampshire Fish & Game.
- Development of hydraulic modeling expertise within NHDES, utilizing new and existing staff, to support greater identification of areas most prone to flooding, utilizing enhanced elevation datasets available.
- Created authorization for stormwater utilities to be formed in state statute.
- Established the provision of technical support from local municipalities in the event of ice jams
- Completed the collection of statewide LiDAR data (enhanced elevation information) necessary for accurate flood mapping.
- Finalized and established a statewide flood hazard geodatabase in support of flood mitigation and emergency response functions, which is continually updated after flood events with local impact information, and with information from local hazard mitigation plan updates.
- NHDES established a Resilience & Adaptation program to aid municipalities and utilities with identifying natural disaster and climate related vulnerabilities within their systems and assisting with corrective implementation measures. The program covers both wastewater and drinking water infrastructure and integrates with existing NHDES asset management program framework. Typical areas of assistance are vulnerability assessments, integration of infrastructure vulnerability data into asset management programs and emergency management related plans, identifying funding resources, training and community outreach, and design strategies to address target concerns (to include flooding).

These actions can all work to reduce the risks to citizens during flood events, through enhanced planning using sound data and science that provides State agencies and town officials with up-to-date information. However, these actions cannot stop flooding, given that every river in New Hampshire can and does flood. Properties and infrastructure adjacent to rivers and streams will continue to be prone to inundation risks. Locations downstream of dams are still at risk of flooding and erosion should dams breach or fail. Rivers and streams will still be prone to erosion and migration, impacting adjacent infrastructure and altering the landscape, particularly in steeper terrain and during active flood events. State agencies will continue to work collaboratively to utilize the latest information and knowledge of flood locations to prioritize the reduction of flood risk now and into the future.

Riverine Erosion, Scouring, and Flooding

River erosion is a recurrent problem in New Hampshire, especially with those rivers and streams within watersheds that have steep terrain, where rivers have been historically straightened and modified, and that have development adjacent to them. Local scale erosion, or scouring, also occurs throughout the State, particularly in the vicinity of bridges and culverts (principally downstream of them) and other structures within rivers, such as retaining walls and riprap revetment, particularly if such structures are not properly placed upon their original installation. As described in previous sections, bed and bank erosion has been a particular problem in the “flashy” streams of northern and western New Hampshire, away from the coastal plain. Most recently, severe bank erosion occurred on rivers and streams as a result of thunderstorm-induced heavy rain in Grafton County (2017 and 2019) and Cheshire County (2021). From these events, homes, businesses, and infrastructure were impacted, demonstrating that extreme rain events of that magnitude can lead to widespread river erosion and river channel changes throughout one or more regions of the State, depending upon the spatial extent of the event.



Watershed/River Name	Total Miles
Ammonoosuc	56
Cocheco	24
Exeter	78
Gunstock Brook	16
Isinglass	17
Lamprey	47
Mascoma	8
Peabody	5
Piscataquog	49
Soucook-Turkey	14
Souhegan	32
Sugar	27
Suncook	21
Total:	**394**

The most dramatic kind of erosion event, known as an "avulsion," occurs when a river cuts through one of its banks and creates and entirely new path, usually abandoning its old channel in the process. A large-scale event in New Hampshire of this type occurred on the Suncook River in Epsom in 2006, when a new channel was created through an old glacial wetland in the vicinity of an abandoned gravel operation, shortening its path by about ¼ mile. A smaller-scale example occurred in 2013 in Surry when a short reach of Merriam Brook became filled with rock from upstream, forcing the high flow to cut a new channel across a homeowner's lawn.

Prior to 2015, the New Hampshire Geological Survey oversaw the collection of fluvial geomorphology data on 394 miles of New Hampshire's rivers and streams. Information collected included the identification of river reaches that have been straightened, and locations of riprap revetment and retaining walls. The existence of river straightening suggests that channel erosion and migration could occur in such locations at a later time given that river channels will naturally seek to recreate meanders for themselves. The presence of riprap or revetment is typically indicative of a pre- existing erosion problem.

Of the 394 miles of streams for which this type of data has been collected in New Hampshire, 72.5 miles have been identified as having been straightened. This constitutes 18% of the assessed rivers. These 394 miles of streams all have two banks, or sides of the channel, encompassing a total of 788 miles of streambank. Of this total, 53.5 miles, or 6.8% of the total length of streambank for which data is available has either had riprap or bank revetment installed. Similarly, 81 miles of streambank, or 10% of the total assessed, were noted as experiencing bank erosion to an extent beyond what is normal background erosion in rivers. While this data is not available for all New Hampshire rivers, these figures provide one quantitative measure of the extent of the concern and potential risks, at least from those rivers that have been so assessed.

Rapid Snowmelt

The State's climate and mountainous terrain increases the susceptibility to flooding as a result of the seasonal melting of the snowpack. In particular, a warm and/or rainy spring can exacerbate this risk as the snow melts faster than it can be absorbed into the groundwater or evaporated. The snowmelt can also flow overland into receiving streams and rivers, causing them to rapidly rise, and in some cases, overflow their banks.[4]

Merriam Brook in Surry on July 31, 2013. The original channel (to the right) filled in with rock transported from upstream, forcing the channel to break through the bank, cutting a new channel for itself at the southern end of the homeowner's lawn (to the left). (Source- NHDES)

Streams, especially those located in the headwaters and watersheds, may experience erosion and scour. Sediment that is eroded and scoured from stream beds and banks can then be deposited at locations where the stream flow decreases, or upstream of undersized culverts, enhancing future flood risks. The more level terrain of New Hampshire, particularly the coastal plain, may experience inundation that is accelerated by rapid melting of the snowpack.

Ice Jam Flooding

A backup of water into areas of the adjacent floodplain can occur when a river or stream is blocked by the buildup of ice.[9] Ice in waterways forms naturally from the freezing of water during the winter months. Melt and/or storm water may then encounter these ice formations causing them to break up and move down the river. Ice may apply lateral and/or vertical force on structures and infrastructure. Moving ice may scour abutments and riverbanks, and ice may also create temporary dams. These dams may create flood hazard conditions where no flood hazard previously existed, as experienced in February 2016 on the Gale River at Plantation Road in Franconia. It is becoming understood that river geomorphology also can influence ice jam formation, and this has been discussed previously in the "Location" section.

Ice jam on the Pemigewasset River at Holderness caused flooding in Holderness and the Plymouth State University parking lot where parked cars became submerged.
(Source, Siobhan Lopez, WMUR)

New Hampshire's exposure to this hazard type has prompted several interventions by the U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory (CREEL). The Corps has constructed dams and ice diversion structures to arrest the flow of large, potentially damaging ice formations to reduce flooding potential and the possible impact by ice on bridges, streambanks, and other structures. Technical measures exist to address ice jams once they have formed; however, because of the uncertainty in prediction of where ice jams will form, it is important for town officials and citizens to learn the signs of formation and know the steps to take from an emergency response perspective upon the formation of an ice jam near individuals and infrastructure.

Groundwater Rise

In coastal areas, groundwater flows from recharge areas to discharge areas along the shoreline. As sea-level rises, the groundwater levels near the coast also rise until a new equilibrium is established between aquifer recharge and groundwater discharge to the sea. Modeling shows that groundwater rise driven by sea-level rise may cause flooding in areas where groundwater levels are already high, not only along the coast but also at significant distances inland.

Extent

Where river gauges are present, the magnitude of flooding is ranked, and area specific forecasts are created using a flood scale that ranges from the Action Stage to Major Flood Stage. The National Weather Service characterizes flood severity to communicate the impact of flooding more effectively as follows:[10, 11]

- Action Stage – Water source is rising, and actions must be taken in preparation of potential significant hydrologic activity. Impacts are isolated to within the main channel mean-annual high-water mark and can include minor overbank flooding of undeveloped floodplain. Examples of impacts include high flows for recreational paddlers, bank erosion, flooding of boat launches, non-damaging overbank flooding.
- Minor Flood Stage – An established stream gage height for a given location at which a rise in water surface level begins to create a hazard to lives, property, or commerce. The issuance of flood warnings is linked to the Flood Stage. Minimal or no property damage, but possibly some public threat. At least one road overtopped (passable or impassable) and does not cut off emergency access to permanent residents/businesses. Foundation

building flooding can occur for seasonal properties and/or outbuildings.

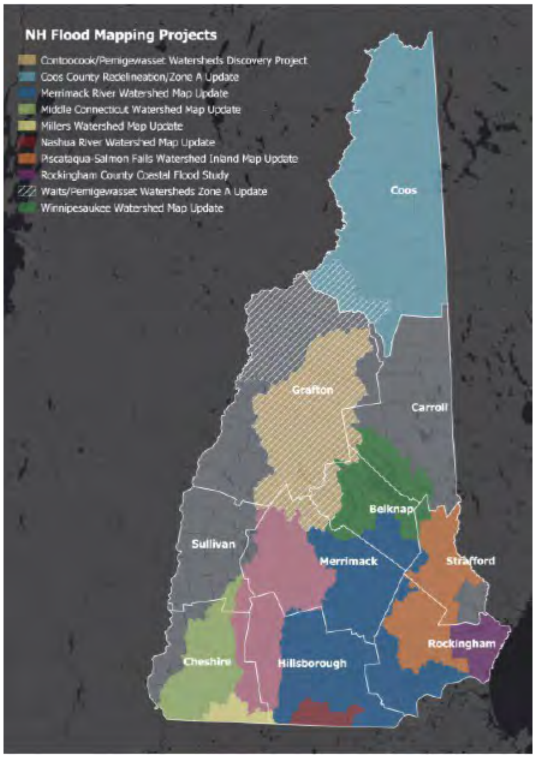
- Moderate Flooding – Threat level has risen with some inundation of structures and roads near streams which could result in evacuations of people and/or transfer of property to higher elevations. Travel in and out of the area disrupted with main throughways cut off.
- Major Flooding – Significant evacuations of people and/or transfer of property to higher elevations and/or extensive inundation of roads resulting in severe impacts to travel in the area.

Areas that are not monitored by river gauges are not forecasted or measured using a specific scale; therefore, the best way to describe the extent of the hazard of flooding is its speed of onset (how quickly the floodwaters rise) and its duration (how long the area remains inundated with flood waters). Floods can happen slowly over time during a long duration event, or they can happen very rapidly (flash flooding). The speed of onset and duration of an inland flooding event is influenced by the size of the channel and contributing watershed area, terrain of the contributing watershed area, intensity and duration of the rainfall or snowmelt, recent rainfall history, and other factors.

Flash flooding can be caused by heavy rain, ice jams, or levee or dam failure. These floods exhibit a rapid rise of water in stream channels that quickly overtops their banks. In some cases, flooding may occur well away from where the heavy rain initially fell. There are many reasons that flash floods occur, but one of the most common causes in New Hampshire results from the copious amounts of rainfall from thunderstorms. This can also occur when slow-moving or multiple thunderstorms (training thunderstorms) move over the same area. These sudden downpours can rapidly change the water levels in a stream and turn small waterways into violent, raging rivers. Urban areas are also at risk for flash flooding due to the number of impervious surfaces.

The Federal Insurance and Mitigation Administration (FIMA) has oversight over the National Flood Insurance Program (NFIP)[12]. As part of the NFIP, Digital Flood Insurance Rate Maps (DFIRMs) have been developed to show Special Flood Hazard Areas (SFHAs), on rivers that have been so mapped, which are areas that are at risk for inundation, based on the delineation of the 1% annual chance and 0.2% annual chance (500-year) floodplain extents. In New Hampshire, DFIRMs are available for all counties apart from Belknap County. For communities that participate in the NFIP, the SFHA is where local floodplain management regulations apply. Additionally, federally backed lending institutions require flood insurance for properties located in SFHAs.

A 1% annual chance flood event does not mean that a flood will occur once in a 100-year period. In the 1960s, the 1-percent annual exceedance probability (AEP) flood was selected as the basis for the NFIP. The 1% AEP was thought be a fair balance between public safety and overly stringent regulations. As a 1% AEP flood has a 1 in 100 probability of being equaled or exceeded in any 1 year – it earned the nickname “100-year” flood as extrapolated the AEP has an average recurrence interval of 100 years, but again does not mean that a flood of the AEP magnitude will only occur once every 100 years. Larger events, such as the “500-year” flood corresponds with a 0.2% AEP. (1 in 500 chance).[13]



Flood Mapping NH
(Source:NH OSI)

Flood Zones are areas that FEMA has defined according to varying levels of flood risk and are displayed on a DFIRM. Flood risk categories (e.g., very low, low, medium, high, and very high) for census blocks that have flood risk are depicted in the Flood Risk Maps for Rockingham[14] and Stafford County.[15] Flood risk is based on the 1% annual chance total asset loss by census block. While FEMA-mapped FIRMs only consider historical flood extent, the 1.7 feet sea-level rise scenario map is mostly contained within the current 1% annual chance floodplain, with minor incursions into the 2% annual chance floodplain and other low-lying areas. Flooding expands beyond the 1% annual chance floodplain under higher sea-level rise scenarios. This means that if sea-level rise reaches higher projections, today's one-percent-annual- chance floods could occur twice every day and the new one percent-annual-chance floods will likely reach further upland.

On the DFIRMs, the SFHAs are delineated into different zones. These zones are described in the tables below.

Moderate to Low-Risk Areas

Zone	Description
B and X (Shaded)	Area of moderate flood hazard, usually the area between the limits of the 1% annual chance and 0.2% annual chance floods, and areas protected by a FEMA-accredited levee as shown on the FIRM. B Zones are used to designate base floodplains of lesser hazards, such as areas protected by levees from 1% annual chance flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile.
C and X (Unshaded)	Area of minimal flood hazard, usually depicted on FIRMs as above the 0.2% annual chance flood level. Zone C may have ponding and local drainage problems that do not warrant a detailed study or designation as a base floodplain. Zone X is the area determined to be outside the 0.2% annual chance flood.

High Risk Areas: Information here also applies to coastal flood areas.	
Zone	**Description**
A	An area inundated by 1% annual chance flooding, for which no Base Flood Elevations (BFEs) have been determined. Mandatory flood insurance purchase requirements and floodplain management standards apply.
AE	An area inundated by 1% annual chance flooding, for which BFEs have been determined. Mandatory flood insurance purchase requirements and floodplain management standards apply.
AH	Areas subject to inundation by 1% annual chance shallow flooding (usually areas of ponding) where average depths are between one and three feet. Base Flood Elevations (BFEs) derived from detailed hydraulic analyses are shown in this zone. Mandatory flood insurance purchase requirements and floodplain management standards apply.
A1-30	Areas subject to inundation by the 1% annual chance flooding event determined by detailed methods. Base Flood Elevations (BFEs) are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply.
AO	Areas subject to inundation by 1% annual chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet. Average flood depths derived from detailed hydraulic analyses are shown in this zone. Mandatory flood insurance purchase requirements and floodplain management standards apply. Some Zone AO have been designated in areas with high flood velocities such as alluvial fans and washes. Communities are encouraged to adopt more restrictive requirements for these areas.
AR	Areas that result from the decertification of a previously accredited flood protection system that is determined to be in the process of being restored to provide base flood protection. Mandatory flood insurance purchase requirements and floodplain management standards apply.
A99	Areas with a 1% annual chance of flooding that will be protected by a federal flood control system where construction has reached specified legal requirements. No depths or BFEs are show within these zones.
Coastal A Zone	An area inundated by 1% annual chance flooding, for which BFEs have been determined and where the flood elevation includes the effects of waves between 1.5 and 3 feet in height. Mandatory flood insurance purchase requirements and floodplain management standards apply.
V	Areas along coasts subject to inundation by the 1% annual chance flooding event with additional hazards associated with storm-induced waves. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply.
VE, V1-30	Areas subject to inundation by the 1% annual chance flooding event with additional hazards due to storm-induced velocity wave action. Base Flood Elevations (BFEs) derived from detailed hydraulic analyses are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply.

Impacts

Flooding impacts can result in damages to life, property, and the environment. During a flood, flood waters can present a severe threat to people, pets, and wild animals through the risk of drowning, becoming trapped, or by emergency services not being able to rescue people in distress. After a flood, if properties are not properly cleaned, mold and other bacteria can linger in areas that were flooded causing health problems for the people, pets, and wild animals that re-inhabit the area. Personal properties (houses, outbuildings, etc.), businesses, industrial complexes, housing units, roads, water infrastructure (drinking water, storm water and wastewater), bridges, and culverts, railroads, power and utility lines, and contents of properties are several examples of assets that can be damaged during a flooding event. Even after the main flood has passed, effects can persist and continue to worsen over time from rotting and degradation of structures.

The environment can also be affected during floods. For example, hazardous materials, chemicals, and pesticides can be released into flood waters, contaminating those waters. Storm drainage systems in urban areas can be overwhelmed, reducing the ability of wastewater treatment facilities to process waste as efficiently as normal, which could lead to downstream water quality impacts. Flooding kills animals, and can introduce flora, fauna, insects, and other organisms to ecosystems in which they are not typically found, distorting the natural balance of the existing ecology. Additionally, contaminants introduced into floodwaters can be introduced to the ecosystem, causing long-term impacts on organisms.

Flooding also has a significant economic impact immediately after the event (with the damage done), directly following the event (loss of commerce due to business closure or inaccessibility), and long after the event (rebuilding and mitigating).

Inland flooding is, by far, the most prevalent hazard for the State’s population of dams and overtopping (due to insufficient discharge capacity) remains the leading cause of dam failures. Inland flooding and the runoff produced by significant rainfall events, can produce inflows that overwhelm a dam’s capacity to pass flow through prescribed outlet works and cause overtopping failures.

Safety and Security	Food, Water, Shelter	Health and Medical	Energy (Power & Fuel)	Communications	Transportation	Hazardous Materials
Government facilities may be unusable due to flood waters. Water rescue operations may be necessary.	Shelter and feeding operations will require assistance from ARC, coordinated by the state. Normal supply lines to coastal areas will can be impacted, requiring alternate supply lines. The State Commodity Distribution Plan can be utilized if needed. Long term housing solutions may be required. Local agriculture may not be able to sustain operations.	Long-term care facilities may require evacuation for those in areas susceptible to coastal flooding. Local medical facilities will also be impacted due to flood waters. Inability to travel may impact staffing. Census levels will rise due to injuries.	Power restoration to areas with significant flooding will take longer to restore. Fuel points may be flooded, and fuel delivery may be impacted due to road conditions.	Power outages can contribute to commercial communications, public safety communications may also see degradation due to outages, requiring assistance from neighboring providers. Flooding can cause damage to underground communication lines	Transportation routes in flood prone areas will be impacted; Major highways are more susceptible to flash floods due to rain. Railways could be impacted by inland flooding. NH has 443 miles of working railway. The tracks in flood prone areas would restrict commodity transit.	Potential for ground water contamination (wells & aquifers), wastewater treatment plants damaged in flood prone areas.

In-land flooding is caused by a variety of factors, in any season. Flooding can be caused by heavy rain over multiple days, ice jams, tropical cyclones and infrastructure failures. While weather forecasts can indicate regions to expect flooding, but we are not able to drill down to specific towns or streets, unless the area is known to flood during weather events.

Previous Occurrences: History of Inland Flooding Events in New Hampshire				
Event Date	**Event Description**	**Impacts**	**Location**	**Information**
12/22/2022	Winter Storm Inland Flooding		Belknap, Carroll, Coos, Grafton Counties	DR-4693: Severe Winter Weather and Inland Flooding
2/18/2022	Ice Jam	Ice chunks lodged against new bridge pylons, which included tree trunks. No damage reported.	Lebanon	Ice jam at the I-89 bridge crossing of Connecticut River when ice flows occurred on river after a jam broke upstream on the White River in Vermont
07/29-07/30/2021	Heavy rainfall and flooding.	Sustained heavy rainfall resulted in significant flooding and multiple road washouts and closures.	Belknap, Merrimack, Sullivan, Cheshire Counties	DR-4624: Heavy rainfall and flooding.
	Additional Information: • Bridges were washed out in Goshen and Walpole. • Home rescues were made in Goshen and Marlow, where water inundated the basement.			
7/18/2021	Heavy rainfall and flooding	Extensive damage from this storm exceeded many town budgets.	Cheshire County	DR-4622: Heavy rainfall and flooding.
	Additional Information: • Southwestern NH recorded over 3" of rainfall in 24 hours (Max Richmond 4.98" • Roads in Richmond, Troy, Winchester, Fitzwilliam, Swanzey, and Keene washed out and impassable for a time • 80 residential basements in Keene were inundated and required assistance to pump out water • Severe flooding prompted first responders to assist residents in Jaffrey.			

7/11/2019	Very heavy rainfall	Multiple culvert blowouts and road washouts.	Grafton County	DR-4457: Heavy rainfall and flooding.
	Additional Information: • Orange recorded approximately 7 inches of rain in a 10-hour period. • Stream banks, retaining walls, revetments, and infrastructure (including a local racetrack) were washed away. • A campground was flooded and prompted emergency swift water rescues.			
8/8/2018	Unknown	Flash flood resulted in water surge up to the roofs of cars on Hall Street and two residents being displaced from their homes.	Concord	Heavy rainfall that stayed relatively local to Concord measured over 3" in 24 hours
10/29 – 10/31/2017	Remnants of Tropical Storm Philippe	Produced unprecedented winds and flooding	Grafton, Coos, Cheshire, Carroll, Hillsborough	DR-4355: Severe Storm and Flooding
	Additional Information: • A powerful storm generated damaging winds and heavy flooding throughout the state. • Flash floods, particularly in Grafton County, caused many road washouts and closures. • A house in Warren was swept away into the Baker River • Power outages to over 270,000 customers			
8/17/2017	Unknown	Multiple road washouts and closures. Parts of Route 101 were shut down and rescue crews were called in to help a stranded motorist in Dublin.	Hancock, Dublin	Tornado warning in effect for parts of Cheshire and Hillsborough counties.
07/01-02/2017	Severe Storms and Flooding	• Detours due to flooding • Flood and wind damage	Grafton county	DR-4329: Severe Storms and Flooding,

	Additional Information: • Route 117 in Sugar Hill Closed • Jellystone Campground in New Hampton had to evacuate nearly 200 people and four vehicles were flooded • Culvert blown out in Orford • 4 people and a dog rescued in Campton • 7 tornado warnings issued in New Hampshire and Western Maine on July 1st – usually NWS Gray issues no more than 6 in an entire year.			
2/27/2017	Unknown	50 vehicles at Plymouth State University were flooded when an ice jam pushed water into the parking lot and then the water froze around the cars due to the low temperatures	Plymouth	
10/21/2016	Severe Storm	Significant flooding	Southern New Hampshire	The following rain amounts were reported by the National Weather Service: • Manchester 3.49" • Newton 3.46" • Stratham 3.39" • Exeter 3.29" • Londonderry 3.14" • Nashua 2.79"
	Additional Information: • 16-year-old Jacob Goulet was killed when he was swept into a 20-feet-deep drain through an unsecured sewer interceptor cover, which had been dislodged by the heavy rainstorm. His body was recovered from the Merrimack River in Tyngsboro, MA, 10 miles away, two days later. • In Nashua and Manchester • Street closures • Numerous emergency calls to rescue people from cars • on flooded city streets • In Nashua, sewer main covers were being dislodged • Nashua Fire received more than 50 calls for service in the three-hour period of rain • Flooding at Brentwood PD • Mast Rd. in Goffstown Closed			

8/15/2015	Unknown	Damaging winds, hail, torrential rainfall, lightning. Fallen tree into a home in Bristol.	Lakes Region, Central, and Southwestern New Hampshire	
2015	Unknown	Next to the Merrimack River, the state access road (New Hampshire Fish & Game) was washed out.	Merrimack River in Canterbury	
	Additional Information: Road only leads to conservation land, but was washed out by the river, and town could not respond to fire or ambulance calls in the area. Railroad tracks 20 feet from road and in danger of being eroded.			
Oct-14	Unknown	Berea Road flooded and washed out	Hebron	
07/15-16/2014	Unknown		Winchester	
	• Additional Information: • Road washouts, basements flooded, with residents at 26 homes stranded on Fosgate, Jantti, Old Swanzey, Purcell and Watson Roads . • Runoff damage to Route 119 at the intersection of Gunn Mountain Road. • Twelve (12) roads washed out or heavily damaged, with one 120- foot section of Old Westport Road washed out from culvert failure and attendant induced bank erosion on Ashuelot River, which parallels the road.			
6/26/2014	Unknown		Woodstock	
	Additional Information: • Route 112 closed from high water. • Lost River overflowed and some of the Lost River Valley Campground was evacuated, with no injuries reported. • On Moosilauke Brook, the channel had capacity reduced from sediment deposition over time, reducing flow capacity, with water and river cobbles/gravel traveling and depositing onto the property of one home in North Woodstock, which led to basement flooding.			

<table>
<tr><td rowspan="2">04/15-
17/2014</td><td>Unknown</td><td>Mohawk River erosion caused a portion of the rock foundation under Howard's Restaurant to fail.</td><td>Colebrook, Columbia, Lincoln, Shelburne, Stratford</td><td>Rapid snowmelt and heavy rain combined with the effects of clear cutting (some locations) led to flooding of Old Mill Rd, Route 3, and Stratford Hollow in Stratford.</td></tr>
<tr><td colspan="4">Additional Information:
High water closed state roads leading to and from Colebrook, isolating portions of town. Closure of Route 26 at Roaring Brook Road. Schoolhouse Brook flooded in the Spring of 2015 washing out part of Meriden Hill Road. Black Mountain Road flooded, and in Shelburne Brookfield Power had to pull boards on the Shelburne Hydro Dam to prevent it from going over Route 2 which caused flooding in town.</td></tr>
<tr><td rowspan="2">3/31/2014</td><td>Unknown</td><td></td><td>Monadnock and Seacoast Areas</td><td></td></tr>
<tr><td colspan="4">In Winchester – 12 roads washed out or heavily damaged including 120’ section of Old Westport Road – estimated more than $1m in damages.
Area communities received 2.4-5.6” of rain
96 homes affected
26 homes stranded
Portsmouth experienced localized flooding</td></tr>
<tr><td>06/26-
07/03/2013</td><td>Unknown</td><td>$5,885,717.69 Public Assistance</td><td>Cheshire, Grafton, and Sullivan Counties</td><td>DR-4139: Severe Storms, Flooding, and Landslides</td></tr>
<tr><td></td><td colspan="4">More Information:
A culvert passing a brook under Slayton Hill Road at the top of the hill south of Route 4 was unable to pass flows created by heavy rain from a thunderstorm. Culvert overtopped, forcing flows to flow down Slayton Hill Road. Force of flow excavated the road and its adjacent terrain away, with all the excavated material depositing at the bottom of the hill at the intersection with Dulac Street.
Merriam Brook channel completely filled in with boulders and cobbles, deposited from the heavy-rain induced flash flood event, eliminating the ability of the channel to convey water, and forcing the brook onto the back lawn of a residence on Joslin Road. Merriam Brook began the process of forming a new channel for itself on the back lawn of a residence on Joslin Road in Surry.
White Bridge Brook channel upstream of Route 12 was completely reconfigured, with extensive sediment deposition, forcing water and river sediment onto the lawn of a business, and then paralleling Route 12 before re-entering Mill Brook downstream.</td></tr>
</table>

10/26-11/08/2012	Unknown	$2,113,605.92 Public Assistance Numerous roads across the state flooded and were damaged, bridges, and banks eroded and scoured	Belknap Carroll, Coos, Grafton, Rockingham, and Sullivan Counties	DR-4095: Hurricane Sandy
6/18/2012	Unknown	$3,039,192.36 Public Assistance	Cheshire County	DR-4065: Severe Storm and Flooding
08/26-09/06/2011	100yr	$18,091,902.88 Public Assistance $1,262,644.95 Individual Assistance	Belknap, Carroll, Coos, Grafton, Merrimack, Strafford, and Sullivan Counties	DR-4026: Tropical Storm Irene
05/26-30/2011	50yr	$1,218,835.96 Public Assistance	Coos and Grafton Counties	DR-4006: Severe Storms and Flooding
03/14-31/2010	50 – 100yr	$2,489,369.98 Public Assistance	Hillsborough and Rockingham Counties	DR-1913: Severe storms and flooding
09/06-07/2008	50 – 100yr	$823,848.76 Public Assistance	Merrimack and Hillsborough Counties	DR-1799: Severe storms and flooding
07/24-08/14/2008	50 – 100yr	$3,673,172.45 Public Assistance	Belknap, Carroll, Coos, Grafton Counties	DR-1787: Severe storms and flooding
7/24/2008	50 – 100yr	$1,269,313.62 Public Assistance	Belknap, Carroll, Merrimack, Rockingham, and Strafford Counties	DR-1782: Severe storms, tornado, and flooding

04/15-23/2007	100 – 500yr	$23,206,682.33 Public Assistance $3,509,042.32 Individual Assistance	Statewide	DR-1695: Severe storms and flooding associated with a Nor'easter
05/12/2006 "Mother's Day Floods"	100 – 500yr	$14,406,821.44 Public Assistance $8,999,191.49 Individual Assistance	Central and Southern Regions	DR-1643: Heavy rainfall 8-16 inches
10/7-18/2005	Exceeded 100 in some areas	$12,314,320.29 Public Assistance $1,102,655.35 Individual Assistance 40 Homes demolished, 4 miles of Route 123 destroyed, and 4 fatalities in Alstead14	Southwestern Region	DR-1610: Heavy rains associated with Tropical Storm Tammy and Subtropical Depression 22 resulted in 6-15 inches of rain.
07/21-8/18/2003	50yr	$973,986.52 Public Assistance	Southwestern Region	DR-1489: Severe storms and flooding occurred in Cheshire and Sullivan counties.
09/18/19/1999	Unknown	$594,693.82 Public Assistance	Central and Southern Regions	DR-1305: Heavy rains associated with Tropical Storm/Hurricane Floyd. • Counties declared: Belknap, Cheshire, and Grafton
06/12-07/02/1998	Unknown	Met Disaster Thresholds	Central and Southern Regions	DR-1231: Series of rainfall events. Counties declared: Belknap, Grafton, Carroll, Merrimack, Rockingham, and Sullivan
	Additional Information: One fatality in Sullivan County • Several weeks earlier, significant flooding, due to rain and rapid snowpack melting, occurred in Coos County, undeclared in this event. Heavy damage to secondary roads occurred.			

11/20-23/1996	Unknown	Met Disaster Thresholds	Northern and Western Regions	DR-1144: Counties declared: Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan
Oct-95	Unknown	Met Disaster Thresholds	Northern and Western Regions	DR-1077: Counties declared: Carroll, Cheshire, Coos, Grafton, Merrimack, and Sullivan.
8/19/1991	Unknown	Extensive damage in Rockingham and Strafford counties, but the effects were felt statewide.	Statewide	DR-917: Hurricane Bob struck New Hampshire
08/07-11/1990	Unknown	Met Disaster Thresholds	Statewide	DR-876: Series of storm events from August 7-11, 1990 with moderate to heavy rains during this period produced widespread flooding.
04/06-7/1987	25 to >50	Met Disaster Thresholds	Lamprey River and Beaver Brook	DR-789: Large rainfall event following the March 31- April 2 storm.
03/31-04/02/1987	25 to 50	Precursor to a significant, following event	Androscoggin, Saco, Ossipee, Piscataquog, Pemigewasset, Merrimack & Contoocook River	Caused by snowmelt and intense rain.
July 1986 – 08/10/1986	Unknown	Met Disaster Thresholds	Statewide	DR-771: Severe summer storms with heavy rains, tornadoes; flash flood and severe winds

February, 1978 ("The Blizzard of '78)	Unknown	Significant	Statewide	Nor'easter brought strong winds and precipitation to the entire state. Hardest hit area was the coastline, with wave action and floodwaters destroying homes. Roads all along the coast were breached by waves flooding over to meet the rising tidal waters in the marshes.
3/14/1977	25 to 50	Unknown	South- central and Coastal New Hampshire	Peak of record for Soucook River
Apr-76	Unknown	Unknown	Connecticut River	Rain and snowmelt brought the river to 1972 levels, flooding roads and croplands.
6/30/1973	25 to >50	Unknown	Ammonoosuc River	Northwestern White Mountains
Jun-72	Unknown	Unknown	Pemigewasset River	Five days of heavy rain caused some of the worst flooding since 1927 along streams in the upper part of the State, damage was extensive along the Pemigewasset River and smaller streams in northern areas.
Feb-72	Unknown	Damage was heavy along the coast.	Coastal Area	Coastal area was declared a National Disaster Area as a result of the devastating effects of a severe coastal storm.
Apr-69	Unknown	Unknown	Merrimack River Basin	Record depth of snow cover in the Merrimack River Basin and elsewhere resulted in excessive snowmelt and runoff when combined with sporadic rainfall.

Apr-60	Unknown	Unknown	Merrimack and Piscataquog	Flooding resulted from rapid melting of deep snow cover and the moderate to heavy rainfall. Third highest flood of record on the rivers.
Dec-59	Unknown	Damage was heavy along the coast.	Piscataquog - Portsmouth	A Nor'easter brought tides exceeding maximum tidal flood levels in Portsmouth.
10/25/1959	25 to >50	Unknown	White Mountain area; Saco. upper Pemigewasset, and Ammonoosuc Rivers.	Largest of record on Ammonoosuc at Bethlehem Junction; third largest of record on Pemigewasset and Saco Rivers.
3/27/1953	25 to >50	Little Damage	Lower Androscoggin, Saco, Ossipee, upper Ammonoosuc, Israel, and Ammonosuc Rivers.	Peak of record for Saco and Ossipee Rivers.
Nov-50	Unknown	Unknown	Contoocook River and Nubanusit Brook	Localized storm resulted in flooding of this area.
Jun-44	Unknown	Unknown	Merrimack River Basin	One of the five highest known floods at Manchester on the Merrimack.
06/15-16/1943	25 to >50	Unknown	Upper Connecticut, Diamond and Androscoggin	Intense rainfall exceeding 4 inches; highest stream stages of record in parts of the affected area.

Jun-42	Unknown	Unknown	Merrimack River Basin	Fourth flood recorded in the lower Merrimack River basin at Manchester, New Hampshire.
9/21/1938	25 to >50	Unknown	Contoocook, western tributaries to Merrimack, and south-western New Hampshire tributaries to Connecticut River	Hurricane. Stream stages similar to those of March 1936 and exceeded 1936 stages in upper Contoocook River.
03/11-21/1936	25 to >50	Unknown	Statewide	Double flood: first, due to rains and snowmelt; second, due to large rainfall.
11/3-4/1927	25 to >50	Unknown	Pemigewasset, Baker, Merrimack, Ammonoosuc, and Connecticut Rivers.	Upper Pemigewasset River and Baker River; exceeded 1936 flood. Downstream at Plymouth, less severe than 1936 flood.
10/3-5/1869	Unknown	Unknown	Androscoggin, Pemigewasset, Baker, Contoocook, Merrimack, Piscataquog, Souhegan, Ammonoosuc, Mascoma, and Connecticut Rivers.	Tropical storm lasting 36 hours. Rainfall, 6-12 inches.

04/19-22/1862	Unknown	Unknown	Contoocook, Merrimack, Piscataquog, and Connecticut Rivers.	Highest stream stages to date on Connecticut River. Due solely to snowmelt.
04/21-24/1852	Unknown	Unknown	Pemigewasset, Winnipesaukee, Contoocook, Merrimack, and Connecticut Rivers.	Merrimack River at Concord, highest stream stage for 70 years; Merrimack River at Nashua, 2 feet lower than in 1785.
03/24-30/1785	Unknown	Unknown	Pemigewasset, Merrimack, Contoocook, Blackwater, and Ashuelot Rivers.	Merrimack, highest stream stage since 1785: Contoocook, one of five highest stages.
10/24/1785	Unknown	Unknown	Cocheco, Baker, Pemigewasset, Contoocook, and Merrimack Rivers.	Greatest Discharge at Merrimack and at Lowell, Mass., through 1902
December 1740	Unknown	Unknown	Merrimack River	First Recorded Flood in New Hampshire

Impact of Climate Change on Hazard	
Climate Change Projection	Impact on Hazard
Increase in Sea Level	• As warmer temperatures cause more water to evaporate (in this case, over the ocean) and therefore more water to fall as precipitation
Increase in Precipitation	• Flooding is influenced by how much water enters the waterway upstream • As warmer temperatures cause more water to evaporate and therefore more water to fall as precipitation • Increased precipitation can result in changes in streamflow • Flooding can disrupt ecosystems by displacing aquatic life, impairing water quality, and increasing soil erosion. Flooding can impact water supplies by introducing sediment, contaminants, or harmful microbes. [16]
Increase in Temperature	• As warmer temperatures cause more water to evaporate and therefore more water to fall as precipitation • Changes in the size and frequency of heavy precipitation events affect the size and frequency of river flooding • The amount of snowpack that accumulates in the winter • Timing of snow melt
Increase in Severe Weather	

Individuals/ Communities Disproportionately Impacted by Hazard	
Individual/Community	**Description of Increased Impact**
Socially Vulnerable Populations (due to income, education, health care access, and housing)	• May live in locations that are prone to climate-related health hazards • May have greater rates of existing medical conditions • May live in poorly maintained or aging infrastructure that may not be able to handle climate-related event • May struggle to access resources and care • May experience limited financial resources or cultural, language, or other barriers that restrict their access to health care, social services, and safe, nutritious food
Children	• Their developing bodies can make them more vulnerable to

	hazards like heat and poor air quality. • Children breathe at a faster rate, increasing their exposure to dangerous air pollutants. • Spending more time outdoors than adults, increases their exposure to heat and cold, rain and snow, outdoor allergens, and insect bites. • Higher water intake can increase exposure to certain contaminants in recreational waters and the risk of developing gastrointestinal or other illnesses. • Children can experience mental health impacts from extreme events that are expected to increase with a changing climate. • Dependance on others for care increases vulnerability
Individuals Aged ≥ 65 Years	• Older people are less able to compensate for the effects of certain environmental hazards, such as air pollution. • Older adults are more likely to have health conditions that make them more sensitive to climate hazards like heat and air pollution, which can worsen their existing illnesses. • Limited mobility, increasing their risks before, during, and after an extreme weather event. • Aging can impact the immune systems, increasing risk for extreme reactions related to heat, insect- and tick-related diseases, and water-related illnesses. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with a Disability/Disabilities	• Decisionmakers may not fully consider people with disabilities in their planning. One reason for this is that climate change effects on people with disabilities have not been studied as much as other vulnerable populations. • Emergency warnings and other important messages may not be available in formats that are accessible to individuals with certain disabilities (such vision or blindness, hearing loss, or mobility issues). • Necessary medical care may be disrupted before, during, and after an event, including due to evacuations, transportation system or health infrastructure damages, or power outages. • Increased likelihood that they may have additional social and economic risk factors, such as poverty and unemployment, that put them at greater risk. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with Pre-existing or Chronic Health Conditions (including behavioral health)	• Chronic medical conditions may increase risk of illness and death, particularly exposure to heat, extreme weather events, water-related illnesses, and poor air quality. • Necessary medical care may be disrupted before, during, and after an event, including due to evacuations, transportation system or health infrastructure damages, or power outages.

	• Some conditions/medications compromise the immune system, increasing risk for extreme reactions related to heat, insect- and tick-related diseases, and water-related illnesses. • Individuals with chronic behavioral health conditions may be more vulnerable to trauma from extreme weather events, as well as disruptions to support networks and mental health care. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.

ENDNOTES – HAZARD: INLAND FLOODING

[1] http://w1.weather.gov/glossary/index.php?letter=f

[2] https://www.fema.gov/national-flood-insurance-program/definitions

[3] https://pubs.usgs.gov/sir/2017/5143/sir20175143.pdf

[4] Lemcke-Stampone, Mary D.; Wake, Cameron P.; and Burakowski, Elizabeth, "New Hampshire Climate Assessment 2021" (2022). The Sustainability Institute. 71. https://scholars.unh.edu/sustainability/71?utm_source= scholars.unh.edu% 2Fsustainability%2F71&utm_ medium=PDF&utm_campaign=PDFCoverPages

[5] https://scholars.unh.edu/cgi/viewcontent.cgi?article=1071&context=sustainability

[6] https://scholars.unh.edu/cgi/viewcontent.cgi?article=1209&context=ersc

[7] https://scholars.unh.edu/cgi/viewcontent.cgi?article=1209&context=ersc

[8] https://scholars.unh.edu/cgi/viewcontent.cgi?article=1209&context=ersc

[9] http://www.floodsafety.noaa.gov/states/nh-flood.shtml

[10] https://www.weather.gov/aprfc/terminology

[11] http://www.nws.noaa.gov/directives/sym/pd01009050curr.pdf

[12] https://www.fema.gov/what-mitigation/federal-insurance-mitigation-administration

[13] https://water.usgs.gov/edu/100yearflood-basic.html

[14] https://map1.msc.fema.gov/data/FRP/FRM_33015C_20160915.pdf?LOC=bef67015322984ef0c3c10e7f83b4d5d

[15] https://map1.msc.fema.gov/data/FRP/FRM_33017C_20160419.pdf?LOC=9bfeaaee447e3cb4b0e8fac13878d24e

[16] Climate Change Indicators – Inland Flooding, EPA. https://www.epa.gov/climate-indicators/climate-change-indicators-river- flooding#:~:text=As%20warmer%20temperatures%20cause%20more,see% 20the%20Heavy%20Precipitati on%20indicator

6.8 Hazard: Landslide

Hazard Overview: Landslide	
HIRA Risk	Low
Future Probability	High
Counties at Risk	All

Definition

A landslide is the downward or outward movement of earth materials on a slope that is reacting to a combination of the force of gravity and a predisposed weakness in the material that allows the sliding process to initiate. The broad classification of landslides includes mudflows, mudslides, debris flows, rockslides, debris avalanches, debris slides and earth flows. Landslides may be formed when a layer of soil atop a slope becomes saturated by significant precipitation and slides along a more cohesive layer of soil or rock. Although gravity becomes the primary reason for a landslide once a slope has become weak through a process such as the one just described, other causes can include: [1]

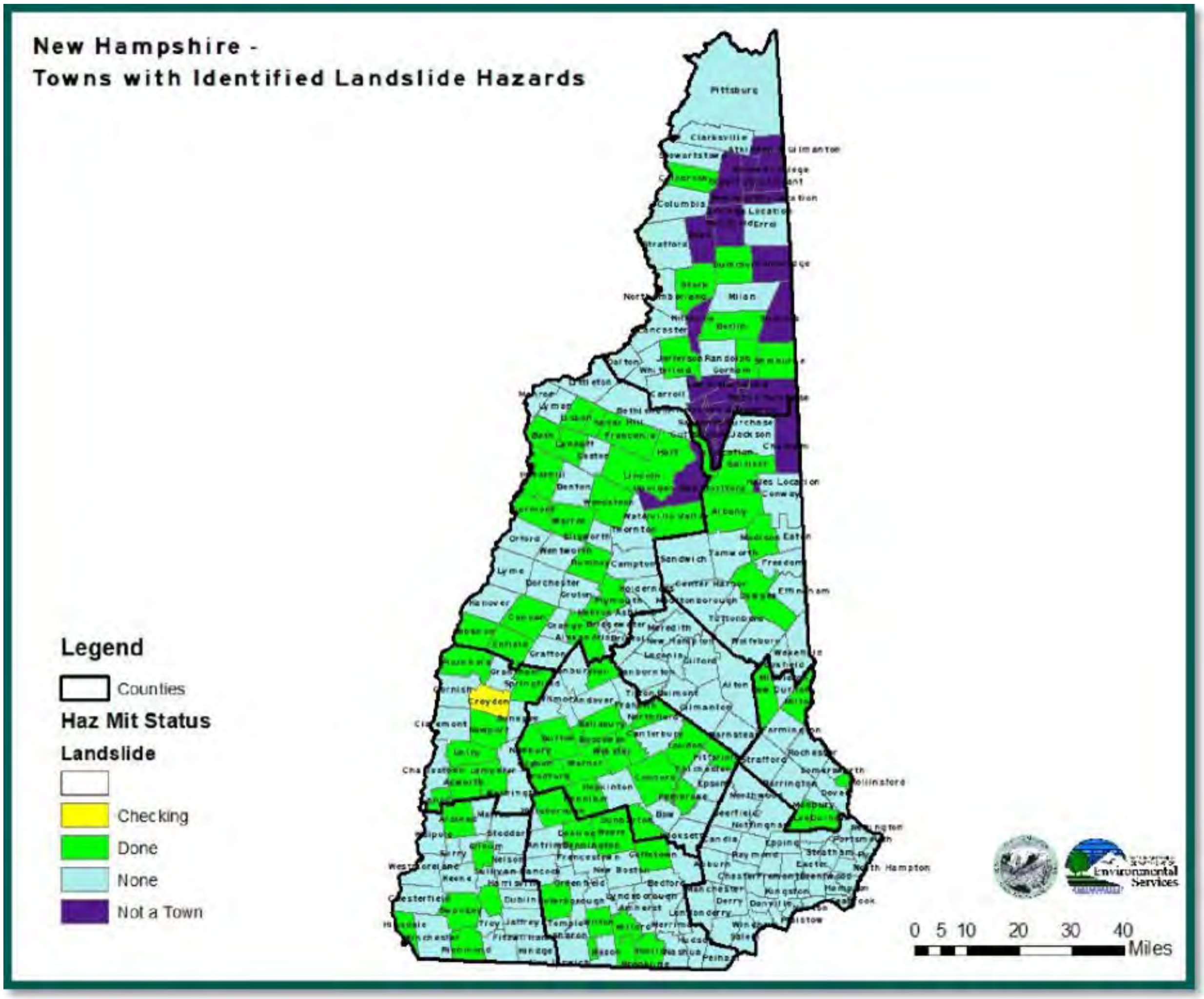
- Erosion by rivers or the ocean that creates over-steepened slopes through erosion of the slope's base. In the case of rivers, this can occur as a result of flash flooding
- Rock and soil slopes are weakened through saturation by snowmelt or heavy rains
- Earthquake creates stress that makes weak slopes fail—earthquakes of 4.0 magnitude and greater have been known to trigger landslides
- Wildfires (loss of vegetation)
- Excess weight from accumulation of rain or snow, stockpiling of rock or ore, the formation of waste piles, or building of man-made structures may stress weak slopes to the point of failure

Location

Steep slopes are located throughout the State of New Hampshire, except in areas near the immediate coast. These slopes are at risk for landslides. Local hazard mitigation plans contain information about specific landslide risks within towns throughout the State. However, a completed compilation of such information is not yet contained in a statewide geodatabase. The New Hampshire Geological Survey, a part of NHDES, began undertaking the task of assembling individual town landslide information into a statewide geodatabase during late-2017 with the goal of allowing greater precision in identifying locations of landslide risk. This information was derived from formally approved local hazard mitigation plans. Once complete, this developed inventory could be used by geologists, engineers, or geotechnicians to identify locations to conduct further, more detailed geotechnical analysis in the future. Below is a graphic of the work that is currently in progress. Areas in green indicate that the location has one or more landslide occurrences (or potential occurrences) noted in their local hazard mitigation plan. The grey-blue color indicates that the local hazard mitigation was reviewed, and no instances of landslides were identified. Yellow indicates locations where the local hazard mitigation plan is still under review for this information.

In the Town of Gorham (Coos County) riverbank erosion continues on all three of the major rivers, the Androscoggin, the Peabody, and the Moose. During Tropical Storm Irene, the Peabody River experienced significant erosion, despite prior efforts to mitigate the problems. Heavy rains from the summits of the White Mountains funnel into the Peabody River at a tremendous velocity, causing riverbank erosion along the way. The most critical area is the bend in the river near the White Birch Lane, where the road washed out, and six homes received flood waters. It is estimated that the structure loss value would be 0 to 1% ($0 to $3,501,836).

In the Town of Acworth (Sullivan County) there are two sites where a potential landslide might occur. The damage value of one site where a landslide did occur was incorporated into the costs of the flood of 2005. It did not affect a structure but caused a clogging of Bowers Brook with trees and other debris. FEMA Disaster Declaration 1610 which brought severe storms and flooding to five NH counties caused approximately $3,000,000 in damages. For Unity (Sullivan County) there is only one area in town where a landslide has previously occurred. The site is located at the intersection of Cold Pond Road and Copeland Brook Road. The landslide occurred in 2005, like Acworth, bringing debris into the road causing repairs to not be finished until 2006.



A geospatial map of towns identified to have landslide hazards identified in their formally approved local Hazard mitigation plans (as of March, 2018). This project is an initiative of New Hampshire Geological Survey. *(Source: NHDES)*

Background and Evolving Hazard Information

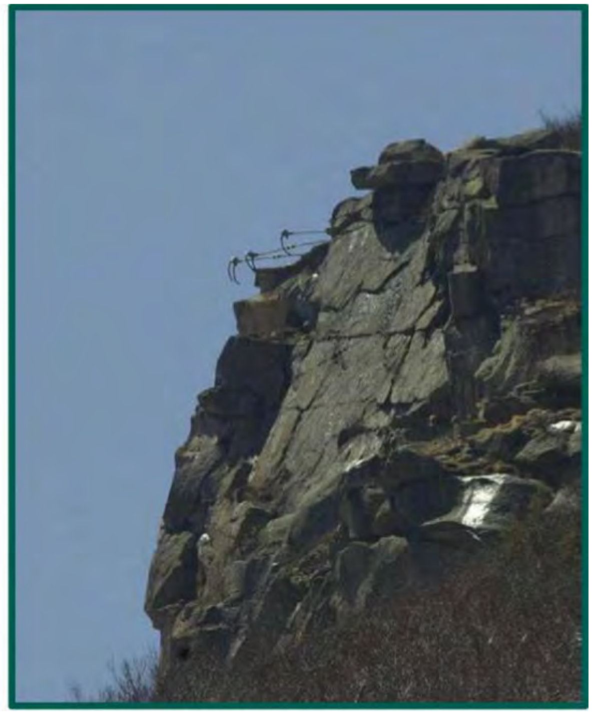
In New Hampshire, the greatest potential for landslide hazards exists in the White Mountains, where steep slopes and marginal soils occur in abundance. Many notable landslides have occurred in the region in the past, including the Willey Slide in 1826. Nine people were killed in that event. New Hampshire's other fatal landslide at Cherry Mountain in 1885 killed one person. Seven major landslides have occurred in Crawford Notch in the 20th century, with six of these causing damage to roads. In April 2006, a mudslide approximately 20 feet high and 40 feet wide significantly damaged one home and threatened others in Hooksett Village. The damaged home was sited at the foot of a steep bank of glacial lake clays, which line the Merrimack River valley. In March 2010, a landslide occurred adjacent to the Souhegan River in Greenville, which closed High Street. Also in 2010, a landslide occurred adjacent to four homes atop a bluff beside the Cocheco River on Wilson Street in Rochester. Another landslide, induced through overtopping of an undersized culvert at the top of a hill, occurred on Slayton Hill Road in Lebanon in July 2013.

December 28, 2022, a rockslide occurred in Merrimack, directly behind a major shopping center, causing a natural gas leak and the evacuation of the shopping center. Extensive debris removal was required to ensure the structure's safety as well as to re-open a road behind the building.

Source, CBS Boston[2]

The potential for property damage resulting from landslide activity remains significant. Areas of New Hampshire most threatened by landslides include much of the rugged steep terrain of the White Mountains and western New Hampshire, as well as the Connecticut River Valley.[3] The threat of landslides in the Connecticut River Valley owes to its unique glacial geologic history. As the last continental glacier receded from the region at the end of the Pleistocene epoch approximately 15,000 years ago, a large glacial lake flooded the Connecticut River Valley as a newly formed glacial ridge impounded drainage to the south in Connecticut. The thick deposits of silt and clay that underlay much of the Connecticut River Valley were deposited beneath the quiet waters of this lake.

Warning signs are often present prior to a large event. Ground cracks, bulging, and slumping may develop in the years prior to a slide event. Foundations in nearby homes may shift significantly and require major repairs. Wetlands surfaces may rise and fall.



Before and After Pictures taken by The Associated Press in 2001 and 2003 respectively – in the right picture the turnbuckles used to secure the Old Man are visible as the 40' structure has disappeared.

The Old Man of the Mountain, the enduring symbol of the State of New Hampshire, no longer exists due to a rockslide. Sometime between the evening of Friday May 2, 2003 and the morning of Saturday May 3, 2003, the stone profile that drew hundreds of thousands of visitors to Franconia Notch State Park each year collapsed. On Saturday, May 3rd at approximately 7:30am, two Franconia Notch State Park Employees noticed that that the Old Man of the Mountain had collapsed. The cause is believed to be continuous action of freezing and thawing of the moisture that had invaded the rock's fissures causing them to expand and contract.

This is perhaps the most well-known landslide in New Hampshire's History due to the deep-rooted uniqueness of this naturally occurring rock formation. Images of the Old Man of the Mountain can still be found on items such as license plates and currency[4].

Extent

While there is 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[5]:

- **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.

Impacts

The primary impacts of a landslide are the damage and destruction to property and infrastructure located in the area that the landslide occurred. The land material moved during a landslide can cause damage to roads, buildings, and infrastructure at the base of the slope on which the landslide occurred. Buildings or infrastructures that are atop the slide, or on the side of the slope where the slide occurs, can be severely damaged or destroyed through its consumption by the slide. The hazard of death and injury to individuals atop, on, or at the base of a slide exists if such individuals are present in those locations when the landslide occurs.

A change in topography or geology can also affect the flora and fauna as well as crops and farmland. Landslides that occur adjacent to a waterbody, such as a river or lake, can introduce excess sediment, increasing the turbidity of the receiving waterbody and impacting water quality if the quantity of sediment is of sufficient quantity. A very large landslide into a river could cause an obstruction that acts like a dam, creating an impoundment of water which leads to sediment and woody material deposition within it. This could also further create an additional risk of a “dam failure” at some future time when the natural dam breaks down, resulting a rapid release of the stored water from upstream.

Landslides at or adjacent to dams can not only cause structural collapse, but those occurring within dam impoundments can displace large amounts of stored water, leading to increased water levels and flood waves that can cause overtopping failures. All such hazards may impact dams, though the frequency of occurrence for landslides in New Hampshire is very minimal – and those occurring in the vicinity of high hazard dams even less so.

Safety and Security	Food, Water, Shelter	Health and Medical	Energy (Power & Fuel)	Communications	Transportation	Hazardous Materials
Road closures, rescue operations may exhaust local capabilities, requiring mutual aid. Government facilities in landslide prone areas can sustain damages.	Sheltering needs will vary, based on location and proximity to residential areas. Drinking water sources can become unusable due to additional sediment in the water.	Landslides in a residential area will cause surge conditions at medical facilities.	Electrical, gas and oil infrastructure are all at risk of outages due to landslides. Restoration may be lengthy.	Communications infrastructure is at risk, and can cause outages impacting public and government communications.	Minimal risk to airports due to location. Roads and bridges are at risk of significant damage requiring road/bridge closures.	Hazardous material storage sites can be at risk, requiring specialized clean up.

Previous Occurrences: History of Landslide Events in New Hampshire

Event Date	Event Description	Impacts	Location	Additional Information
11/18/1755	Cape Ann Earthquake	Mass movement of landforms	Newcastle	
06/12-07/02/1998	Flood Event	Fatality due to Landslide	Unknown	A death occurred when an individual was caught in a landslide of mass soil due to flooding.
05/03/2003	Old Man of the Mountain	Rock formation representing the face of an “old man” which became a symbol synonymous with the State fell in a landslide event.	Franconia Notch	

05/14/2006	Mother's Day Flood	Thousands of dollars of property damage displacing a family for more than a week. Debris covered railroad tracks.	Bow	Debris and mud from an adjacent property caused thousands of dollars of damage to a property on Route 3A.
May and June 2006	Mother's Day Flood and June rain event	Two homes on Granite Street were evacuated due to landslides on a hill twice within one month	Hooksett	Moisture caused landslides
10/17/2007	Snow Event	Route 101 blocked due to landslide	Wilton	5[6]
03/31/2010	Landslide	High Street closed	Greenville	A landslide occurred on a steep slope adjacent to the Souhegan River pool in Greenville, High Street was located directly atop the slide, forcing its closure, with ground cracks directly adjacent to the road. A detour was required for school buses and traffic headed to New Ipswich. Engineered stabilization was required.
04/07/2010	Landslide	Backyards of four homes on Wilson Street slumped into the floodplain of the Cocheco River	Rochester	Landslide likely occurred through sliding of material against an interface layer between permeable sand and less permeable clay. During field surveys in 2016, water was observed seeping out of the exposed bank at this interface.
10/31/2012	Hurricane Sandy	Landslide and Fatal Landslide	Goffstown and Lincoln	An owner of a construction company was inspecting storm damage to a house foundation under construction when the foundation hole was filled with water and collapsed trapping the individual in a landslide of mud, water, and rocks down a two to three story high hill. In Goffstown there was a landslide on Riverview Park Road adjoining the Piscataquog River.
07/02/2013	Landslide	Landslide completely washed out Slayton Hill Road, with earth material entering the Meadowmere Housing development at the base of the slope	Lebanon	A thunderstorm with heavy rain caused a stream at the top of the hill on Slayton Hill Road south of the Mascoma River crossing to overtop an undersized culvert which conveyed the stream under the road. The water then flowed down Slayton Hill Road, completely washing out the road and its adjacent land, and depositing the material at the base of the slope just south of the Mascoma River, with earth material also traveling down the slope and entering the Meadowmere Housing development, causing damage.
12/22/2022	Rockslide	Rockslide obstructed an access road and caused a natural gas leak at an Outlet Mall.	Merrimack	Unknown at time of plan.

Impact of Climate Change on Hazard	
Climate Change Projection	**Impact on Hazard**
Increase in Sea Level	Increase in sea level will lead to an increase in tidal and coastal flooding during storm surges, which may lead to an increase in landslides and coastal erosion.
Increase in Precipitation	Increases in precipitation, with a focus on increased heavy or prolonged rain events, may soften ground causing earth to give way and create landslides.
Increase in Temperature	N/A
Increase in Severe Weather	Increases in severe storms with heavy rain may soften ground and trigger additional landslides

Individuals/ Communities Disproportionately Impacted by Hazard	
Individual/Community	**Description of Increased Impact**
Socially Vulnerable Populations (due to income, education, health care access, and housing)	• May live in locations that are prone to climate-related health hazards • May have greater rates of existing medical conditions • May live in poorly maintained or aging infrastructure that may not be able to handle climate-related event • May struggle to access resources and care • May experience limited financial resources or cultural, language, or other barriers that restrict their access to health care, social services, and safe, nutritious food
Children	• Their developing bodies can make them more vulnerable to hazards like heat and poor air quality. • Spending more time outdoors than adults, increases their exposure to heat and cold, rain and snow, outdoor allergens, and insect bites. • Children can experience mental health impacts from extreme events that are expected to increase with a changing climate. • Dependance on others for care increases vulnerability
Individuals Aged ≥ 65 Years	• Limited mobility, increasing their risks before, during, and after an extreme weather event. • Some medications can change the body’s ability to respond to heat, increasing risk for heat illnesses and death as the climate warms. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with a Disability/Disabilities	• Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with Pre-existing or Chronic Health Conditions (including behavioral health)	• Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.

ENDNOTES – HAZARD: LANDSLIDE

[1] https://landslides.usgs.gov/learn/ls101.php
[2] https://www.cbsnews.com/boston/news/rockslide-merrimack-premium-outlets-new-hampshire-gas-leak/
[3] https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/geo-12.pdf
[4] http://www.pressherald.com/2013/04/08/ceremony-to-mark-10th-anniversary-of-nhs-old-man/
[5] https://oas.org/dsd/publications/Unit/oea66e/ch10.htm
[6] https://www.youtube.com/watch?v=ujqUAelLpMA

6.9 Hazard: Lightning

Hazard Overview: Lightning	
HIRA Risk	**Low**
Future Probability	**High**
Counties at Risk	**All**

Definition

Lightning is a visible electric discharge produced by a thunderstorm. The discharge may occur within or between clouds, between a cloud and the air, between a cloud and the ground, or between the ground and a cloud.[1]

There are roughly 5-10 times as many cloud flashes as there are cloud to ground flashes. There are two types of ground flashes: negative polarity (those that occur because of electrification in the environment) and positive polarity (charge build up on tall structures, airplanes, rockets, and towers on mountains). Negative polarity lightning goes from cloud to ground while positive polarity lightning goes from ground to cloud.

Thunder always accompanies lightning but may or not be heard depending on the position of the observer. As lightning passes through the air, it heats the air to a temperature of 18,000-60,000 degrees Fahrenheit. This causes the air to rapidly expand and contract creating a sound wave known as thunder. Thunder can be heard up to 10 miles away from the strike. At longer distances thunder sounds like a low rumble as the higher frequency sounds are absorbed by the environment.

Location

The entire State of New Hampshire is at risk for lightning; areas at enhanced risk include tall buildings, areas of higher elevation, sporting arenas, open bodies of water, large fields, and campgrounds with sparse tree coverage. Negative polarity lightning (cloud to ground) usually occurs in the immediate area of the storm, whereas positive polarity lightning (ground to cloud) can strike long distances around the cell when no immediate signs of a thunderstorm are present. Some lightning strikes occur far outside of the parent thunderstorm—these are called "bolts from the blue", as they appear to come from a clear sky. These strikes are much more dangerous because they can strike up to 25 miles outside of the storm, catching people off guard in what appears to be clear conditions.

The below locations are examples which were highlighted through a combination of efforts which included a survey completed by the RPCs and NH HSEM field staff, historical data, and the National Risk Index.

In Tilton (Belknap County), tall buildings, tall or exposed trees, and exposed boats are particularly susceptible to lightning strikes. Homes near the water and boats on the lake are vulnerable to summer storms and accompanying lightning strikes. In the Lakes Region, fewer than two lightning strikes occur per square kilometer annually. While this value is not particularly high compared with other parts of the country, the frequency of storms with lightning is a significant local concern, especially during the summer months. The town's computer and communication system could also be impacted by lightning. Assuming 1% town-wide damage to buildings annually, then each year lightning could result in $5.1 million in damages.

The Town of Sanbornton (Belknap County) is susceptible to power outages, which have the potential to cause great disruption to residents and the functioning of the town. Though there is backup power for most of the municipal facilities, there are several community lifelines that could be impacted. Locally, there were a half dozen strikes that occurred in 2012 some which resulted in minor structural damage. Assuming a 1% town-wide damage to buildings, each year lightning could result in $2,778,445 in damages.

The Town of Goffstown (Hillsborough County) reports that fire alarm systems are quite vulnerable to damaged. Some strikes have also started structure fires; lightning has also caused several small brush fires. No specific dates of lightning were noted. The potential damage to town buildings is between $0 and $11,899,382.

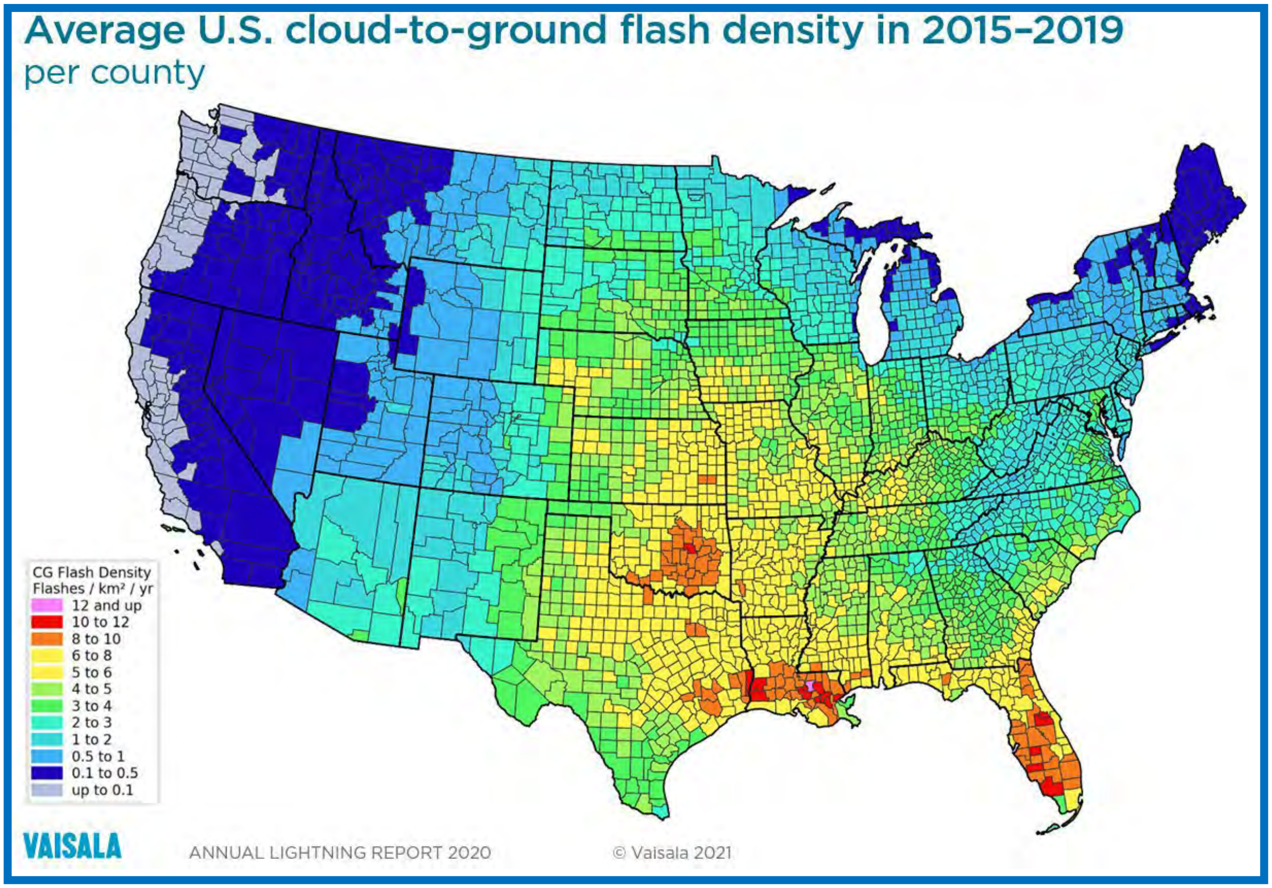
Background and Evolving Hazard Information

Lightning is one of the oldest observed weather phenomena on earth. Lightning is most commonly associated with thunderstorms; however, lightning can also occur during extremely intense forest fires, strong convective snowstorms, surface nuclear detonations, and during volcanic eruptions. Lightning is a natural and necessary phenomenon which helps maintain the earth's natural electrical balance.

Lightning can have different color characteristics depending on environmental factors such as haze, dust, moisture, and raindrops. Lightning is usually described as white or blue; however, it can also be described as pink or green when lightning occurs during a snowstorm.[2]

Lightning strikes the ground in the United States approximately 25 million times per year. The chance that a lightning strike could injure or kill a person during any given year is one in 240,000.

The State of New Hampshire does not experience lightning as often as most other areas of the Country. New Hampshire and Massachusetts are the only New England states that have lightning flash density rates lower than national average.[3]



Despite the relatively low incident of lightning in New Hampshire, the State has a relatively high injury rate due to lightning. The high risk in comparison to frequency of lightning events is due to the activities that citizens and guests of the State partake in. Lightning is most common in New Hampshire during the summer months when there is more instability and moisture in the atmosphere. On warm summer days, people are outside enjoying the variety of recreational activities that attract people to northern New England such as hiking, biking, swimming, boating, golfing, etc. – all activities which leave individuals vulnerable during a lightning storm. Lightning during winter months is extremely rare but has been observed. Referred to as thundersnow, lightning during snowstorms is possible under uncommon meteorological conditions where a strong instability and abundant moisture are present in the atmosphere.

Sports venues, such as the New Hampshire Motor Speedway (NHMS) in Loudon, are also at enhanced risk for lightning hazards due to the topography of the land and venue infrastructure. In 2012, a man was killed at a NASCAR race in Pennsylvania when he was struck by lightning 5 minutes after the race was stopped.[4] NHMS has a site safety plan and there is an Event Action Plan (EAP) updated for every race which includes lightning precautions and triggering event information for evacuating the grandstands.

Extent

While weather forecasters can and do forecast the likelihood of intense lightening activity, it is impossible to forecast individual strikes as lightning is so widespread, frequent, and random during a storm, as there is still not a full scientific understanding of the cloud electrification processes. Lightning strikes can be measured against each other through electrical calculations of the voltage and amperage that was discharged (the higher the voltage and amperage, the stronger and more severe the individual strike is). For the purposes of emergency management, all lightning strikes are viewed as equally dangerous regardless of their amps or volts, as any lightning strike is strong enough to cause infrastructure damage, injury, or death.

Research shows that the severity of a storm is roughly correlated to lightning frequency; however, there is significant regional variability, and no direct correlation has yet been found.[5] That said, there appears to be a general increase in the frequency of lightning as a thunderstorm becomes more intense (e.g., larger in area and vertical growth, more organized, hail producing, etc.). There is currently not a widely adopted scale for measuring lightning storms in the northeastern United States. When developing fire weather forecasts, the National Weather Service measures the severity of lightning storms using the Lightning Activity Level (LAL) which is based on cloud and storm development as well as number of lightning strikes in a 5-minute period.

Lightning Activity Level (LAL)	Description
1	No Thunderstorms
2	Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, 1 to 5 cloud to ground strikes in a 5-minute period.
3	Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6 to 10 cloud to ground strikes in a 5-minute period.
4	Scattered thunderstorms. Moderate rain is commonly produced Lightning is frequent, 11 to 15 cloud to ground strikes in a 5-minute period.
5	Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 cloud to ground strikes in a 5-minute period.
6	Dry lightning (same as LAL 3 but without rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with a Red Flag Warning.

Impacts

Lightning poses a large threat to humans when precautions are not taken. Most lightning injuries in humans are due to exposure during thunderstorms and failure to find adequate shelter. A lightning strike can kill humans and animals by disrupting the natural electricity of the central nervous system causing cardiac arrest. A person who is struck by lightning can survive, but often suffers from superficial burns, loss of consciousness, amnesia, confusion, tingling, and other medical issues. Basic lightning safety precautions to avoid lightning strike include seeking safe shelter in an enclosed building, staying away from water and electrical sources within the building, and refraining from standing near windows to observe the storm. If caught outside with no sturdy structure to take shelter in, a closed vehicle is the next best option, followed by crouching in a ditch on the balls of your feet to minimize contact with the ground. The most obvious solution is to check the weather forecast before outdoor activities and rescheduling if thunderstorms are forecast.

Lightning storms occur on an annual basis and frequently results in minor power outages/surges, strikes near and to buildings which can result in isolated fires, electrical damage, damage to powerlines and transformers, and has started several wildfires in the state. New Hampshire is ranked among the states with the lowest number of lightning related fatalities, with the most recent occurring almost 24 years ago in 1994 when a surfer was struck while walking out of the water at Jenness Beach in Rye, New Hampshire.

Safety and Security	Food, Water, Shelter	Health and Medical	Energy (Power & Fuel)	Communications	Transportation	Hazardous Materials
Outdoor personnel must take precautions to avoid lightning strikes. Lightning can cause damage to government buildings. Fires can result from strikes.	Sheltering needs will be minimal. Damage to utility infrastructure may cause power outages.	Medical needs will-vary - fires will cause the most medical needs.	Damage to utility infrastructure can create long term outages.	Lightning strikes to communications infrastructure can cause outages.	Airports may be forced to delay flights until the storm clears for safety. Road, rail and bridge impacts are minimal.	Minimal impacts.

Previous Occurrences: History of Lightning Events in New Hampshire				
Event Date	**Event Description**	**Impacts**	**Location**	**Additional Information**
June, 2012	Strike to Sarah Long Bridge	Lift mode function damaged, gauges knocked out. Bridge was closed for hours while repairs took place	Portsmouth	
July, 2012	Residential Strike	3 people treated with nonlife-threatening injuries from a nearby lightning strike	Laconia	
August, 2012	Sports Venue Strike	$200,000 in damages to equipment and building	Goffstown	Goffstown Babe Ruth League
June, 2013	Strike at Boy Scout Camp	Nearly thirty people were transported to the hospital after complaining of tingling and burning sensations following a nearby lightning strike	Belmont	Camp Bell Scout Reservation
September, 2013	Campground Strike	Man and 14-year old boy were struck by lightning at a campground receiving minor injuries	Tamworth	Possibly a positive charged lightning strike as it was ahead of the storm and very bright.
August, 2016	Residential strike	$5,000.00 in damages, extinguished by 14-year old boy and grandfather.[6]	Manchester	
May, 2020	Residential strike	Two structures struck by lightning caught on fire causing $20,000 in property damages each.[7]	Moultonborough /Meredith	Part of a squall line that also caused extensive wind damage.

Impact of Climate Change on Hazard	
Climate Change Projection	**Impact on Hazard**
Increase in Sea Level	N/A
Increase in Precipitation	N/A
Increase in Temperature	Climate change is beginning to shift seasons resulting in longer, warmer summer months, and an earlier spring onset, which may create more intense heat waves. Lightening is mostly observed during the warmer summer months, and the longer the season becomes, the opportunity for damaging lightening increases.
Increase in Severe Weather	Longer and warmer summer months may increase the frequency of severe thunderstorms. These storms can include lightening, which can cause damage to property in the forms of starting fires and striking buildings which may create electrical damage. Lightening poses a threat to personal safety as well if humans do not heed warnings and take shelter in a timely manner as severe storms approach.

Individuals/ Communities Disproportionately Impacted by Hazard	
Individual/Community	**Description of Increased Impact**
Socially Vulnerable Populations (due to income, education, health care access, and housing)	• May live in locations that are prone to climate-related health hazards • May live in poorly maintained or aging infrastructure that may not be able to handle climate-related event • May experience limited financial resources or cultural, language, or other barriers that restrict their access to health care, social services, and safe, nutritious food
Children	• Spending more time outdoors than adults, increases their exposure to heat and cold, rain and snow, outdoor allergens, and insect bites. • Higher water intake can increase exposure to certain contaminants in recreational waters and the risk of developing gastrointestinal or other illnesses. • Dependance on others for care increases vulnerability
Individuals Aged ≥ 65 Years	• Older adults are more likely to have health conditions that make them more sensitive to climate hazards like heat and air pollution, which can worsen their existing illnesses. • Limited mobility, increasing their risks before, during, and after an extreme weather event. • Some medications can change the body's ability to respond to heat, increasing risk for heat illnesses and death as the climate warms. • Aging can impact the immune systems, increasing risk for extreme reactions related to heat, insect- and tick-related

	diseases, and water-related illnesses. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with a Disability/Disabilities	• Emergency warnings and other important messages may not be available in formats that are accessible to individuals with certain disabilities (such vision or blindness, hearing loss, or mobility issues). • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with Pre-existing or Chronic Health Conditions (including behavioral health)	• Chronic medical conditions may increase risk of illness and death, particularly exposure to heat, extreme weather events, water-related illnesses, and poor air quality. • Some conditions/medications compromise the immune system, increasing risk for extreme reactions related to heat, insect- and tick-related diseases, and water-related illnesses. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.

ENDNOTES – HAZARD LIGHTNING

[1] http://www.lightningsafety.noaa.gov/science/science_thunder.htm
[2] https://www.nssl.noaa.gov/education/svrwx101/lightning/faq/
[3] https://www.vaisala.com/sites/default/files/documents/WEA-MET-Annual-Lightning-Report-2020-B212260EN- A.pdf
[4] https://www.si.com/racing/2016/07/14/ap-car-nascar-lightning-strike-lawsuit-1st-ld-writethru
[5] https://journals.ametsoc.org/doi/abs/10.1175/1520-0493%282003%29131%3C1211%3ATRBSSR%3E2.0.CO%3B2
[6] http://www.wmur.com/article/manchester-man-survives-lightning-strike-in-new-hampshire/4632689
[7] http://www.unionleader.com/weather/For-Manchester-family-lightning-strike-was-a-close-call-08142016

6.10 HAZARD: SOLAR STORMS AND SPACE WEATHER

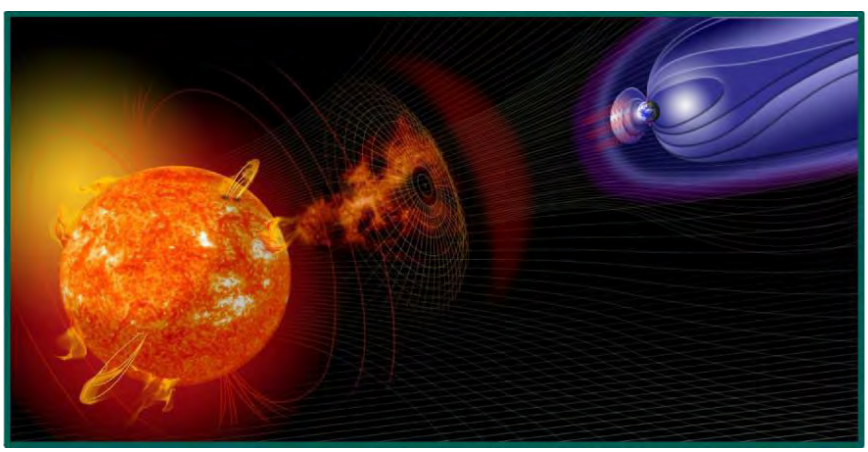
Hazard Overview: Solar Storms & Space Weather	
HIRA Risk	Low
Future Probability	Low
Counties at Risk	All

Definition

The term space weather is relatively new and describes the dynamic conditions in the Earth's outer space environment, similar to how the terms "climate" and "weather" refer to the conditions in the Earth's lower atmosphere. Space weather includes all conditions and events on the sun, in the solar wind, in near-Earth space, and in our upper atmosphere that can affect space-borne and ground-based technological systems.

Solar activity (solar storms) refers to solar flares, coronal mass ejections, high-speed solar wind, and energetic solar particles. Any of these events may occur for a few minutes to several hours, can affect Earth for days to weeks. All solar activity is driven by the solar magnetic field. A solar flare is an intense burst of radiation resulting from the release of sunspot magnetic energy, which can occur for minutes to hours. Solar prominence is a large, bright feature that extends outward from the sun's surfaces. A coronal mass ejection (CME) occurs when the outer solar atmosphere's magnetic field is closed, resulting in a confined atmosphere that suddenly explodes, releasing bubbles of gas and magnetic fields. The surface of the sun is hot electrified gas boiling up from the interior of the sun out into space-this is referred to as high-speed solar wind. Solar wind travels at 800,000 to 5 million miles per hour and carries mass the size of Utah's Great Salt Lake into space every second; however, solar wind is 1000 million times weaker than the winds that we experience on Earth.

A geomagnetic storm occurs when a CME or high-speed solar winds strike and begin to penetrate the Earth's magnetosphere and can decrease the Earth's magnetic field strength for 6-12 hours.



NASA Artist Depiction of sun events affecting Earth *(Source: NASA)*

Location

The entire State of New Hampshire is at risk for solar storms and space weather.

In Pittsfield (Merrimack County) the significant danger from solar storms is the potential communications and electronic disruption. Satellites, vehicles, radios, airplanes, cell phones, computers, power lines, and the internet have the capability to temporary cessation because of solar winds. Satellites, navigation, and electricity are sensitive to geomagnetic storms which can cause electrical current surges in power lines, interference in radio broadcasts, television and phone signals, and problems with defense communications.

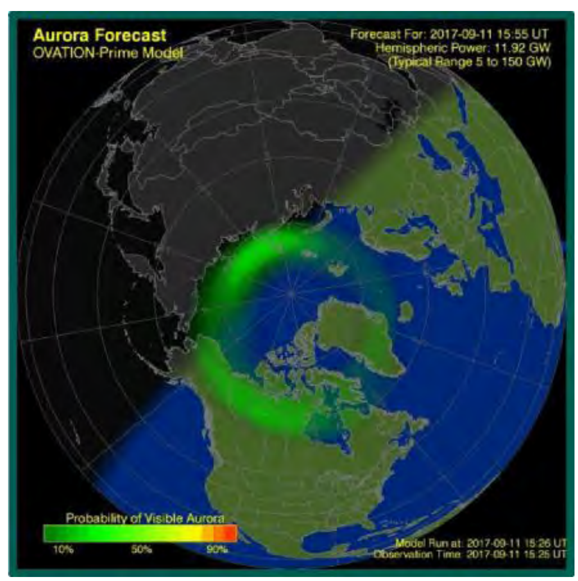
In Plymouth (Grafton County) though while no significant previous occurrences from solar storms, there have been recent disruptions to HF radio communications causing minor impacts and disruptions.

Background and Evolving Hazard Information

Space weather affects Earth due to the sun sending energy across the Earth in the form of light and electrically charged particles and magnetic fields. As the sun is a giant mass of energy constantly fusing atoms, it creates million-degree temperatures and strong magnetic fields. Although space weather has occurred since the beginning of time, little was understood about the causes and impacts of these instances on the planet. It has only been in the last 200 or so years where multiple science fields have come together to study space weather.

Not all space weather is damaging or effects humans or technology. Perhaps one of the most well-known effects of space weather on the Earth's atmosphere is the Aurora Borealis (aka Northern Lights – northern hemisphere) and the Aurora Australis (southern hemisphere). Aurora displays are a result of solar wind where some of the charged particles become trapped in the Earth's atmosphere.

As society becomes increasingly reliant on electronics and technology, the hazards presented by space weather are not to be underestimated. The magnetic disturbances that solar storms can bring can disrupt communications, damage, or destroy electronic components, corrode gas and oil pipelines, and cause significant damage to spacecraft and satellites outside the Earth's protective atmosphere.



Aurora forecast image
(Source: The Aurora Service)

Radio operators have long been aware of the effects of space weather and how it impacts radio communications, especially those in the High Frequency (HF) band (3-30MHz). Depending on atmospheric conditions from space weather, radio signals can be partially or completely blocked, or may “skip” across the atmosphere and travel long distances beyond what is normally possible.

Most airliners communicate with line-of-sight radio frequencies that operate in the Very High Frequency (VHF) band (30-300MHz) and are transferred from control center to control center throughout a flight as part of the air traffic system. HF radios are used for transoceanic flights and flights to the poles as VHF radios cannot maintain a line of sight with the curvature of the Earth. HF waves can bend with the curvature of the Earth by bouncing off the atmosphere. For this reason, HF waves are most susceptible to electromagnetic interference which causes communications problems.

Extent

Geomagnetic Storms

Scale	Description	Effect	Physical Measure	Average Frequency (1 cycle = 11 years)
G 5	Extreme	**Power systems:** Widespread voltage control problems and protective system problems can occur; some grid systems may experience complete collapse or blackouts. Transformers may experience damage. **Spacecraft operations:** May experience extensive surface charging, problems with orientation, uplink/downlink, and tracking satellites. **Other systems:** Pipeline currents can reach hundreds of amps, HF (high frequency) radio propagation may be impossible in many areas for one to two days, satellite navigation may be degraded for days, low-frequency radio navigation can be out for hours, and aurora has been seen as low as Florida and southern Texas (typically 40^0 geomagnetic lat.).	Kp = 9	4 per cycle (4 days per cycle)
G 4	Severe	**Power systems:** Possible widespread voltage control problems and some protective systems will mistakenly trip out key assets from the grid. **Spacecraft operations:** May experience surface charging and tracking problems, corrections may be needed for orientation problems. **Other systems:** Induced pipeline currents affect preventive measures, HF radio propagation sporadic, satellite navigation degraded for hours, low-frequency radio navigation disrupted, and aurora has been seen as low as Alabama and northern California (typically 45^0 geomagnetic lat.).	Kp = 8, includin g a 9-	100 per cycle (60 days per cycle)
G 3	Strong	**Power systems:** Voltage corrections may be required, false alarms triggered on some protection devices. **Spacecraft operations:** Surface charging may occur on satellite components, drag may increase on low-Earth-orbit satellites, and corrections may be needed for orientation problems. **Other systems:** Intermittent satellite navigation and low-frequency radio navigation problems may occur, HF radio may be intermittent, and aurora has been seen as low as Illinois and Oregon (typically 50^0 geomagnetic lat.).	Kp = 7	200 per cycle (130 days per cycle)
G 2	Moderate	**Power systems:** High-latitude power systems may experience voltage alarms, long-duration storms may cause transformer damage. **Spacecraft operations:** Corrective actions to orientation may be required by ground control; possible changes in drag affect orbit predictions. **Other systems:** HF radio propagation can fade at higher latitudes, and aurora has been seen as low as New York and Idaho (typically 55^0 geomagnetic lat.).	Kp = 6	600 per cycle (360 days per cycle)
G 1	Minor	**Power systems:** Weak power grid fluctuations can occur. **Spacecraft operations:** Minor impact on satellite operations possible. **Other systems:** Migratory animals are affected at this and higher levels; aurora is commonly visible at high latitudes (northern Michigan and Maine).	Kp = 5	1700 per cycle (900 days per cycle)

Solar Radiation Storms

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

Radio Blackout

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

Impacts

Solar storms and space weather are always impacting the Earth and its atmosphere and are therefore an ongoing threat to New Hampshire. While the Earth is somewhat protected from solar storms and space weather by its upper atmosphere the potential for a loss of communications, power, and GPS exists daily. New Hampshire is still at risk for a significant event that could affect utilities infrastructure, leading to a long-term utility outage. Individual components of the overall utility infrastructure are inherently connected and becoming more sophisticated over time. This enhances the possible impacts of a severe space weather event and could increase the vulnerability of all sectors of critical infrastructure.

Safety and Security	Food, Water, Shelter	Health and Medical	Energy (Power & Fuel)	Communications	Transportation	Hazardous Materials
Facilities may be impacted through power outages. Radios may not be available for first responder use. GPS information may be unavailable. Increased or lack of response can be possible.	Shelter power may be impacted. Food deliveries may be delayed due to transportation issues. Potable water resources may be impacted due to power outages.	Medical facility infrastructure may be impacted due to power outages. Communications may be impacted.	Power systems may suffer from infrastructure failure or disruption. Long term outages for all customers.	Communications frequencies may be inoperable, impacting private and government entities.	Utility outages will impact transportation. Draw bridges, airports, traffic lights may all be rendered inoperable.	Hazmat software used to model impacts may experience outages.

Previous Occurrences

While no significant, damaging solar storms or space weather have impacted the State of New Hampshire in recent years, HF radio communications routinely experience minor impacts or disruptions. Occasionally, when there is a particular large CME, the aurora borealis is visible in areas of New Hampshire. Nearby events include Quebec, Canada, which experienced a 9-hour blackout in March of 1989 when solar winds caused a fluctuation in the Earth's magnetic field and caused Hydro-Quebec's transmission to go down. Quebec is 150 miles north of Pittsburg, New Hampshire.

Impact of Climate Change on Hazard	
Climate Change Projection	**Impact on Hazard**
Increase in Sea Level	Unknown
Increase in Precipitation	Unknown
Increase in Temperature	Unknown
Increase in Severe Weather	Unknown

Individuals/ Communities Disproportionately Impacted by Hazard	
Individual/Community	**Description of Increased Impact**
Socially Vulnerable Populations (due to income, education, health care access, and housing)	• May experience limited financial resources or cultural, language, or other barriers that restrict their access to health care, social services, and safe, nutritious food
Children	• Dependance on others for care increases vulnerability
Individuals Aged ≥ 65 Years	• Aging can impact the immune systems, increasing risk for extreme reactions related to heat, insect- and tick-related diseases, and water-related illnesses. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with a Disability/Disabilities	• Decisionmakers may not fully consider people with disabilities in their planning. One reason for this is that climate change effects on people with disabilities have not been studied as much as other vulnerable populations. • Emergency warnings and other important messages may not be available in formats that are accessible to individuals with certain disabilities (such vision or blindness, hearing loss, or mobility issues). • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with Pre-existing or Chronic Health Conditions (including behavioral health)	• Chronic medical conditions may increase risk of illness and death, particularly exposure to heat, extreme weather events, water-related illnesses, and poor air quality. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.

6.11 HAZARD: WILDFIRE

Hazard Overview: Wildfire	
HIRA Risk	Low
Future Probability	Medium
Counties at Risk	All

Definition

A wildfire is any non-structural fire, other than prescribed fire, that occurs in the Wildland. Wildland here is defined as consisting of vegetation or natural fuels.[1] Wildfires can be referred to as brushfires, wildland fires, or grass fires depending on the location and what is burning.

Location

The entire State of New Hampshire is at risk for wildfires with increased risk in heavily wooded areas.

The below locations are examples which were highlighted through a combination of efforts which included a survey completed by the RPCs and NH HSEM field staff, historical data, and the National Risk Index.

The City of Berlin (Coos County) is at medium risk for wildfire and estimated to cost $11,370,524 to $56,852,622 in damages given 1 to 5% potential loss values. In most recent years, there have been two small wildfires one four-acre fire in Tinker Brook and the other was also in Tinker Brook.

In Gorham (Coos County), the risk for wildfire is moderate and estimated to cost $3,501,835 to $17,508,182 in damages given 1 to 5% potential loss values. There are two potential losses with a wildfire, the loss of forest land and the threat to the built-up human environment and structures within the Wildland Urban Interface. In most recent years three small fires have occurred, one behind the mill in Cascade, one off Main Street, and one above Libby's. Two were half acre, while the one off Main Street was a three-acre fire.

In Hampton (Rockingham County), the Beach district contains many older wood-frame structures that are built very close to each other. Other conflagration risk areas include the downtown area of High Street, Lafayette Street, Exeter Road, Timber Swamp Road, Mill Road, and Whites Lane. Lastly Phragmites are concentrated in the areas of North Beach, Kings Highway, and Cusak Road.

Background and Evolving Hazard Information

During an average year, this state experiences approximately 375 wildfires which burn 240 acres. These averages can vary wildly though during times of drought or exceptional dryness, or due to unnatural fuel buildups such as from a wind event or ice storm. While much of the state is covered by forest not considered to be high-hazard, such as northern hardwoods, there are pockets of high-hazard areas that dot the state. Examples of fire-prone fuel types include pitch pine and scrub oak, red pine rocky ridges, dry Appalachian oak, oak-pine, and phragmites.

The Division of Forests and Lands is the state agency with statutory authority over wildfire management on all lands outside of the White Mountain National Forest. For the National Forest and the portion of the Appalachian Trail that runs through New Hampshire, the U.S. Forest Service has primary jurisdiction. However, for the vast number of wildfire incidents in the state it is local fire departments that provide initial attack. When fires become large or complex the state provides support and incident command. For wildfires on or near the National Forest, the state and Forest Service have an agreement in which we provide mutual aid to each other. If fire activity exceeds the capacity of in-state resources, there are agreements and statutes in place to allow mutual aid from outside the state via the Northeast Forest Fire Compact and a Master Stafford Act Agreement with federal partners.

While preventing and suppressing wildland fires remains a high priority within the state, there is a growing recognition that lack of fire is having a negative impact on some of our unique natural communities that are fire-dependent or fire-adapted. Ensuring we have an aggressive program for detecting and suppressing wildfires, while also being able to use fire as a management tool, has created a transition from strictly fire suppression organizations to fire management organizations.

Goal - Keep the frequency and size of wildfires to a minimum reducing costs and risks to people and structures; and protecting New Hampshire's forests and natural communities.

<u>Strategies:</u>
(Note: Strategies 1 – 4 from the 2020 NH Forest Action Plan fall under a different goal)

5. Ensure local fire departments and first responders are prepared to safely and effectively handle initial attack of wildfires.
    - Conduct annual training for local Forest Fire Wardens and firefighters.
    - Maintain agency Personal Protective Equipment (PPE) and town tool resale programs for towns and cooperators.
    - Acquire vehicles and equipment through the Federal Property Acquisition programs to supplement local fire departments.
    - Collaborate with State Fire Academy and Fire Standards and Training Commission to provide an adequate level of wildfire suppression training standards for all firefighters .

6. Maintain and enhance capacity to respond and manage incidents that become large, complex or extended attack
    - Support training and staffing of local Type III incident management team(s).
    - Provide advanced level ICS and command and general staff training for forest rangers, special deputy wardens, and others.
    - Provide an emergency firefighter mobilization program.
    - Coordinate with NH Homeland Security and Emergency Management for in-state support of wildfire incidents.
    - Participate in resource sharing through the Northeast Forest Fire Protection Compact and the Master Agreement with the US Forest Service.
    - Provide adequate equipment and supplies for large incidents by pre-positioning caches that can rapidly be deployed to supplement local resources.
7. Maintain and improve systems to prevent and detect wildfires
    - Provide an early detection system for prompt discovery of fires which is both effective in function and efficient in cost.
    - Evaluate wildfire causes through aggressive investigation and tailor fire prevention efforts to focus on these areas.
8. Ensure a robust planning and intelligence effort for pre-season and pre-event wildfire readiness and preparedness
    - Maintain current weather stations for fire weather forecasting and determine gaps where additional weather data is needed.
    - Work towards county-level Community Wildfire Protection Plans while supporting hazard mitigation planning efforts of individual communities.
    - Working with Homeland Security and Emergency Management, develop plans for mitigation of "event-fuels" that result from damaging weather events and increase hazard by creating an unnatural buildup of fuels.
    - Actively participate in and promote the implementation of the Northeast Regional Cohesive Wildland Fire Management Strategy.

From the **2020 NH Forest Action Plan**, available at
https://www.nh.gov/nhdfl/reports/forest-action-plan.htm

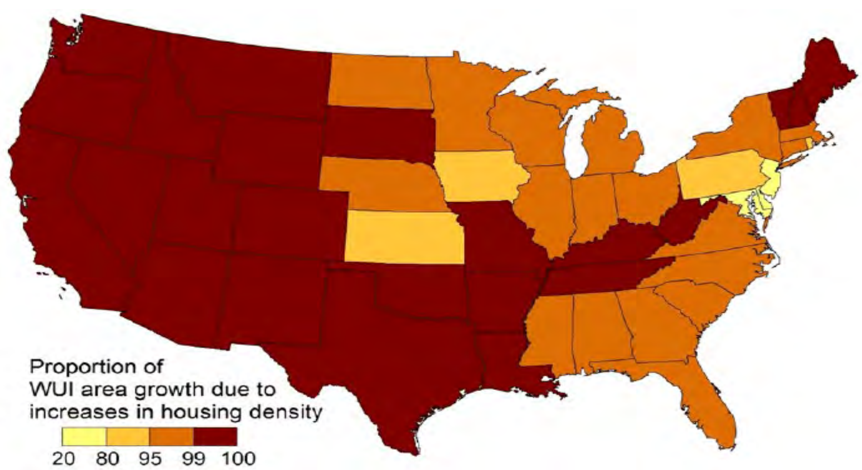
This risk is exacerbated during times of drought and after natural disasters, which lead to an unusual fuel build up (such as numerous downed trees or buildup of slash and underbrush). The proximity of many populated areas to the State's forested lands exposes these areas and their population to the potential impact of wildfire.

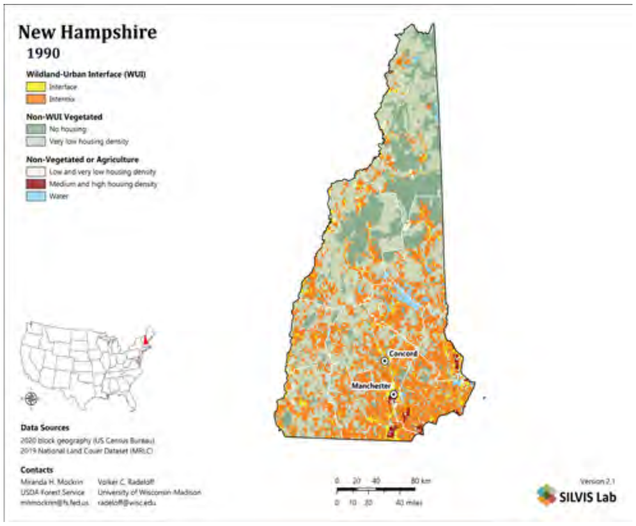
Areas that abut and are near wildlands are referred to as being within the Wildland-Urban Interface (WUI). The WUI is a zone where structures and other human developments meet or intermingle with undeveloped wildlands. The WUI is any point where the fuel feeding a wildfire, changes from natural (wildland) fuel to manmade (urban) fuel.

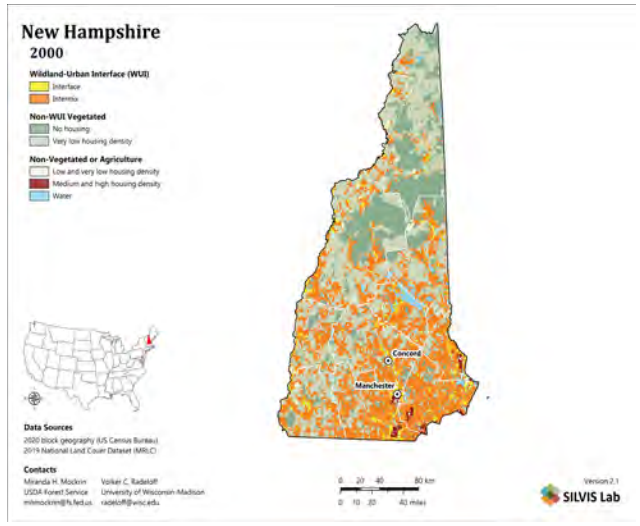
When houses are built close to forests or other types of natural vegetation, they pose two problems related to wildfires: First, there will be more wildfires due to human ignitions. Second, wildfires that occur will pose a greater risk to lives and homes, they will be hard to fight, and letting natural fires burn becomes impossible.[3]

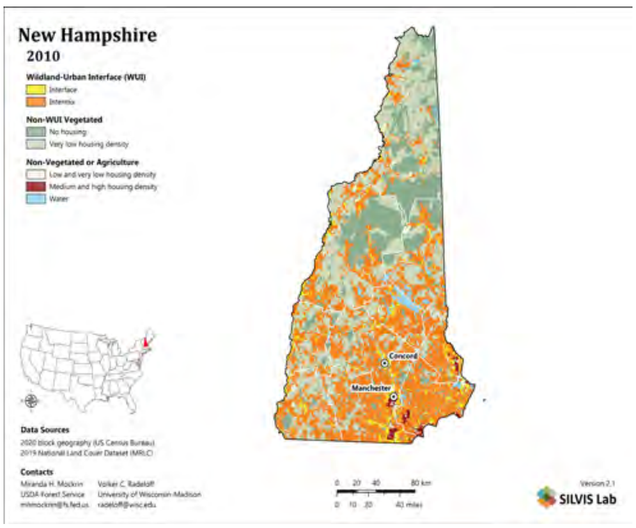
Creating new WUI occurs in two ways: construction of new homes in or near existing wildland vegetation, and an increase in wildland vegetation within and near previously developed areas. The close proximity of houses and wildland vegetation does more than increase fire risk. As houses are built in the WUI, native vegetation is lost and fragmented; landscaping introduces nonnative species and soils are disturbed, causing nonnatives to spread; pets kill large quantities of wildlife; and zoonotic disease, such as Lyme disease, are transmitted. Thus, understanding WUI patterns and WUI growth is important with respect to not only wildfires but many other environmental problems as well[3].

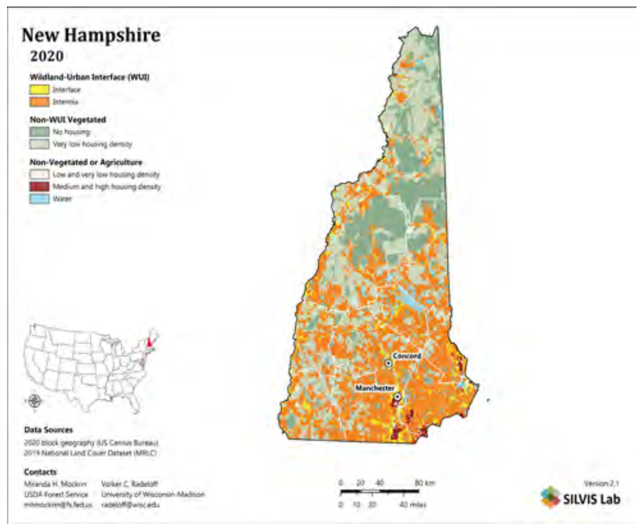
The proportion of new WUI area from 1990 to 2010 due to housing growth alone was >80% in all but four northeastern states, and >95% in the vast majority of states.
(Source: *Radeloff et al. 10.1073/pnas.1718850115, Table S2)*











AREA %	WUI (total)				Non-WUI			
STATE	1990	2000	2010	2020	1990	2000	2010	2,020
New Hampshire	34.5%	37.5%	41.6%	42.1%	65.5%	62.5%	58.4%	57.9%

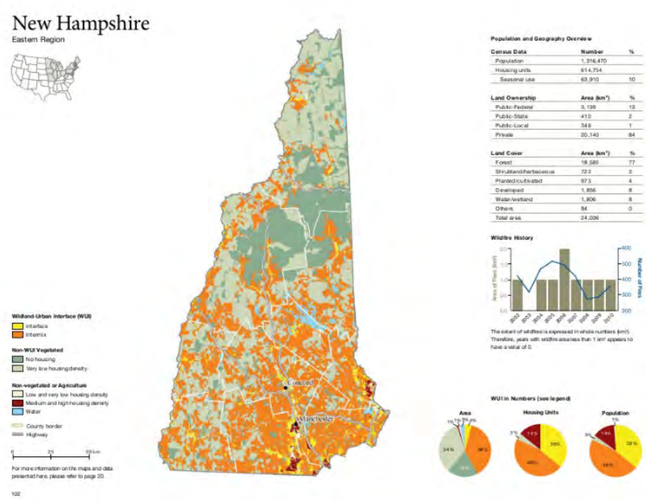
HOUSING %	WUI (total)				Non-WUI			
STATE	1990	2000	2010	2020	1990	2000	2010	2,020
New Hampshire	75.4%	77.0%	78.5%	78.4%	24.6%	23.0%	21.5%	21.6%

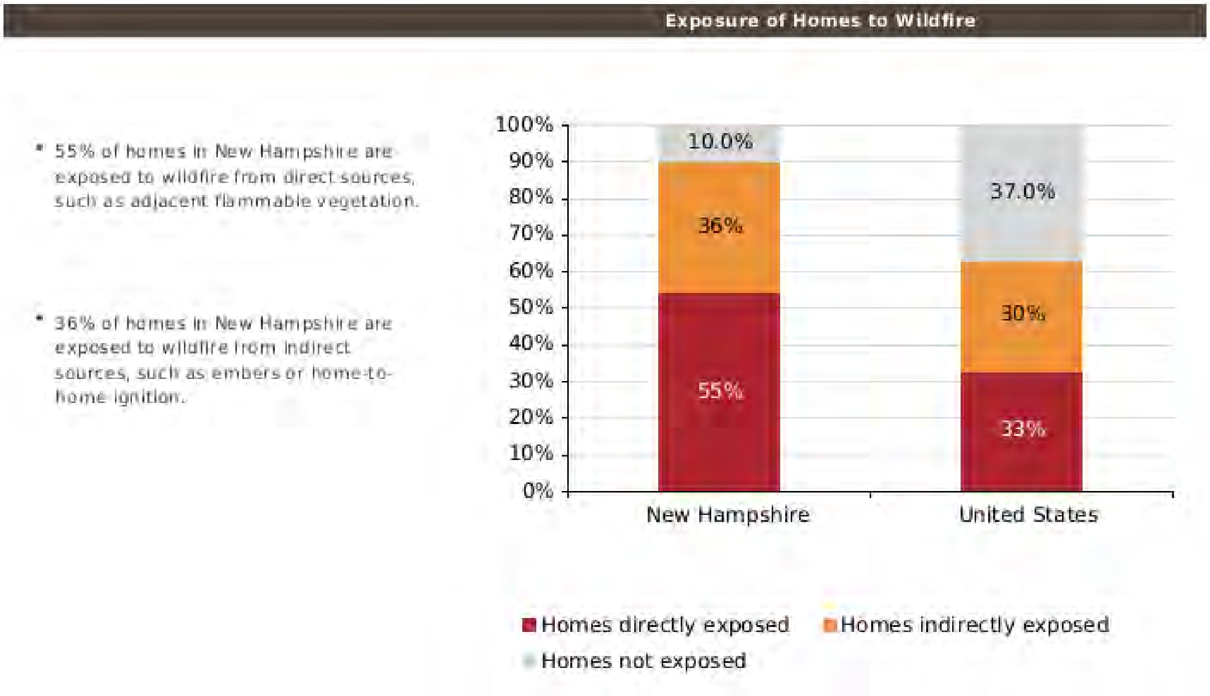
(Source: *Radeloff et al, 2022*)[6]

Gain and loss in WUI area, houses, and people due to housing change, vegetation change, and a combination of the two factors.

		WUI area, km^2			WUI houses, *n*			WUI population, *n*		
Category	Parameter	1990–2000	2000–2010	1990–2010	1990–2000	2000–2010	1990–2010	1990–2000	2000–2010	1990–2010
Housing change	Gain due to housing, *n*	133,403	115,543	217,059	1,872,054	2,325,118	4,599,060	4,418,282	5,333,375	10,779,700
	Gain due to housing, %	95.7	98.2	96.8	86.0	96.7	93.8	85.3	96.7	93.8
	Loss due to housing, *n*	−24,268	−28,910	−22,664	−414,458	−513,198	−472,472	−953,750	−513,198	−472,472
	Loss due to housing, %	76.6	80.5	65.0	43.0	42.9	33.2	41.4	23.2	16.8
Vegetation change	Gain due to vegetation, *n*	4,517	1,471	4,411	280,982	70,563	257,307	706,454	161,123	605,781
	Gain due to vegetation, %	3.2	1.2	2.0	12.9	2.9	5.2	13.6	2.9	5.3
	Loss due to vegetation, *n*	−6,766	−6,715	−11,378	−536,546	−674,648	−926,111	−1,315,387	−1,673,620	−2,280,581
	Loss due to vegetation, %	21.4	18.7	32.6	55.6	56.3	65.0	57.1	75.8	81.0
Housing and vegetation change	Gain due to both, *n*	1,453	652	2,870	23,169	8,872	46,105	56,247	19,973	109,418
	Gain due to both, %	1.0	0.6	1.3	1.1	0.4	0.9	1.1	0.4	1.0
	Loss due to both, *n*	−641	−270	−830	−13,710	−9,714	−25,669	−35,046	−21,606	−61,995
	Loss due to both, %	2.0	0.8	2.4	1.4	0.8	1.8	1.5	1.0	2.2
Total change	Gain, km^2	139,373	117,666	224,341	2,176,205	2,404,553	4,902,472	5,180,983	5,514,471	11,494,899
	Gain, %	24.00	17.09	38.62	7.07	6.51	15.93	7.13	6.39	15.83
	Loss, km^2	−31,675	−35,894	−34,871	−964,714	−1,197,560	−1,424,252	−2,304,183	−2,208,424	−2,815,048
	Loss, %	−5.45	−5.21	−6.00	−3.13	−3.24	−4.63	−3.17	−2.56	−3.88

According to the United States Department of Agriculture's ***Forest Services Forests of New Hampshire, 2020*** fact sheet, New Hampshire has an estimated 4,708,302 acres of forest land and 82% of the state is forest (forest area/total area with water removed).[5] Maine is the only more forested state, with 89% of the land being forested.[6] Data cited from the USDA Forest Services in the 2017 NH All Hazards Mitigation Plan was from 2005 which reported that "Forests occupy 88.9% of the State which equates to approximately 5.3 million acres."[7] Additional data reported in 2017 included that "A 2010 study by the USDA identified that New Hampshire has the greatest percentage of homes in the WUI out of the total number of homes than any of the other states in the United States, with 82.6% of homes located in the WUI."[8]



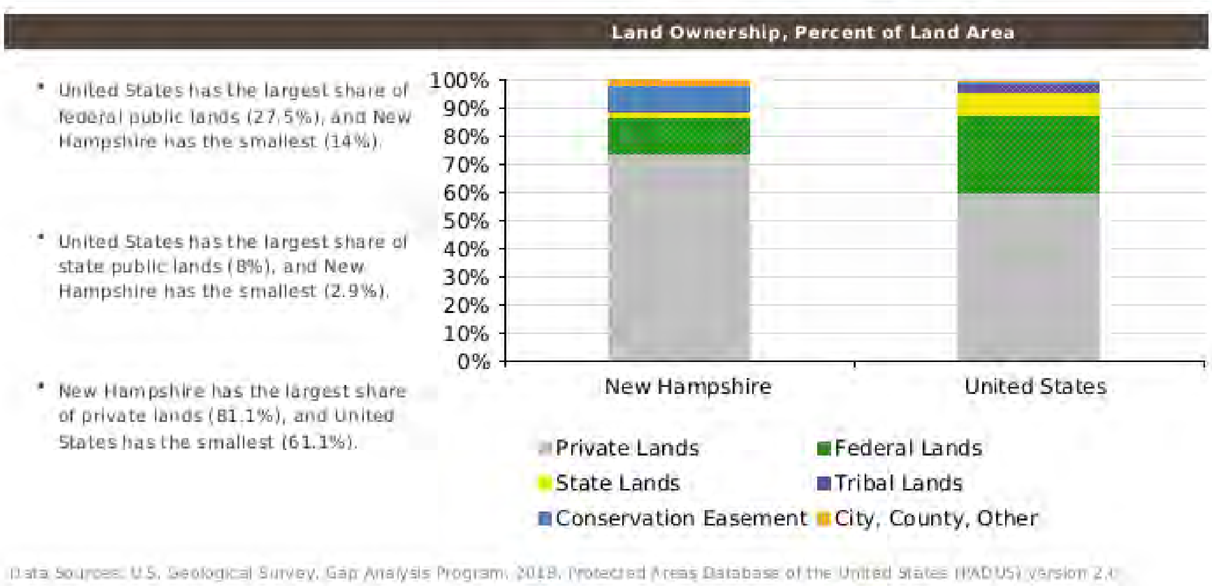


A home's ability to survive wildfire is driven primarily by local conditions (known as the "home ignition zone"), including the construction materials and the vegetation in the immediate area.[9] individual home assessments are a way to accurately assess home susceptibility to wildfire. Communities can reduce their risk to homes by reducing wildfire likelihood, wildfire intensity, exposure, and susceptibility. For example, fuel treatments on US Forest Service lands may reduce wildfire likelihood or intensity on nearby homes and communities. For private lands, reducing wildfire likelihood and susceptibility requires the landowner's commitment to conduct and maintain mitigation efforts. Communities can put ordinances in place that require wildfire mitigation activities, including land use planning tools such as landscape ordinances or improved building standards and materials that reduce susceptibility to wildfires that reduce the risk from wildfires.

Managing the built environment

"Layered regulations at the community scale—like zoning, building codes, and retrofit programs—can help ensure homes in wildfire-prone areas are hardened against the embers and radiant heat of a wildfire. Missing the Mark concludes there is ample evidence that wildfire-resistant construction and applicable building codes are highly effective at reducing wildfire risks to communities, and that they are not prohibitively expensive to implement. They have also been shown to save millions in avoided expenses. At the same time, funding for those efforts has been elusive. Federal agencies provide little guidance and financial assistance to facilitate these approaches, and only a few states have implemented robust policies. As a result, community leaders and homeowners are left without the support, information, and encouragement they need to reduce the risk from wildfire."

- Missing the Mark: Effectiveness and Funding in Community Wildfire Risk Reduction (June 2023)



Race and ethnicity are strongly correlated with disparities in health and vulnerability to natural hazards and with access to aid and resources, including wildfires. Black, Native American, Hispanic, and other people of color may be more vulnerable to disasters due in part to cultural and institutional barriers. Race and wealth are linked with health conditions like asthma that can be exacerbated by wildfire smoke and environmental stress, and with access to aid and resources after a wildfire event. People living on Indian reservations in remote, rural areas that have higher wildfire hazard potential combined with higher rates of poverty, disabilities, and mobile home housing are particularly vulnerable to wildfire disasters.[10]

(Source: *Lowell Sun, Published April 25, 2021*)

Wildfire Risk

New Hampshire

Potentially Vulnerable Populations

Populations, 2021*	New Hampshire	United States
Families in poverty	16,505	7,181,779
Households with no car	25,554	10,349,174
Mobile Homes	27,618	6,509,758
People under 5	63,509	19,423,121
People over 65	250,136	52,888,621
People with disabilities	171,838	41,055,492
People with language barriers	12,559	12,736,062
Percent of Total**		
Families in poverty	4.7%	8.9%
Households with no car	4.7%	8.3%
Mobile Homes	5.1%	5.2%
People under 5	4.6%	5.9%
People over 65	18.2%	16.0%
People with disabilities	12.7%	12.6%
People with language barriers	1.0%	4.1%

High Reliability: Data with coefficients of variation (CVs) < 12% are in black to indicate that the sampling error is relatively small.
Medium Reliability: Data with CVs between 12 & 40% are in orange to indicate that the values should be interpreted with caution.
Low Reliability: Data with CVs > 40% are displayed in red to indicate that the estimate is considered very unreliable.

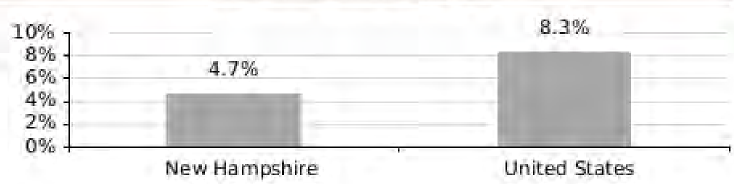
** Each measure on this page comes from a different subset of the overall population. For example, "poverty status" is not determined for all families. "Households with no car" is determined only for occupied households. "People with disabilities" includes only those people in civilian, noninstitutionalized settings. "Language barriers" is determined only for people five years or older.

Families in Poverty, 2021*

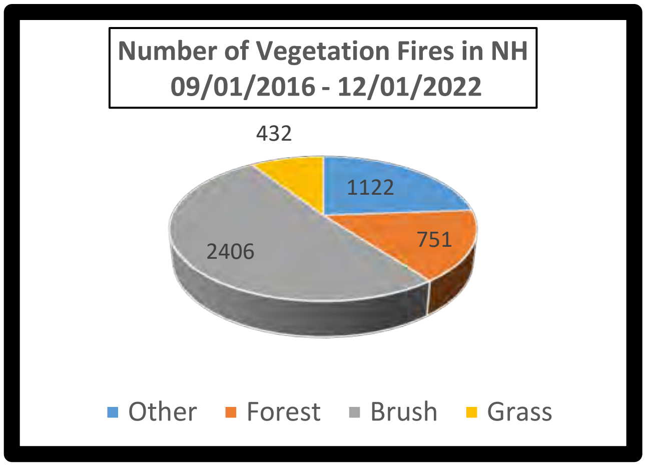
- From 2010* to 2021*, United States had the largest share of families in poverty (9%).

Households with No Car, 2021*

- From 2010* to 2021*, United States had the largest share of households with no car (8%).



* ACS 5-year estimates used. 2021 represents average characteristics from 2017-2021; 2010 represents 2006-2010.

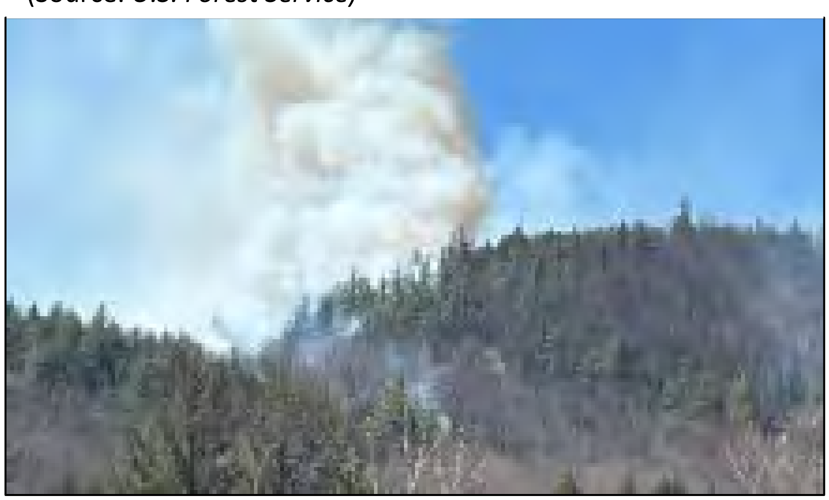


According to data from the New Hampshire Fire Incident Reporting System (NHFIRS) provided by the New Hampshire Fire Marshal's Office (NHFMO), there were 4,711 vegetation fires reported between 9/1/2016 to 12/1/2022. The majority of these were brush fires, as seen in the pie chart below. The incidents noted as "other" on the chart are likely miscoded data that belong to the brush and forest categories.

Almost all wildfires (97%) in the WUI are caused by people. Human-caused wildfires are responsible for 92% of the wildfires that threaten structures, which is 30 times more than lightning-caused wildfires.[11] The causes of these fires include debris burning, campfires, arson, children, smoking, and lightning, among others. The 2016 fire season was particularly prolific due to the extreme drought conditions that occurred across the State. During the 2016 season, 1,090 acres were burned, with 330 of those in the Town of Albany (located within the White Mountain National Forest), and 199 acres in Stoddard (located in Cheshire County).

Typically, the months of April and May experience the highest number of fire-starts, with another typically smaller spike of fires in October and November. The reason many fires occur in spring and fall are because the forest is predominately made up of hardwood trees, which are sensitive to fire.

The Centennial Fire in May 2022 burned across the Appalachian Trail, resulting in the closure of that portion of the trail.
(Source: *U.S. Forest Service)*



Fires involving hardwoods typically burn in early spring before green-up, and again in late fall after leaf-drop when fuel sources are elevated. New Hampshire can experience an active summer fire season, but normally this occurs only with an extended period of hot, dry weather resulting in drought-like conditions. While most of the State is covered in northern hardwood forests containing maple, birch and beech, there are numerous smaller “pockets” of high-hazard fuel types scattered throughout the State. These hazardous fuel types include the pitch-pine, scrub oak, spruce-fir, phragmites, and oak-pine forests.

The 2022 Bemis Fire occurred on steep terrain and closed a hiking trail. *(Photo courtesy of the Bethlehem Fire Department)*

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 into southern Maine. Large fire activity continued through the early 1950’s, and again in the mid-1960’s, including a crown fire (a fire that spreads from treetop to treetop) that spread from Brentwood through Exeter and into Kensington. Fire activity in the 1970’s and 1980’s led to the creation of permanently staffed fire departments in many towns. This now permanent resource, in tandem with existing volunteer assets, showed a general decrease in total acreage burned; however, the total number of fires started continued to increase over time.

Concerns of the New Hampshire Department of Natural and Cultural Resources (NH DNCR), Division of Forest and Lands (DFL) include future natural disturbances such as hurricanes, wind events, ice storms, and insect or disease outbreaks that may create a significant amount of woody debris in the forests. A second, weather-related concern, is any period of prolonged drought, which makes fire starts more likely and suppression efforts much more difficult. A third concern is the continual sprawl of developed land into historically rural, forested areas. Although this development has slowed in recent years, homes and other valuable resources that are scattered throughout the forest often have limited accessibility and may be some distance from the closest fire department, thereby increasing the danger of damage or destruction from a wildland fire.

NH DNCR-DFL provides resources to local fire departments and promoting educational materials to the public that encourage preventative practices. Examples of these efforts can be seen in the daily publishing of daily fire danger predictions, the Smokey the Bear program, the requirement of burn permits, the staffing of fire towers, and their participation in federal grant programs. NH DNCR, Division of Forests and Lands teams up with the National Weather Service in Gray, ME to utilize forecast data and information from a State-owned network of three remote weather stations (located in Lancaster, Bear Brook, and the Saco District of the White Mountains) to produce daily fire weather predictions. These predictions are rated on a scale from Low to Extreme and are made publicly available online, posted outside of local fire departments, and distributed via email to a list serve containing the names of Fire Wardens, Deputy Fire Wardens, and local fire departments who subscribe.

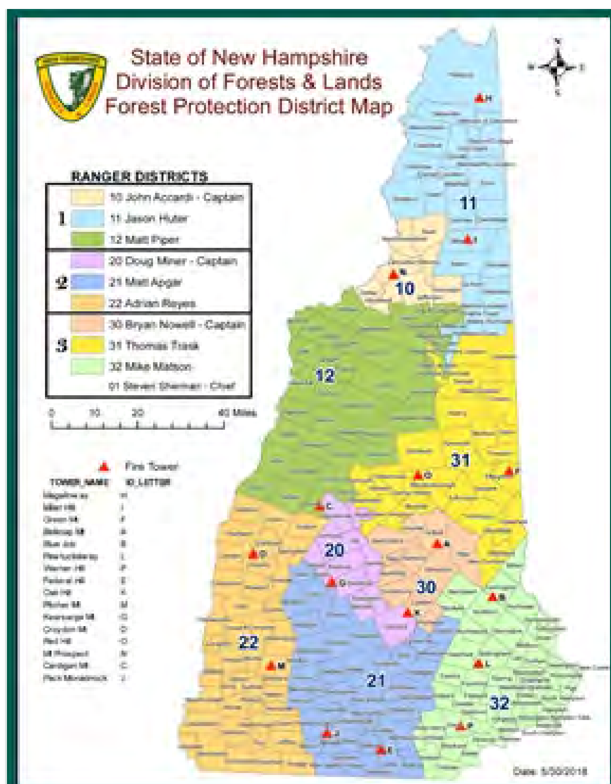
The daily fire danger ratings are as follows[4]:

- Low (Green)—Fire starts are unlikely. Weather and fuel conditions will lead to slow fire spread, low intensity, and relatively easy control with light mop-up. Controlled burns can usually be executed with reasonable safety.
- Moderate (Blue)—Some wildfires may be expected. Expect moderate flame length and rate of spread. Control is usually not difficult and light to moderate mop-up can be expected. Although controlled burning can be done without creating a hazard, routine caution should be taken.
- High (Yellow)—Wildfires are likely. Fires in heavy, continuous fuel such as mature grassland, weed fields and forest litter, will be difficult to control under windy conditions. Control through direct attack may be difficult but possible and mop-up will be required. Outdoor burning should be restricted to early morning and late evening hours.
- Very High (Orange)—Fires start easily from all causes and may spread faster than suppression resources can travel. Flame lengths will be long with high intensity, making control very difficult. Both suppression and mop-up will require an extended and very thorough effort. Outdoor burning is not recommended.
- Extreme (Red) - Fires will start and spread rapidly. Every fire start has the potential to become large. Expect extreme, erratic fire behavior. NO OUTDOOR BURNING SHOULD TAKE PLACE IN AREAS WITH EXTREME FIRE DANGER.

Towns use the daily fire danger ratings to determine whether they will issue burn permits. In New Hampshire, burn permits are required at any time that there is not complete snow cover on the ground in the area where a person wishes to burn. These permits are used as a preventative measure to limit burning to days when fire danger is reduced and often restricts people to burning after five o'clock in the afternoon when temperatures and humidity values are lower and less likely to promote rapid fire growth and spread. Additionally, these permits offer information printed on them about safe burning practices to educate the public, such as how far a fire should be set back from structures and what types of items are appropriate and safe to burn. Fire permits are typically only given out when the daily fire danger is either low or moderate and are issued in four different categories:

- "Category I fire": A small, controlled fire, such as a camp or cooking fire, no greater than 2 feet in diameter contained within a ring of fire resistive material or in a portable fireplace.
- "Category II fire": A controlled fire, such as a camp or cooking fire, no greater than 4 feet in diameter contained within a ring of fire resistive material or in a portable fireplace.
- "Category III fire": Any other fire not a category I or category II fire or a fire greater than 4 feet in diameter or a fire not contained within a ring of resistive material.
- "Category IV fire": A fire, other than a category I fire, that can be kindled between the hours of 9:00 am and 5:00 pm whether raining or not.

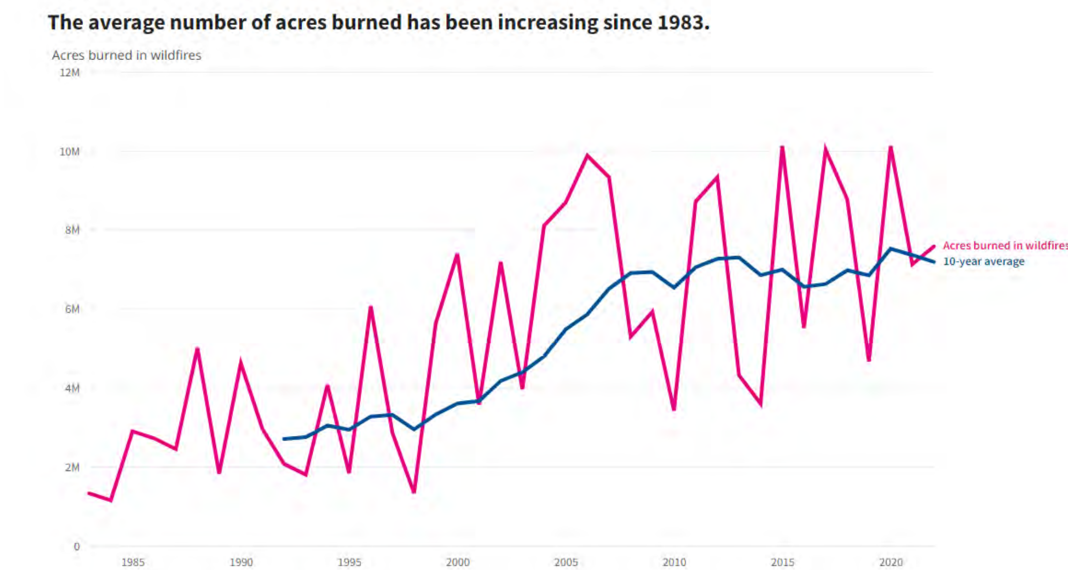
In addition to fire permits, NH DNCR-DFL promotes early fire detection and prevention by staffing and maintaining 15 fire towers around the State. These fire towers are open to the public allowing citizens the opportunity to learn about fire prevention while contributing to the observation network by reporting any potential fires that they may see. These fire towers are staffed on class three or above days (High, Very High, or Extreme fire danger). Additionally, NH DNCR-DFL maintains a contract with the Civil Air Patrol (CAP) to enhance their monitoring capabilities. The CAP flies two routes across the State looking for potential fires (shown in the map).



Map showing fire towers across New Hampshire.
(Source– NH DNCR-DFL)

Local fire departments find an increased need for State personnel, equipment and technical support from the Division of Forests and Lands as fire numbers and incident complexity increases. For example, even though the southern tier of the State experiences the highest number of fires, fires in the northern regions, where the population is minimal, are complicated by poor access and rugged terrain, which greatly hinders efficient and safe response by firefighters. While there are over 8,000 firefighters in New Hampshire, they belong to predominantly volunteer organizations with roughly 1,000 firefighters belonging to permanent departments in larger towns or cities. These volunteer, full-time, or combination fire departments generally specialize in structural fire response and emergency medical services. Though early detection of fires has helped to decrease the total acreage burned, it is common for towns to rely on State support for any incident that involves wildfires greater than a few acres in size.

As of 2021, there were 58,985 wildfires that burned 7.1 million acres — an area about the size of Massachusetts, according to data compiled by the National Interagency Fire Center (NIFC).



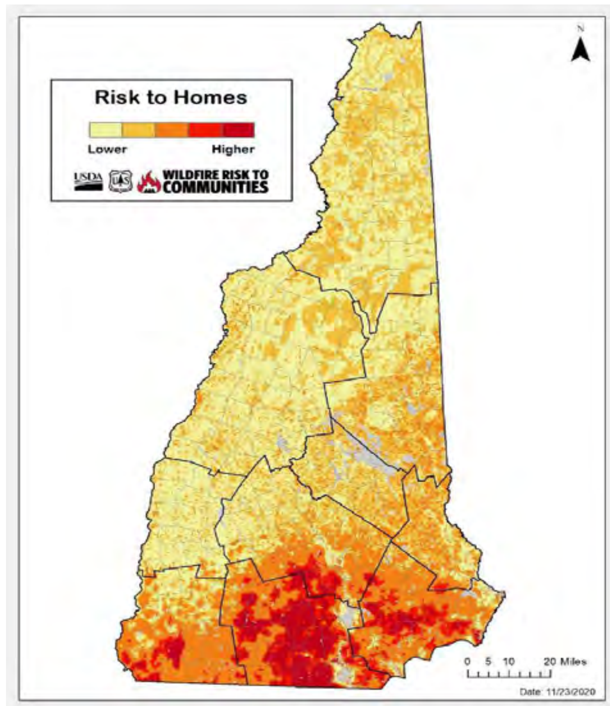
NH DNCR-DFL supports local communities' needs to equipment through the following programs:

- Federal Excess Personal Property Program (FEPP): This program allows for NH DNCR, Division of Forests and Lands to acquire surplus federal firefighting equipment (such as trucks, tools, apparatus, etc.) and make it available on loan to local communities. The equipment remains the property of the federal government. NH DNCR has provided over two million dollars, worth of equipment to the local communities through this program.

- Federal Firefighter Property Program (FFP): This program allows for NH DNCR, Division of Forests and Lands to acquire surplus federal firefighting equipment (such as trucks, tools, apparatus, etc.) and make it available on loan to local communities. There is no cost to the local communities, with the exception that they must maintain the equipment. After a loan period of one year, the equipment becomes property of the local community. NH DNCR has provided approximately one million dollars, worth of equipment to the local communities through this program.

Wildfire Protection – (From the 2020 NH Forest Action Plan)
New Hampshire experiences wildfires on a seasonal basis with spring and fall being the most active times of the year. Wildfire Management focuses on strategies to keep the frequency and size of wildfires to a minimum reducing costs and risks to people and structures; and protecting New Hampshire's forests and natural communities. The Division of Forests and Lands is responsible by state law for providing wildland fire detection, prevention, and suppression on all lands in the state, except within the boundaries of the White Mountain National Forest. This accounts for over 4.1 million acres that fall under state jurisdiction for wildland fire protection.

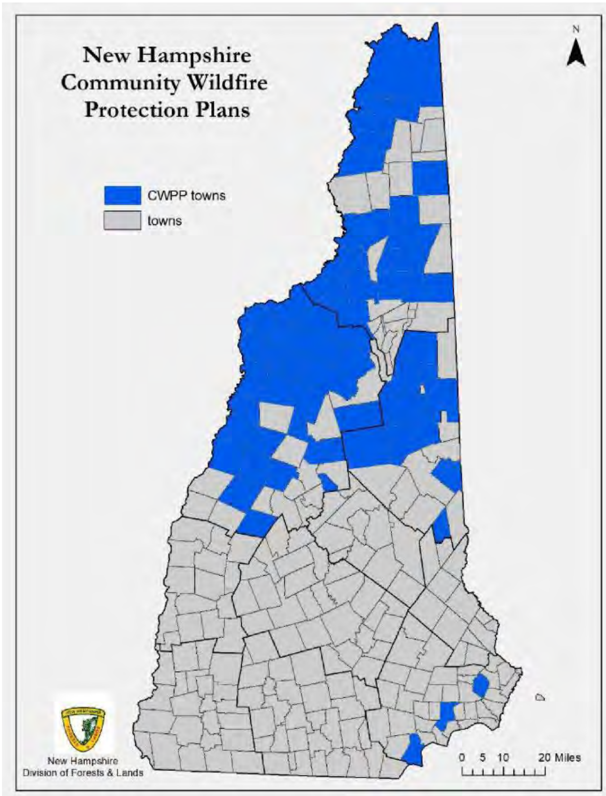
Each year New Hampshire experiences approximately 375 wildfires. These fires burn approximately 240 acres collectively, although this figure can vary considerably depending on weather. Large fires (>100 acres) though once common, are now a rarity. However, in the spring of 2015 the state experienced a 275-acre wildfire, which was the largest in many years. In 2016, New Hampshire experienced multiple large fires, including one that burned 190 acres within state jurisdiction and another one on the White Mountain Nation Forest, which burned 329 acres. In 2017, the state had a busy fall fire season with a very complex 75-acre fire that burned on private and National Forest lands. In addition to wildfires, the state experiences approximately 125 illegal outdoor fires that are extinguished before they become a wildfire.



New Hampshire Wildfire Risk
Source: *USDA Forest Service*

New Hampshire relies on community fire departments for initial attack, and the state provides a leadership support role. The exception to this is the unincorporated towns in the northern portions of the state where the division takes more of an initial attack responsibility.

The primary methods of fire detection in New Hampshire are through citizen reports, fire towers, fire service personnel, and air patrols. The state operates and maintains 15 part-time fire detection lookout towers located throughout the state. The state also uses the Civil Air Patrol to conduct aerial fire detection.



Community Wildfire Protection Plan Communities

As mentioned previously, New Hampshire is a heavily forested state with a large population which lives within the Wildland Urban Interface. The division and the forest rangers work with communities to help develop Community Wildfire Protection Plans (CWPP's). Throughout the state this is commonly completed with a town's Hazard Mitigation Plan which allows the forest ranger, town planners and emergency responders to participate in the comprehensive risk management process for the town.

The New Hampshire Fire Management Program is more than suppression. The fire management strategy includes preparedness, assistance to communities, suppression/support, equipment, training of fire personnel and volunteers, community mitigation, prescribed burns, hazardous fuels reduction, law enforcement, prevention, and education. New Hampshire's fire prevention program is very active, with numerous presentations reaching tens of thousands of people each year.

On average, the Forest Protection Bureau responds to 625 fire related calls for service each year.

Prescribed Fire

Fire Adapted Communities in NH - Fires have impacted the landscape of New Hampshire for generations. The frequency, geographical distribution, and intensity have varied during different eras. In pre-settlement times, there were more fires of lower intensity around Native American villages.[13]

During colonial times and the industrial revolution era, fires were larger and more geographically dispersed and were associated with land clearing as well as industrial activities and infrastructure. In the 20th and 21st centuries, more fires were inadvertently caused by humans from activities such as camping and residential brush pile burning.

Over the past 100 years, natural resource managers began to better understand the ecological benefits of forest fires. We now know that certain forest types and wildlife habitats are adapted and depend on fire for their maintenance and regeneration.

Prescribed Fire in NH – Prescribed fire is used in New Hampshire to meet a range of management goals that benefit public safety, forest-based recreation, wildlife management, silviculture, agriculture, invasive species management and sustaining unique natural communities.

The University of New Hampshire, Cooperative Extension Service conducted surveys with the following results.

Summary of prescribed fire in New Hampshire - 2014-2017

Summary Statistics	Municipal Fire Departments				State Agencies				Federal Agencies				Other			
Year	2014	2015	2016	2017	2014	2015	2016	2017	2014	2015	2016	2017	2014	2015	2016	2017
# of burns	34	24	12	15	24	17	15	9	19	7	10	8	5	5	3	3
Acres burned	216.3	113.8	220.5	185.0	39.0	31.4	18.0	7.5	150.1	55	68.0	110.0	108.5	166.0	35.0	70.0
Ac / burn	6.36	4.74	18.38	12.33	1.63	1.85	1.20	0.83	7.90	7.86	6.80	13.75	21.7	33.2	11.67	23.33
% of total burns	41.5%	45.3%	30.0%	42.8%	29.3%	32.1%	37.5%	25.7%	23.5%	13.5%	25.0%	22.9%	6.1%	9.4%	7.5%	8.6%
# of towns where burns occurred	19	24	7	9	17	10	8	5	6	4	5	6	4	5	3	3
% of towns where burns	14.1%	10.2%	3.0%	3.8%	7.3%	4.3%	3.4%	2.1%	2.5%	1.7%	2.1%	2.5%	1.7%	2.1%	1.3%	1.3%

Prescribed fire objectives, 2014-2017[1]

Objectives	Complete Data	Municipal Fire Departments	State Agencies	Federal Agencies	Other
Agriculture	30	20	0	1	9
Forestry	4	0	0	3	1
Public Safety[2]	113	56	52	1	4
Biodiversity	57	21	8	22	6
Wildlife	42	0	12	31	0

[1]Some respondents indicated multiple primary burn objectives for a single burn.
[2]Public safety includes both fuels reduction and training burns

Fuels associated with burn objectives 2014-2017[1]

Objectives/Fuels	Grass	Shrub	Timber Litter	Slash
Agriculture	23	17	0	0
Forestry	0	2	3	3
Public Safety	55	34	52	0
Biodiversity	38	28	10	10
Wildlife	36	15	2	4

[1]One survey response indicated unknown fuel type and is not reflected in the table

Hazard Reduction – Dangerous fuel loads (i.e. vegetation) can be burned and reduced in a controlled way to minimize the risk of difficult to control wildfires.

Wildland Fire Training – Local fire departments require a significant amount of training to combat fires, both structural and wildfires. Prescribed burns provide an excellent opportunity for firefighter trainees to get first-hand experience on how to control forest fires.

Forestry – Prescribed fire can encourage oak regeneration and is currently used in some regions of the northeast to promote these species.

Agriculture – Wild blueberry growers have found by experience and research that periodic pruning via fire can stimulate higher yields and can reduce certain insects and diseases. Also, prescribed fire has been used to maintain pastures and increase nutrients of the forage.

Improve Wildlife Habitat & Maintain Rare Natural Communities – There are a host of natural communities and associated wildlife in NH that benefit from fire including pine barrens, rocky ridges, grasslands, and shrublands. Pine barrens in particular support a suite of species that are regionally and globally rare. These include the federal and state endangered Karner Blue Butterfly (NH's state butterfly), and nearly a dozen other rare moths and butterflies. Natural communities with soils that are well to extremely well-drained require periodic fire to maintain their structure and species composition. Of NH's 414 endangered or threatened plant species, 108 occur in these types of dry to semi-dry soil conditions.

Aesthetics & Outdoor Recreation – Prescribed fire can be used to maintain aesthetics and views.

Fire Adapted & Dependent Natural Communities in NH

NH Fire Dependent Natural Communities	NH Moderately Fire Prone Natural Communities
Appalachian oak - pine rocky ridge (S3)	Appalachian wooded talus (S1S2)
Chestnut oak forest/woodland (S1S2)	Bayberry - beach plum maritime shrubland (S1)
Circumneutral rocky ridge (S1)	Coastal rocky headland (S1)
Dry Appalachian oak forest (S3)	Maritime meadow (S1)
Dry red oak - white pine forest (S3S4)	Maritime shrub thicket (S1)
Jack pine rocky ridge (S1)	Maritime wooded dune (S1)
Mixed pine - red oak woodland (S1S2)	Oak - mountain laurel forest (S3)
Pitch pine - Appalachian oak - heath forest (S1)	Red oak - black birch wooded talus (S3S4)
Pitch pine rocky ridge (S1)	Red oak - ironwood - Pennsylvania sedge woodland (S2)

Pitch pine - scrub oak woodland (S1S2)	Red spruce - heath - cinquefoil rocky ridge (S3S4)
Red oak - pine rocky ridge (S3S4)	Rich Appalachian oak rocky woods (S2)
Red pine rocky ridge (S2)	Rich red oak rocky woods (S2S3)
Red pine - white pine forest (S2S3)	Semi-rich oak - sugar maple forest (S2S3)
Riverwash plain and dunes (S1)	
Subalpine rocky bald (S2)	

Fire-prone natural communities in New Hampshire with state ranks in parentheses. State ranks describe rarity of the natural community within NH. Visit the "Natural Communities of New Hampshire" online or read Sperduto and Nichols (2004) for more information.

S1 (Critically Imperiled): At very high risk of elimination due to extreme rarity (generally one to five occurrences), very steep declines, or other factors.

S2 (Imperiled): At high risk of elimination due to a very restricted range, very few examples (generally six to 20 occurrences), steep declines, or other factors.

S3 (Vulnerable): At moderate risk of elimination due to restricted range, relatively few examples (generally 21 to 100 occurrences), or vulnerable to elimination because of other factors.

S4 (Apparently Secure): Occasional to somewhat widespread but not uncommon or rare; possible cause for long-term concern due to declines or other factors.

S5 (Secure): Demonstrably common, widespread, and abundant.

Extent

Currently, there is not a universally adopted scale for measuring wildfires within the State of New Hampshire. There are numerous factors that can be used to describe the severity and complexity of a wildfire:

- Acreage of the fire (size)
- Topography and landscape
- Amount of time required to extinguish the fire
- Environmental factors (drought or wind)
- Damages to urban infrastructure along the WUI, damages to utility infrastructure, or other severe environmental damages
- Amount and types of resources required to extinguish the fire (expressed in number of alarms)

Generally, fire personnel most commonly use the acreage of the fire and the number of alarms to describe the magnitude of the wildfire, as these descriptions are relatable to the size of the fire and number of resources required to extinguish. While this is not an exact science, these two factors alone are easily understood and allow a straightforward comparison of the magnitude of wildfire events. Some wildfire events that may not easily be described using the severity metrics listed above may include:

- Significant acreage fires that are isolated to a large, flat field which require few resources to extinguish (greater area covered, less alarms needed)
- Small acreage fires that occur in a remote, difficult landscape burning deep into the ground, which often requires a more diversified and coordinated response.

The National Wildfire Coordinating Group (NWCG) has developed a fire size classification chart to describe a wildfire by the areal extent in acres:

Size Class of Fire	Size of Fire in Acres
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

Impacts

Wildfires can have extensive impacts on not only the natural environment, but also the economy, air quality, communities, livestock, and quality of human life. Below is a list of potential impacts from wildfires:

- Loss of wildland habitats, forested areas, and sensitive species
- Loss of structures when fires cross of the Wildfire Urban Interface, resulting in homeless peoples and disruption of businesses
- Reduction of air, water, and soil quality post event
- Increased amount of airborne toxins from burning of non-organic materials
- Increased risk of food shortages
- Degradation of land quality and increased risk of soil erosion, landslides, and mudslides (especially when immediately followed by heavy rain)
- Loss of recreational land
- Loss of cultural and heritage sites
- Increase in insurance premiums.

Safety and Security	Food, Water, Shelter	Health and Medical	Energy (Power & Fuel)	Communications	Transportation	Safety and Security
Mutual aid may be necessary from local, state or federal entities to control wildfires. Delayed response to non-wildfire events are possible. Government facilities may be unusable due to proximity to fires or fire may consume structures.	Shelters may be vulnerable due to proximity to fire. Long term shelter needs will be needed for uninhabitable homes. Food supplies are vulnerable to fire, leading to localized shortages or loss.	Patients with significant burns will require transport out of state. Respiratory care will be needed. Potential surge plan activation is possible.	Utility infrastructure can sustain damage and become inoperable due to fire; long term outages will occur. Vulnerable fuel sites will require considerable intervention.	Communications infrastructure can sustain damage, leading to communication outages for public and government entities.	Delays in transportation can occur due to fire proximity to roads or airports.	Hazardous Materials will require HazMat teams; resources may be engaged leading to delays in response times.

Previous Occurrences: History of Wildfire Events in New Hampshire				
Event Date	**Event Description**	**Impacts**	**Location**	**Additional Information**
1885	Wild River East Fire	3,000 acres burned	Wild River East	
1888	Zealand Valley Fire	12,000 acres burned	Zealand Valley	
1903		84,255 acres burned	Northern New Hampshire	
August 1907	Owl's Head Fire			Influenced lawmakers to include a section in the Weeks Act for fire control.
1907	Lincoln Fire	5,000 acres burned	Lincoln, New Hampshire	
1908	Shelburne Fire	5,060 acres burned	Shelburne, New Hampshire	
1912	Swift River Fire	1,000 acres burned	Conway, New Hampshire	
1914	Rock Branch Fire	10,052 acres burned	Conway, New Hampshire	
1923	Waterville Valley Fire	3,500 acres burned	Waterville, New Hampshire	

1940s	In the1940's, huge landscape-scale forest fires in New England fed on debris left by the September 1938 hurricane. In 1941, the infamous Marlow-Stoddard fire burned 27,000 acres during the last three days of April before a freak May 1 snowfall extinguished the blaze. The fire started at a Marlow sawmill engaged in sawing some of the 500 million board feet of lumber salvaged statewide from the four billion board feet of pine timber blown-down during the '38 hurricane. The Marlow-Stoddard fire was the largest fire to feed on the fuel of hurricane debris. The worst forest fire season ever recorded in New Hampshire and Maine came six years later in October 1947. In Maine, fires burned from Fryeburg to the coast, leveling Bar Harbor. A prolonged autumn drought fueled fires that blackened a total of 20,000 acres across New Hampshire in one month.[iii]			
1941	Marlow/ Stoddard Fire	27,000 acres burned	Marlow and Stoddard, New Hampshire	
October 19, 1947		15,242 acres burned	Statewide	On October 19, 1947, an afternoon lightning strike near Lake Solitude on Mount Sunapee ignited a smoldering blaze that was not reported until two days later by the midnight bus driver heading from Concord to Claremont. For a week, dry winds fanned flames that scorched eight miles of the Sunapee ridge and burned to within two miles of the village of Goshen where 500 firefighters battled the wind-whipped inferno. The first rain of the month fell on October 28th and on the 30th, B-17 bombers were used for experimental cloud-seeding using dry ice to wring rain to extinguish the blaze by Halloween.[iv]
June 25, 1953	Grantham Fire	1,570 acres burned	Grantham, New Hampshire	The Grantham Mountain forest fire started on June 25, 1953 and burned 1,570 acres. The
June 23, 1953	Shaw Mountain Fire	1,554 acres burned	Shaw Mountain, New Hampshire	Mt. Shaw fire started on June 23, 1953 and burned 1,554 acres.
1962	Concord Plains Fire	900 acres burned	Concord, New Hampshire	
1963	Kensington/ Exeter Fire	760 acres burned	Kensington and Exeter, New Hampshire	
1984	Table Mountain Fire	100 acres burned	Bartlett, New Hampshire	
1988	Red Hill Fire	262 acres burned	Moultonborough, New Hampshire	
2004	Lucy Brook Fire	140 acres burned	Bartlett, New Hampshire	

2015	Bayle Mountain Fire	275 acres burned	Ossipee, New Hampshire	
2016	Covered Bridge Fire	330 acres burned	White Mountain National Forest in Albany, New Hampshire	
April 2016	Stoddard Brush Fire	199 acres burned	Town of Stoddard	Dozens of firefighters from 22 fire departments battled a six-alarm brush fire that burned 199 acres around routes 9 and 123. 17 families were evacuated from their homes as a precaution.
May 2018	Bow Brush Fire	5 acres burned	Town of Bow	About 60 firefighters were call to the Town of Bow to fight a multiple alarm brush fire in the woods along the Branch Londonderry Turnpike. A breeze and dry conditions made extinguishing the fire challenging.[v]
May 2022	Shelburne	25 acres	Shelburne	
May 2022	Bemis Fire	106 acres	Crawford Notch State Park	

Impact of Climate Change on Hazard	
Climate Change Projection	**Impact on Hazard**
Increase in Sea Level	N/A
Increase in Precipitation	Increased precipitation from severe thunderstorms, hurricanes, wind events, ice storms, and insect or disease outbreaks that may create a significant amount of woody debris in the forests which may increase the risk of wildfires.
Increase in Temperature	Drought is a major risk factor for wildfires. During periods of hot, dry weather the risk of wildfires starting increases. Increased heat also poses additional hazards to emergency crews needed to contain and extinguish wildfires.
Increase in Severe Weather	Increased precipitation from severe thunderstorms, hurricanes, wind events, ice storms, and insect or disease outbreaks that may create a significant amount of woody debris in the forests which may increase the risk of wildfires.

Individuals/ Communities Disproportionately Impacted by Hazard	
Individual/Community	**Description of Increased Impact**
Socially Vulnerable Populations (due to income, education, health care access, and housing)	May have greater rates of existing medical conditions, May live in poorly maintained or aging infrastructure that may not be able to handle climate-related event May struggle to access resources and care • May experience limited financial resources or cultural, language, or other barriers that restrict their access to health care, social services, and safe, nutritious food
Children < 5 Years	Their developing bodies can make them more vulnerable to hazards like heat and poor air quality. Children breathe at a faster rate, increasing their exposure to dangerous air pollutants. Spending more time outdoors than adults, increases their exposure to heat and cold, rain and snow, outdoor allergens, and insect bites. Higher water intake can increase exposure to certain contaminants in recreational waters and the risk of developing gastrointestinal or other illnesses. Children can experience mental health impacts from extreme events that are expected to increase with a changing climate. • Dependance on others for care increases vulnerability
Individuals Aged ≥ 65 Years	Older people are less able to compensate for the effects of certain environmental hazards, such as air pollution. Older adults are more likely to have health conditions that make them more sensitive to climate hazards like heat and air pollution, which can worsen their existing illnesses. Limited mobility, increasing their risks before, during, and after an extreme weather event. Some medications can change the body's ability to respond to heat, increasing risk for heat illnesses and death as the climate warms. Aging can impact the immune systems, increasing risk for extreme reactions related to heat, insect- and tick-related diseases, and water-related illnesses. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.

Individuals with a Disability/Disabilities	Emergency warnings and other important messages may not be available in formats that are accessible to individuals with certain disabilities (such vision or blindness, hearing loss, or mobility issues). Increased likelihood that they may have additional social and economic risk factors, such as poverty and unemployment, that put them at greater risk. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with Pre-existing or Chronic Health Conditions (including behavioral health)	Chronic medical conditions may increase risk of illness and death, particularly exposure to heat, extreme weather events, water-related illnesses, and poor air quality. system or health infrastructure damages, or power outages. Some medications can affect the body's response to heat, increasing risk for heat illnesses. Some conditions/medications compromise the immune system, increasing risk for extreme reactions related to heat, insect- and tick-related diseases, and water-related illnesses. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.

ENDNOTES – HAZARD: WILDFIRE

[1] https://www.nwcg.gov/glossary/a-z#letter_w

[2] Radeloff, V. C., D. P. Helmers, H. A. Kramer, M. H. Mockrin, P. M. Alexandre, A. Bar-Massada, V. Butsic, T. J. Hawbaker, S. Martinuzzi, A. D. Syphard, and S. I. Stewart. 2018. Rapid growth of the U.S. Wildland Urban Interface raises wildfire risk. Proceedings of the National Academy of Sciences, 115(13): 3314-3319.

[3] Radeloff et al. 10.1073/pnas.1718850115.

[4] Radeloff et al. 10.1073/pnas.1718850115.

[5] USDA Forest Service. 2021. Forests of New Hampshire, 2020. Resource Update FS-335. Madison, WI: U.S. Department of Agriculture, Forest. Service. 2p. https://doi.org/10.2737/FS-RU-335 .

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June 5, 2023

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6.12 Hazard: Severe Winter Weather

Hazard Overview: Severe Winter Weather	
HIRA Risk	High
Future Probability	High
Counties at Risk	All

Definition

The State of New Hampshire experiences four types of severe weather during the winter months, which usually bring snow, high winds, and/or rain depending on temperatures:

Heavy Snow

In forecasts, the amount of snow that is expected to fall is expressed as a range of values, such as 10-12”. There can be considerable uncertainty regarding snowfall values during heavy snowstorms and phrases such as “...up to 20 inches” or “ 1 2 inches or more” can be utilized. Heavy snow is generally defined as[1]:

- Snowfall accumulating to 4” – 6” or more in depth within 12 hours or less; or
- Snowfall accumulating to 6” – 8” or more in depth within 24 hours or less

These amounts are determined to be significant enough to disrupt or slow transportation systems and public safety departments' response capability.

Blizzard

A blizzard is a snowstorm with the following conditions that is expected to prevail for a period of three hours or longer[2]:

- Sustained wind or frequent gusts to 35mph or greater; AND,
- Considerable falling and/or blowing snow that frequently reduces visibility to less than one-quarter mile.

Snow Squall

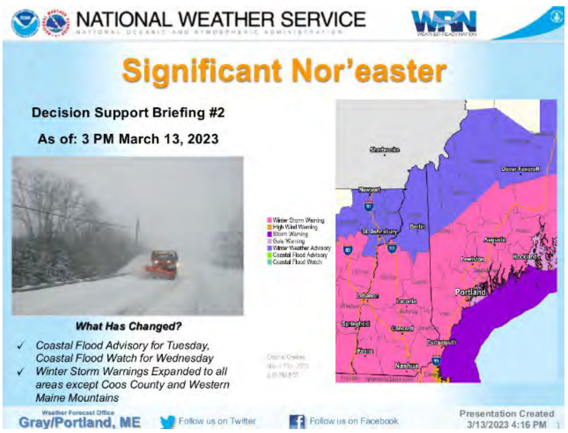
A snow squall is an intense, but limited duration, period of moderate to heavy snowfall, accompanied by strong, gusty surface winds, near zero visibilities and possibly lightning (generally moderate to heavy snow showers). Snow accumulation rates are significant but overall amounts are limited.

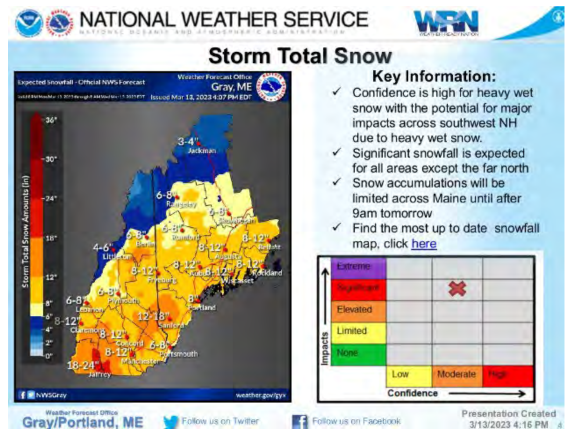
Sleet

Sleet is defined as pellets of ice composed of frozen or mostly frozen raindrops or refrozen partially melted snowflakes. These pellets of ice usually bounce after hitting the ground or other hard surfaces. Heavy sleet is a relatively rare event defined as an accumulation of ice pellets covering the ground to a depth of one-half inch or more. Sleet can be extremely slick and hazardous to drive on compared to snow, but it doesn’t drift or cause low visibilities.

Nor’easter

A Nor’easter is a large cyclonic storm that tracks north/northeastward along the East Coast of North America. It is so named due to the northeasterly prevailing wind direction that occurs during the storm. While these storms may occur at any time of the year, they are most frequent and severe during the months of September through April. Nor’easters usually develop off the east coast between Georgia and New Jersey, travel northeastward, and intensify in the New England region. Nor’easters nearly always bring precipitation in the form of heavy rain and/or snow, as well as gale force winds, rough seas, and coastal flooding.[3]





New Hampshire (New England) is especially susceptible to strong Nor’easters during the winter as the polar Jet stream transports cold, artic air southward across the northern central US. This airmass then moves eastward toward the Atlantic Ocean where it meets warm air from the Gulf of Mexico generating a strong low-pressure system. The warm waters of the Gulf Stream help keep the coastal waters off of New England relatively mild during the winter, which in turn helps warm the cold winter air over the water. The presence of the relatively warmer, moist air over the Atlantic and cold, dry Arctic air over the land provide the temperature contrast necessary to generate the strong frontal boundaries that help a Nor’easter intensify.

Ice Storm

Ice storms typically occur with warm frontal boundaries, where warm air rises up and over a shallow mass of cold air near the earth’s surface. When snow falls from clouds near just north of the warm frontal boundary, it will fall through the deep warm layer aloft first and melt completely into a liquid water droplet. As it passes through the shallow cold layer near the surface, the water droplet cools to the point of being supercooled (a liquid raindrop that remains a liquid at the freezing point). When these supercooled water droplets make contact with freezing surfaces on the ground, such as streets and walkways, they freeze on contact forming layers of ice. This process of freezing rain, when persistent over a long period of time, will form layers that may exceed over an inch thick in extreme cases.

Any accumulation of ice can present hazards; however, significant accumulations of ice (1/4” of mean radial ice thickness or greater) can pull down trees and utility lines resulting in loss of power and communications. Walking and driving also becomes very dangerous to almost impossible during an ice storm.[4]

Location

The entire State of New Hampshire is at risk for severe winter storms. Higher elevations are at an increased risk for ice accumulation.

The below locations are examples which were highlighted through a combination of efforts which included a survey completed by the RPCs and NH HSEM field staff, historical data, and the National Risk Index.

The impact to the City of Laconia (Belknap County) critical facilities such as populations to protect and essential services. There is a citywide concern for wide-spread power outages, interrupted or unsafe travel conditions, and downed trees. The major threats to Laconia from ice storms include structural damage due to heavy loads on roofs, interruptions of services such as electricity, fuel, water, and communications, as well as hazardous road conditions.

In Sanbornton (Belknap County), there are segments of the community more at risk though the entire town can be affected by severe winter weather. These populations include elderly, people that in need of regular medical care, and young children. Downed limbs, wires, and unplowed or treated roads can severely limit emergency access to many residences. A severe ice storm impacted central and southern New Hampshire in 2008. Over 400,000 people were without power, some for over two weeks, and overall damages exceeded $15 million. In Sanbornton, most critical facilities were identified as being vulnerable to severe winter weather. All structures in Sanbornton are susceptible to damage by severe winter weather events. Assuming 1% to 5% town-wide damage to buildings, severe winter weather could result in $2,778,445 to $13,892,227 in damages annually.

Severe winter weather is a hazard that impacts all of Hillsborough County. However, areas on the western side of the county experience significantly heavier snow and higher snow totals overall due to the elevation of the area. Nor'easters create situations where high winds, intense snowfall and cold temperatures that can cause significant damage that can have impacts to many vulnerable communities. Significant power outages due to fallen trees and utility poles can occur especially for facilities and populations that are more rural such as in Antrim, Hillsborough, Lyndeborough and Mason. Additionally, the western side of the county, where these towns are located, is more remote and less densely populated adding additional vulnerability concerns. Essential facilities and community lifelines for all of these communities are greatly impacted by severe winter weather due to the potential impacts of disruption of communication and roadway accessibility.

Background and Evolving Hazard Information

New Hampshire's natural climate allows for frozen precipitation to occur during the winter months, most commonly between December and March, when the average high temperature ranges between 36°F and 44°F and average monthly snowfall ranges between 11 and 18 inches. On average, New Hampshire receives a total annual snowfall of 61 inches.[5] Due to natural variations in climate and synoptic meteorology patterns, it is not impossible for areas of the State, especially higher elevations, to receive snow earlier or later in the year than the average.

The latest snowfall on record in New Hampshire is on May 26, on two separate years: 2013 and 1967. While most of the snowfall did not accumulate, there were small accumulations in higher elevations.[6]

With that being said, any ice accretion or compounding factors of cold temperatures, strong winds, high moisture content snow, and/or back-to-back severe winter weather can cause major disruption, property and utility damage, injuries, and deaths in the State.

Extent

Heavy Snow

The severity of a heavy snowstorm is directly dependent on how much snow is falling and how fast it is falling. This is usually expressed by the National Weather Service in the amount of inches that an affected area of the State will receive and the amount of time that they are expected to receive that snowfall in. Also, the amount of snow that falls in an hour is a unit of measurement of severity for a heavy snowstorm. Storms that produce 2 inches of snowfall in an hour or more begin to tax the ability of snowplows to keep the roadways clear, can produce blizzard like conditions when combined with wind, and can quickly lead to treacherous road conditions. The Winter Storm Warning criteria for the State of New Hampshire are as follows:

- 6" or more of snow expected in a 12-hour period –or
- 9" or more of snow is expected in a 24-hour period –or
- a combination of snow, ice, and/or wind that produces life threatening impacts is expected.
- The criteria is planned to change and is listed in the heavy snow at the top of the document.
  The mixed precipitation threshold remains.

NOAA has developed the Regional Snowfall Index (RSI) which is a snowfall impact scale that uses the area of snowfall, amount of snowfall, and population to attempt to quantify the societal impacts of a snowstorm.[7] The RSI is an evolution of the previous Northeast Snowfall Impact Scale (NESIS).

Regional Snowfall Index (RSI), NOAA			
Category	**RSI Value**	**Description**	**Approximate % of Storms**
0	0-1	N/A	54%
1	1-3	Notable	25%
2	3-6	Significant	13%
3	6-10	Major	5%
4	10-18	Crippling	2%
5	18+	Extreme	1%

Blizzard
As a blizzard has specific scientific conditions that are either met or not met for a storm, the RSI scale referenced above could assist in the severity rating of a blizzard.

Nor'easter
The severity of a Nor'easter is directly dependent on the time of year and the type of weather that the Nor'easter brings. Nor'easters during the winter can cause heavy snowfall, blizzard conditions, ice, and strong winds. Occasionally these strong coastal low-pressure systems will occur during the summer and can produce significant rainfall, cause flooding, and generate tornadoes or straight-line wind events (micro/macrobursts). The severity of Nor'easters along coastal areas can also be measured by using storm tide and storm surge levels as described in the coastal flooding section.

Ice Storm
The Ice Storm Warning criteria for The State of New Hampshire is an accumulation of $^{1}/_{2}$" of elevated flat ice accumulation or greater (this may change to .75" in the future). Note: the NWS official ice accretion forecasts are in provided in Elevated Flat Ice Accretion, which is a different forecast than Mean Radial Ice Thickness. The number of variables that need to be taken into consideration to accurately measure the intensity of an ice storm make the process difficult. Only a limited number of weather stations, are able to measure ice accumulations; therefore, observers must report accumulations to the weather service to get an accurate depiction of the severity of an icing event. Furthermore, ice accumulation can vary drastically over topography and over short distances, making interpolation of reported values less accurate.[8]

Impacts

All severe winter storms present a hazard to life, property, and the environment. Although winter is an annual, expected, occurrence in the State of New Hampshire, the cold temperatures, precipitation, wind, and slippery conditions result in numerous injuries and deaths each year due to exposure and traffic accidents. Even in the absence of *severe* winter weather, the winter season presents a threat for extreme cold temperatures, placing people and animals at risk for hypothermia and frostbite resulting in temporary to permanent injuries or death.

Seasonal build-up of snow and ice can cause damage to property and the environment by collapsing buildings, destroying utility infrastructure/lines, and damaging trees and vegetation. Property owners should always be aware of snow load on structures throughout the winter and should be regularly clearing roofs and outbuildings. While a single large storm may cause a structural collapse, the threat of a structural collapse increases throughout the winter season, especially if there are frequent snowstorms with high total accumulations.

There are also secondary impacts that occur because of severe winter weather. The first is carbon monoxide poisoning. Numerous people are injured and killed annually through the improper use and/or venting of generators or heating equipment. Structure fires are also a result of improper use and venting of generators, heating equipment, and improper cleaning of chimneys/vents.

Heavy Snowstorm

A heavy snowstorm can bring a significant amount of snowfall to the affected area(s), which can result in treacherous and impassability of roadways, damage to infrastructure and buildings due to snow load (exacerbated when the snow has a high moisture content increasing the density of the snow), power outages and long-term utility outages, closed businesses and economics, as well as the impacts listed above.

Blizzard

Blizzard conditions present an immediate danger to people and pets that are outside due to the bitterness of the wind and lack of visibility. Frostbite and hypothermia can occur very quickly to exposed skin in blizzard conditions. Anyone who is out walking or driving (vehicles, snowmobiles, etc.) can be injured or killed due to the lack of visibility – whiteout conditions can come suddenly and without warning.

Nor’easter

Nor’easters have the potential to impact the State to a higher degree than hurricanes and tornadoes as they occur more frequently. These storm systems also have a much larger diameter than a hurricane and therefore affect a much larger geographical area. The impacts of a Nor’easter include: storm tides and surges that lead to beach erosion along the coast; heavy precipitation (rain, snow, sleet, freezing rain, and a mixture) that cause inland flooding and/or ice jams; riverine erosion; damage to roads and drainage infrastructure; heavy winds which can damage buildings, utility infrastructure, and trees; ice; and secondary hazards which result from structure fires and carbon monoxide poisoning.

Ice Storms

Ice storms are incredibly dangerous and can cause severe impacts and millions of dollars in damages. Ice can increase the weight of branches by 30 times and a 'A” of ice coverage on powerlines can add 500lbs of extra weight. The 1998 Ice Storm caused more than $1.4 Billion in damages to Northern New York and New England. Travel can become extremely dangerous with any amount of ice accumulation. When there is $^{1}/_{4}$ to 'A” of ice accumulation, damage to trees and powerlines causes utility outages and road closures. Additionally, dangerous road conditions and other impacts, as described above, may occur. Any ice accumulation greater than 'A” can be catastrophic, resulting in much more severe tree and utility infrastructure damage that will require extensive recovery efforts and lead to widespread power outages that may last days or weeks.[9]

Costs associated with clearing State roads are projected and incorporated into yearly budgets, limiting the economic impact on fiscal budgets, with the exception of above average snowfall years. The table below shows NH DOT – Highway Maintenance and Turnpike statistics from State fiscal years 2014-2018, each running from July 1st through June 30th, which highlights the costs and staffing hours associated with snow and ice removal from State roads.

Fiscal Year	Dollars Spent	Hours Plowing	Lane Miles Plowed
2014	$49,224,351	314,525	2,754,363
2015	$51,384,184	338,259	2,912,211
2016	$33,781,401	176,250	1,517,337
2017	$52,682,990	340,116	2,861,940
2018	$52,586,251	299,845	2,552,029
2019	$54,883,318	299,659	2,385,397
2020	$46,972,187	248,232	2,036,049
2021	$45,055,519	200,528	1,712,851
2022	$52,499,865	218,906	1,957,620

(Source, NH DOT)

Previous Occurrences:

Severe winter weather occurs on an annual basis and frequently results in traffic disruptions, traffic accidents, fires, and short-term power outages. On a localized scale, people are injured and killed due to primary and secondary effects of severe winter weather annually.

While these events occur with high frequency, by and large a significant coordinated response is not required, the State's emergency response capabilities as a whole are not taxed. Preparations and monitoring occur for each and every potential storm and some coordination is done, such as conference calls between the National Weather Service, NH HSEM, state department heads, local communities, and schools; however, this is mostly a preparedness and response function.

For the purposes of this plan, as severe winter weather is completely unavoidable in New Hampshire, events summarized below are those events which caused significant damages, had long duration impacts, resulted in numerous injuries and deaths, required a major coordinated effort, and/or presented a unique set of hazards or challenges. This will allow for an understanding of the major potential impacts that the state is susceptible to in larger events and can be used to determine potential mitigation actions to limit these impacts.

Previous Occurrences: History of Severe Winter Weather Events in New Hampshire

Event Date	Event Description	Impacts	Location	Additional Information
3/14/2022	Nor'easter	Heavy Wet Snow; 3+ feet in parts of Cheshire County. 45% of Cheshire County was without power at the height of the storm	Statewide	
12/22 – 12/25/2022	Severe Winter Weather and Inland Flooding	Heavy wet snow and high wind gusts; fastest wind speed recorded on land at MWOB	Statewide	This storm resulted in Major Disaster Declaration DR 4693

Event Date	Event Description	Impacts	Location	Additional Information
3/13/2018	Heavy Snow	The storm brought heavy snow to all of NH with the greatest amounts across the southeastern part of the State.	Statewide	Snowfall totals ranged from about 15 to 29 inches across the State. In addition, blizzard to near blizzard conditions were reported in coastal Rockingham County from mid-morning through mid- afternoon. This storm resulted in DR- 4371
3/1-9/2018	Snow and Coastal Flooding	Back-to-back coastal storms produced high winds, a large storm surge, and large battering waves along the New Hampshire coast. This storm resulted in DR-4370.	Statewide	Particularly hard hit were coastal communities along the seacoasts of New Hampshire and southwestern Maine where the large battering waves damaged roads and infrastructure along the coast. Although tide levels were below flood levels for some of this period, the large waves continued to produce damage at the times of high tide.
1/4/2018	Heavy Snow and Coastal Flooding	The storm brought 10 to 15 inches of snow to much of New Hampshire, with lesser amounts along the Connecticut River Valley.	Statewide	The energy from a storm slipping southeast from the Great Lakes merged with the energy from low pressure off the southeast U.S. coast to form an intense area of low pressure off the mid-Atlantic coast by the morning of January 4th. The intense low brought heavy snow and high winds to much of the region, with blizzard conditions to the Seacoast area. In addition, the storm brought coastal flooding and erosion along the coast.
3/14/2017	Heavy Snow	High winds and/or heavy wet snow downed trees and created numerous power outages across southeastern portions of the State. Snowfall amounts across New Hampshire ranged from about 12 to 20 inches. In the Seacoast area, the strong winds combined with heavy wet snow to cause numerous power outages. . Farther inland, across Belknap and Carrol Counties, the strong winds downed trees onto	Statewide	The storm brought heavy snow to all of New Hampshire with high winds leading to blizzard or near blizzard conditions across much of central and southern portions of the State. Much of the snow in any given area fell during about a six-hour window with weather spotters reporting snowfall rates of 2 to 3 inches per hour. Some of the stronger wind gusts across New Hampshire included 82 mph at the Isle of Shoals, 62 mph in Portsmouth, 45 mph in Laconia, 41 mph in Concord, 40 mph in Manchester, 38 mph in

		roads and wires leading to blocked roads and power outages. Particularly hard hit was a section of Route 109 in the Town of Tuftonboro where downed trees snapped utility poles and brought down wires. This storm resulted in DR-4316.		Whitefield and Rochester, and 37 mph in Keene.
2/9/2017	Heavy Snow	Snowfall amounts generally ranged from several inches in Coos County to more than 15 inches in interior Rockingham County.	Statewide	An area of low pressure off the Delmarva Peninsula on the morning of the 9th intensified rapidly as it moved northeast through the Gulf of Maine during the day. The low brought heavy snow to all but Grafton and Coos Counties.
12/29/2016	Heavy Snow	Much of New Hampshire received between 6 and 16 inches of snow with lesser amounts along the Connecticut River Valley. Along the Seacoast, most of the precipitation fell as rain with only an inch or two of snowfall accumulation. Inland from the coast and across southern areas, the rain changed to a heavy, wet snow which clung to trees and wires which resulted in scattered power outages. More than 11,000 homes and businesses saw outages due to the storm.	Statewide	An area of low pressure moving northeast from the Carolinas on the morning of December 29th, combined with a low dropping southeast from Canada, to form an intense area of low pressure that moved through the Gulf of Maine during the early morning hours of the 30th.
2/14/2015	Heavy Snow	Snowfall amounts ranged from 6 to 12 inches across much of the area with up to 17 inches along the coast.	Statewide	Low pressure dropping southeast from Canada on the morning of the 14th intensified rapidly as it developed into two separate areas of low pressure southeast of Cape Cod. The two lows brought a moderate to heavy snow across the southern half of the state and near blizzard conditions along the coast.

Event Date	Event Description	Impacts	Location	Additional Information
01/26-29/2015	Heavy Snow	Snowfall amounts ranged from 10 to more than 30 inches across much of the southeastern part of the state. Elsewhere, amounts were generally 6 to 14 inches with some lower amounts in the Connecticut River Valley. This storm resulted in DR- 4209.	Statewide	An 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. Along the coast, large waves combined with a storm surge produced coastal flooding and splash over. In Hampton, the Tuesday morning tide was 1.43 feet above flood levels, inundating many streets on the bay side of town.
2/5/2014	Heavy Snow	Six to twelve inches of snow fell across eastern Hillsborough County. Eight to thirteen inches of snow fell across western and central Hillsborough County. Six to 9 inches of snow fell across Cheshire County.	Statewide	Low pressure moving off the mid-Atlantic coast intensified as it moved northeastward over Nantucket. This spread heavy snow across all of southern New England.
01/02-03/2014	Heavy Snow	The storm brought 6 to 14 inches of snow across the much of the state south of Coos County.	Statewide	

Event Date	Event Description	Impacts	Location	Additional Information
02/08-10/2013	Blizzard "Nemo"	The state received over two feet of snow in many areas of central and southern New Hampshire. Travel was hampered while plow trucks cleared roadways; however, most drivers stayed off roadways. Incident delivered a significant amount of snow in a short period of time, but only limited power outages and damages were reported. Received Disaster Declaration related to debris removal. DR-4105	Statewide	
10/29/2011 – 10/30/2011	"Snowtober" Nor'easter	A significant early snowstorm dropping heavy wet snow struck New Hampshire when a lot of the leaves were still on the trees causing a large amount of damage to trees and power infrastructure. Nearly $4.5 Million in Damages. DR-4049	Statewide	Thundersnow was observed in the southern part of the state.
02/23/10 – 03/03/2010	Severe Winter Storm	Extreme winds caused significant amount of power outages, massive amount of debris, and nearly $20 Million in Damages. DR-1892	Statewide	
02/14/1986 – 02/15/1986	Ice Storm	Fierce Ice Storm in higher elevations in the Monadnock Region. 10 Miles wide of Ice from Massachusetts border to New London, New Hampshire	Western New Hampshire	
01/08/1979 – 01/5/1979	Ice Storm	Major Disruption to power and transportation	Statewide	
01/27/1966 – 01/31/1966	Severe Winter Storm	Large amount of snowfall resulting in disruption of power and transportation	Statewide	
02/03-04/1961	Heavy Snow and Wind	8-40" of snow and hurricane gale force winds across New England	Statewide	
01/19-20/1961	Heavy Snow	24" of snowfall	Statewide	
12/12/1960	Heavy Snow and Wind	13-17" of snow and winds between 36-51 MPH across New England	Statewide	
02/14-17/1958	Heavy Snow	10-20" of snowfall across New England	Statewide	
12/17-20/1929	Ice Storm	Unprecedented disruption and damage to telephone, telegraph, and power system	Statewide	

Impact of Climate Change on Hazard	
Climate Change Projection	**Impact on Hazard**
Increase in Sea Level	N/A
Increase in Precipitation	An increase in severe winter weather could potentially lead to an increase in winter precipitation. There are four main categories of winter precipitation described above in the hazard narrative, and an increase in all of these categories are possible. This possible increase could result in an increase of unsafe structures due to increased weight to do snow, ice, and rain accumulating on rooftops. It could also lead to structure roof collapses, therefore leading to personal safety being compromised. An increase of winter precipitation also creates unsafe travel conditions throughout the state. These events also use a considerable amount of resources to deal with the clean-up associated with these storm events.
Increase in Temperature	N/A
Increase in Severe Weather	Increase in frequency and intensity of extreme winter weather will potentially impact coastal storm surges, splash over and coastal erosion, including inundation of coastal and marine ecosystems. An increase of this type of severe weather impacts the state by creating unsafe travel conditions for all modes of transportation.

Individuals/ Communities Disproportionately Impacted by Hazard	
Individual/Community	**Description of Increased Impact**
Socially Vulnerable Populations (due to income, education, health care access, and housing)	• May live in locations that are prone to climate-related health hazards • May have greater rates of existing medical conditions, • May live in poorly maintained or aging infrastructure that may not be able to handle climate-related event • May struggle to access resources and care • May experience limited financial resources or cultural, language, or other barriers that restrict their access to health care, social services, and safe, nutritious food
Children	• Their developing bodies can make them more vulnerable to hazards like heat and poor air quality. • Children breathe at a faster rate, increasing their exposure to dangerous air pollutants. • Spending more time outdoors than adults, increases their exposure to heat and cold, rain and snow, outdoor allergens, and insect bites. • Higher water intake can increase exposure to certain contaminants in recreational waters and the risk of developing gastrointestinal or other illnesses.

	• Children can experience mental health impacts from extreme events that are expected to increase with a changing climate. • Dependance on others for care increases vulnerability
Individuals Aged ≥ 65 Years	• Older people are less able to compensate for the effects of certain environmental hazards, such as air pollution. • Older adults are more likely to have health conditions that make them more sensitive to climate hazards like heat and air pollution, which can worsen their existing illnesses. • Limited mobility, increasing their risks before, during, and after an extreme weather event. • Some medications can change the body's ability to respond to heat, increasing risk for heat illnesses and death as the climate warms. • Aging can impact the immune systems, increasing risk for extreme reactions related to heat, insect- and tick-related diseases, and water-related illnesses. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with a Disability/Disabilities	• Decisionmakers may not fully consider people with disabilities in their planning. One reason for this is that climate change effects on people with disabilities have not been studied as much as other vulnerable populations. • Emergency warnings and other important messages may not be available in formats that are accessible to individuals with certain disabilities (such vision or blindness, hearing loss, or mobility issues). • Necessary medical care may be disrupted before, during, and after an event, including due to evacuations, transportation system or health infrastructure damages, or power outages. • Increased likelihood that they may have additional social and economic risk factors, such as poverty and unemployment, that put them at greater risk. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with Pre-existing or Chronic Health Conditions (including behavioral health)	• Chronic medical conditions may increase risk of illness and death, particularly exposure to heat, extreme weather events, water-related illnesses, and poor air quality. • Necessary medical care may be disrupted before, during, and after an event, including due to evacuations, transportation system or health infrastructure damages, or power outages. • Some medications can affect the body's response to heat, increasing risk for heat illnesses. • Some conditions/medications compromise the immune system, increasing risk for extreme reactions related to heat, insect- and tick-related diseases, and water-related illnesses. • Individuals with chronic behavioral health conditions may be

	more vulnerable to trauma from extreme weather events, as well as disruptions to support networks and mental health care. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.

ENDNOTES – HAZARD: SEVERE WINTER WEATHER

[1] http://forecast.weather.gov/glossary.php?word=HEAVY%20SNOW
[2] http://w1.weather.gov/glossary/index.php?letter=b
[3] http://www.nws.noaa.gov/om/winter/noreaster.shtml
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[5] US Climate Data 2023 | version 3.0 | by US Climate Data. NH, http://www.usclimatedata.com/climate/new- hampshire/united-states/3199
[6] https://www.wmur.com/article/memorial-day-weekend-snowfall-in-nh/5133050
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6.13 HAZARD: HIGH WIND EVENTS

Hazard Overview: High Wind Events	
HIRA Risk	High
Future Probability	High
Counties at Risk	All

Definition

The State of New Hampshire experiences two types of high wind events that may result from other severe storms and may occur at any time of the year:

Tornadoes: A tornado is a narrow, violently rotating column of air that extends from the base of a thunderstorm to the ground. Because wind is invisible, it is hard to see a tornado unless it forms a condensation funnel made up of water droplets, dust, and debris. Tornadoes are the most violent of all atmospheric storms.[1]

Straight-line winds: This term describes any thunderstorm wind that is not associated with rotation and is usually used to differentiate from tornadic winds. There are several sub-types of straight-line winds[2]:

Downdraft – small-scale column of air that rapidly sinks towards the ground.

Downburst – result of a downdraft; referred to as a macroburst when the area affected is greater than 2.5 miles and microburst when less than 2.5 miles.

Gust Front- leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. Characterized by wind shift, temperature drop, and gusty winds in front of a thunderstorm.

Derecho - widespread, long-lived windstorm that is associated with a band of rapidly moving showers or thunderstorms. A typical derecho consists of numerous microbursts, downbursts, and downburst clusters. If the wind damage swath extends more than 240 miles and includes wind gusts of at least 58 mph or greater along most of its length, then the event may be classified as a derecho.

Location

The entire State is at risk for high wind events.

The below locations are examples which were highlighted through a combination of efforts which included a survey completed by the RPCs and NH HSEM field staff, historical data, and the National Risk Index.

In 2022, there was a tornado that touched down in Chesterfield (Cheshire County) causing property damage. A tornado was confirmed more recently in July of 2023 that left damages in Marlborough (Cheshire County) and Dublin (Cheshire County). Marlborough, trees came crashing down onto cars and in Dublin, trees fell on a car outside the Dublin School. There was also a solar array damaged. No injuries were reported.

In July and August of 2020, in Jaffrey (Cheshire County), there were two events that caused downed trees and powerlines as well as trees on houses and vehicles. There were no reported injuries. The public works, fire and police departments all responded to the events and assisted with rerouting traffic, while debris removal and powerlines were removed from unsafe areas. It is unknown the dollar amount of damages caused by these events. Notably, the potential impacts include structural damage, loss of life or injury, as well as disruption of utility services.
In the Town of Pittsfield (Merrimack County), the center and northern sections of Pittsfield are forested, and its Class V and Class VI gravel roads run the risk of isolation through debris impacted infrastructure (trees down on roads and powerlines) after a tornado, resulting in power failure with little emergency access until the way is cleared. Wooded and forested sections of Town are vulnerable to tree fall. One-egress roads and remote neighborhoods are especially vulnerable to high wind events, including tornadoes.

The City of Franklin (Merrimack County) combines severe wind and tornado within its Local Hazard Mitigation Plan. Severe wind events can occur anywhere in Franklin though the higher elevations are more susceptible. More than a half dozen events have been recorded in just over a decade resulting in varied impacts. Wind impacts have previously caused damage to trees and powerlines and in a nearby community a large fiber communication cable fell across the highway.

Background and Evolving Hazard Information

Although not typically thought of as an area that is susceptible to tornadic activity, the State experiences at least one confirmed tornado annually and numerous straight-line wind events each year. One of the earliest tornadoes occurred in September of 1821 when a tornado passed from the Connecticut River near the town of Cornish to the Town of Boscawen leaving 6 dead, hundreds injured, and thousands homeless. In 1998, an F2 tornado in Antrim blew down a large section of the Great Brook Middle School, and in 2008, another F2 tornado affected five counties in New Hampshire by downing trees, closing roadways, leaving 100 homes uninhabitable, cutting off phone and electric service to 12,500 customers, and killed one person when their home collapsed. Microbursts are a frequent hazard in the state with multiple events per year, with many more happening than are officially documented. The NWS conducts official storm damage surveys (high wind assessments) to determine if a tornado occurred or not.

Extent

Tornadoes are measured based on the 3 second gust wind speed of the rotational winds. The Fujita Scale was developed at the University of Chicago in 1971 by Tetsuya Theodore Fujita in coordination with what is now known as NOAA's Storm Prediction Center to categorize each tornado by its intensity and estimated wind speeds. This scale is based off the Beaufort scale and Mach Numbers.

Enhanced Fujita Scale	
EF Number	3 Second Gust (MPH)
0	65-85
1	86-110
2	111-135
3	136-165
4	166-200
5	Over 200

The Fujita scale was updated in 1973 and continued to be used for several more decades. Over the years the following weaknesses were identified in the Fujita Scale:

- Subjective based solely on the damage caused by tornado
- No recognition of different [building] construction
- Difficult to apply with no damage indicators (if 3/4-mile-wide tornado does not hit a structure, what F-Scale should be assigned?)
- Subject to bias
- Based on worst damage (even if only one building)
- Overestimates wind speeds greater than F3

Downbursts are primarily based on their size, but consideration is also given to duration and wind speed.[3]

Downburst Classification		
	Microburst	**Macroburst**
Size	Less than 2.5 Miles	Greater than 2.5 Miles
Duration	5-15 Minutes	5-30 Minutes
Wind speed (3 second gust - MPH)	up to 168 miles per hour	Damaging winds causing widespread damage, possibly as high as 134 mph[4]

Enhanced Fujita Scale Damage Indicators	
Number	**Damage Indicator**
1	Small barns, farm outbuildings
2	One- and two- family residences
3	Single-wide mobile homes
4	Double-wide mobile homes
5	Apt, condo, townhouse (3 stories or less)
6	Motel
7	Masonry apt or motel
8	Small retail building (fast food)
9	Small professional (doctor office, branch bank)
10	Strip mall
11	Large shopping mall
12	Large, isolated "big box" retail building
13	Automobile showroom
14	Automotive service building
15	School – 1 – story elementary (interior or exterior halls)
16	School – Jr. or Sr. high school
17	Low-rise building (1-4 story)
18	Med-rise building (5-20 stories)
19	High-rise building (over 20 stories)
20	Institutional building (hospital, government, or university)
21	Metal building system
22	Service station canopy
23	Warehouse (tilt-up walls or heavy timber)
24	Transmission line tower
25	Freestanding tower
26	Free standing pole (light, flag, luminary)
27	Tree – hardwood
28	Tree – softwood

Impacts

All high wind events can result in significant damage to property and the environment as well as can represent a serious threat to personal safety as flying debris can cause serious bodily harm and/or death. Tornadoes, specifically, are assessed against 28 different damage indicators to classify the event.

Safety and Security	Food, Water, Shelter	Health and Medical	Energy (Power & Fuel)	Communications	Transportation	Safety and Security
Utility outages, structure damage as well as injury can require mutual aid support and additional dispatch assistance. Damage to communication systems can delay response.	Shelters can be required to house those damaged homes, and those without utilities. Long term shelter options may be required. Established shelters can sustain damage based on location.	Hospitals may experience medical surge, and sustain damage to facilities.	Utility outages will occur. Sustained high winds will prevent restoration efforts. Gas stations may not be operational.	Public and government owned communication towers may sustain damage due to wind damage, causing disruption in service.	Airports cannot operate with sustained high winds, causing delays and outages. Bridges and roads can sustain damage, or become blocked by debris.	Hazardous Material storage facilities may sustain damage requiring intervention.

Previous Occurrences: History of Downburst Events in New Hampshire

Event Date	Event Description	Impacts	Location	Additional Information
08/03/2018	Microburst	Damage to trees and homes near Sawyer Lake.	Gilmanton	Winds up to 80 mph, hail, and torrential rainfall.
07/28/2018	Microburst	More than 45 properties damaged by hurricane force winds and hail associated with a microburst. Eight people were injured when a tree crashed through the roof of a cabin. Many downed trees and wires.	Bow Lake, Strafford County	Eleven people huddled near a stone fireplace within a cabin for protection. Eight people were injured—two required transport to the hospital after a beam came down and hit one in the head and the other in the back.
07/20/2017	Microburst	Dozens of trees blown down, thousands of people without power across multiple towns, multiple roads closed	Route 125 Barrington	
07/18/2016	Macroburst	Hundreds of trees were brought down closing numerous roads, thousands without power, significant property damage	Sweet Hill Road, Route 108, Forest Street and Red Oak Drive Plaistow	Wind event spread from Plaistow, New Hampshire to Cohasset, MA (~50 miles) according to the NWS in Taunton, MA

10/30/2012	Microburst	Several large trees came down, landing on two summer homes, demolishing one. No injuries were reported.	Franklin	
07/04/2012	Microburst	Several large trees came down landing on homes or parked vehicles, 30 homes damaged and 12 people were sheltered at a local hotel	Tilton	
09/06/2011	Microburst	15 campers damaged, $200,000 in damages, 2,000 without power	566 Route 3A Bow	"Some of these things were pushed up to 60, 70, 80, 90 yards," said Lee Kimball of Bow Emergency Management. "Apparently, one got airborne and took out the three primary lines and snapped a pole before being dumped on the other side of the street."
07/06/1999	Macroburst	2 fatalities, 2 roofs blown off structures, downed trees, widespread power outages, and damaged utility poles and wires	Merrimack, Grafton, and Hillsborough Counties	
07/26/1994	Microburst	Downed trees, utility poles and wires, 1,800 homes without power, and 50-60 homes damaged	Moultonborough	
08/18/1991	Microburst	11 Injured, 5 killed, and nearly $2.4 Million in damages	Stratham	

Previous Occurrences: History of Tornado Events in New Hampshire

Date	EF	Fatalities	Injuries	Width (Yards)	Length (Miles)	Affected Counties	Damage	Touch Lat	Touch Lon	Lift Lat	Lift Lon
7/18/2022	1	0	0	250	0.36	Cheshire	$2K	42.9244	-72.4543	42.929	-72.451
5/15/2022	1	0	0	330	4.8	Sullivan	$6K	43.3086	-72.3878	43.3659	-72.3362
8/22/2020	0	0	0	50	1.54	Belknap	0	43.566	-71.2714	43.566	-71.2444
8/22/2020	0	0	0	50	1.65	Carroll	$5K	43.75	-71.15	43.7383	-71.1278
6/18/2018	0	0	0	25	9.45	Grafton		44.15	-72	41.1	-71.83
6/18/2018	0	0	0	20	0.2	Grafton		44.08	-71.72	44.08	-71.72
5/4/2018	1	0	0	300	36	Sullivan and Merrimack	-	43.1594	-72.408	43.291	-71.729
7/18/2016	0	0	0	200	2.02	Coos	-	45.0685	-71.342	45.07	-71.301
7/30/2015	0	0	0	100	0.42	Merrimack	-	43.2866	-71.828	43.29	-71.822
7/24/2014	0	0	0	10	0.02	Belknap	-	43.687	-71.305	43.686	-71.304
7/4/2014	0	0	0	10	0.36	Belknap	-	43.5868	-71.352	43.587	-71.344
7/24/2008	2	1	2	880	50.46	Rockingham Merrimack, Belknap, Strafford, Carroll	-	43.15	-71.31	43.85	-70.99
8/25/1969	3	0	0	17	5.7	Grafton	$5K-$50K	43.87	-71.7	43.95	-71.7
8/20/1968	3	0	1	27	1	Hillsborough	$5K-$50K	43.1	-72.8	Unk.	Unk.
5/20/1963	3	0	0	100	14	Cheshire, Hillsborough	$5K-$50K	42.9	-72.1	43.07	-71.93
6/9/1953	3	0	5	100	1.5	Rockingham	$5K-$50K	42.97	-70.97	Unk.	Unk.

Event Date	Event Description	Impacts	Location	Additional Information
August 25, 1969	Severe Thunderstorm with hail, possible tornado	Hail up to and over 2" in diameter fell in an area 7-8 miles long and 2 miles wide, stripped leaves from trees, littered ground with leaves 2"+ deep. Windows broken, gardens and crops destroyed, trees uprooted and broken, some damaging buildings. Four cars damaged by falling trees.	Thornton and Woodstock – Grafton County	Tornado funnel may have only barely touched the ground.
July 12, 1970	Severe Thunderstorm with hail, wind, lightning	Large hail up to 2" in diameter in Laconia. Extensive damage to fruit and vegetables in Peterborough, where hail accumulated to 1.5" deep on ground.	Belknap County	Scattered wind and lightning damage, including utility outages.
August 17, 1970	Thundersquall with hail, wind, lightning, and tornado	A small tornado cut 30-yard path around ¼ mile long in Winchester. All trees in path her uprooted or broken near ground. Hail 2"+ dented cars. The thundersquall entered MA and re-entered NH continuing through Hollis and Southern Nashua. Few reports of funnel in this area. Falling trees damaged homes and crushed some cars. Lightning damage including the starting of 28 fires, with one home nearly total loss. Utility failures. Crops flattened by rain, wind, and hail.	Winchester in Cheshire County; Hollis and Nashua in Hillsborough County	Associated with a thundersquall in MA.
July 11, 1980	Severe Thunderstorm with lightning and hail	Severe thunderstorms across the state with southern areas hardest hit. Reports of hailstones up to 2" (Milford) and "golf ball" sized in Merrimack causing scattered crop damage and possible damage to buildings and vehicles. Lightning caused scattered power outages, fires, and damage to buildings, trees, utility poles, and transformers.	Statewide, with most severe in Hillsborough County (Hancock, Milford, Merrimack, Nashua, Litchfield,) and into Rockingham County (Derry, Londonderry).	Severe thunderstorm Watch was in effect from 1pm to 7pm and extended to 8pm.

August 24, 1998	Severe Thunderstorm with hail and high winds	A severe thunderstorm dropped golf ball – to baseball-sized hail (up to 2.75”) and caused high winds from Tamworth to Freedom. The hail broke windshields and windows, and dented cars while fallen trees blanketed the roadways. Route 153 and Cleveland Hill Roads were closed. Some trees fell on buildings in the area. An automobile dealership in Ossipee had numerous dented cars. The damage was extensive along Route 16. In addition to downed trees, canoes were damaged at the Ossipee Lake Campgrounds. Based on the damage to trees, winds were estimated to be more than 58 mph.	Freedom and Tamworth, Carroll County	
July 11, 2006	Severe Thunderstorm with hail, high wind, and lightning	Severe thunderstorms with lightning, hail, and wind. Lightning strikes to at least three homes caused total or significant destruction. Hail stones 2”+ reported in multiple towns (Exeter, Hampton Falls). Multiple people injured due to lightning strikes. 3” – 5” fell causing minor flooding	Rockingham County	
July 9, 2007	Severe Thunderstorms with hail and damaging winds	An extended period of severe thunderstorm activity affected much of southern New Hampshire from the early afternoon through the evening hours of July 9th. Numerous reports of large hail and damaging winds were fielded during this event. Concord reported 2” diameter hail. Downed large branches in Lebanon. Wind gusts of 67 and 69 mph measured at the Lebanon Airport.	Merrimack, Grafton, Belknap, and Rockingham Counties	

June 22, 2008	Severe Thunderstorms with hail and damaging winds	Severe thunderstorms developed in western New Hampshire during the late morning hours of June 22nd and spread eastward during the early afternoon. These storms produced damaging winds and hail across central and southern New Hampshire. Baseball size hail (3”) was reported at Mt. Cardigan in Orange.	Orange, Grafton County	
July 18, 2008	Severe Thunderstorms with hail, very heavy rain, and damaging winds	A stationary front over southern New Hampshire became the focus for severe thunderstorm activity as a short wave approached the region from the west. Low level shear quickly increased during the late morning and early afternoon setting the stage for a major severe weather outbreak. Large hail (up to 2” in diameter reported in Strafford County) damaging winds and very heavy rain were associated with these storms which began developing in the early afternoon and lasted into the evening hours.	Strafford, Carroll, Grafton, Belknap, Merrimack, and Rockingham Counties	

June 6, 2011	Severe Thunderstorms with hail, very heavy rain, and damaging winds	The squall line pushed into central and southern New Hampshire by midafternoon and reached the coast by early evening. Good heating ahead of this line with dew points in the upper 60s to lower 70s resulted in capes of 1500 to 3000 j/kg across much of the region. Although shear was limited, stronger cells moving around 35 kts transported strong mid-level winds to the surface resulting in numerous reports of wind damage. Up to 45,000 people were without power by late afternoon in southern New Hampshire. Stronger cells also produced quarter to golf ball size hail. Washington reported hail 2" diameter.	Washington, Sullivan County;	Broad shortwave crossing southern Canada pushed an associated cold front into southern Canada during the early afternoon. A pre-frontal trough moved into eastern New York during the early afternoon with individual cells and line segments forming into one large squall line with bowing segments.
May 29, 2012	Severe Thunderstorms with hail, very heavy rain, and damaging winds	Three high precipitation supercell thunderstorms moved in the same path over central Cheshire County. These thunderstorms each produced two to three inches of rain, with most of it falling over Surry, Gilsum, and Keene and to a somewhat lesser extent over Sullivan, Walpole, and Westmoreland. The NWS cooperative observer at Surry Mountain Dam recorded 6.91 inches of rain total, while the Taunton WSR-88D radar estimated storm total rainfall of up to 8 to 9 inches in less than a couple of hours. This resulted in flash flooding across much of this area. Westmoreland reported hail 2" diameter.	Cheshire and Hillsborough Counties	A warm front moved through southern New Hampshire early Tuesday morning, leaving the area in a very moist, warm, and unstable airmass. Tuesday afternoon a cold front began moving across western New York and approaching southern New Hampshire. As the front made its way across this area, it set off showers and thunderstorms across much of eastern New York and western Massachusetts in an especially moist environment. These storms eventually moved over parts of southern New Hampshire.

July 3, 2014	Severe Thunderstorms with hail, heavy rain, and damaging winds	A warm and very humid air mass remained in place across the region on the afternoon of July 3rd. A slow-moving cold front to the west of the area triggered afternoon convection which quickly became severe. Large hail and damaging winds affected a large portion of the forecast area.	Rockingham , Grafton, Sullivan, Belknap, Carroll, and Merrimack Counties	
July 19, 2015	Severe Thunderstorms with hail and damaging winds	High instability and increasing shear helped to develop more organized supercells and lines of thunderstorms. Large hail and damaging winds were prevalent with these storms. Rochester (Strafford County) reported hail 2.5" in diameter.	Strafford, Carroll, Belknap, Sullivan, Merrimack, Coos Counties.	A cold front approaching from the west initiated afternoon convection across Eastern New York and Western New England on the afternoon of the 19th.
May 21, 2022	Severe Thunderstorms with hail and damaging winds	Severe thunderstorms reached the New Hampshire border during the evening on May 21st that dropped 1.75 to 2 inch hail stones in Dixville Notch. Convective outflow damaging winds downed trees in at least one municipality. Hail damage to vehicle reported.	Coos County	An unseasonably hot and humid airmass was firmly in place across New England with highs well into the 80s across the interior mountains. A pre-frontal trough ahead of an approaching cold front triggered a long line of severe thunderstorms that had a history of causing wind damage across Quebec province.
August 26, 2022	Severe Thunderstorms with hail and damaging winds	A line of thunderstorms developed across Vermont and quickly moved across the state from west to east during the early to midafternoon hours. Some storms embedded within the line become severe bringing damaging wind gusts and large hail. A severe thunderstorm dropped hail the size of golf balls with a few stones being reported as 2" in diameter northwest of Wolfeboro in Melvin Village. Severe weather was more concentrated along the Connecticut River Valley and Lakes Region.	Carroll, Grafton, Sullivan, Cheshire, Belknap Counties	A pre-frontal trough ahead of strong cold front and surface low over New York state interacted with a hot and humid airmass on the afternoon of August 26th.

Impact of Climate Change on Hazard	
Climate Change Projection	**Impact on Hazard**
Increase in Sea Level	N/A
Increase in Precipitation	N/A
Increase in Temperature	Increase in high wind events will accelerate the drying of streams and wetlands across the state. This will exacerbate drought and dry conditions throughout the state, and in-turn, will create an increased wildfire risk. When wildfires do happen, increased high wind events will create additional hazards and dangerous conditions for emergency crews working to contain these fires. High wind events could also prevent mitigation efforts when fires do break-out due to the conditions being too dangerous for emergency crews due to wind. Consequently, we could potentially see an increase in both the numbers of wildfires, and in increase in the loss of property and natural resources due to the increased high wind events.
Increase in Severe Weather	Increase in frequency and intensity of storms will create more frequent and more damaging high wind events. This will lead to additional damage being created from these storms. One example being more extreme and widespread power outages statewide due to increased sustained wind speeds and increased and sustained wind gusts during these storms. This will result in greater damage to natural resources, property and infrastructure. The increased damage and loss to the electrical infrastructure will also lead to larger, more complex, and longer lasting restoration efforts for each storm that occurs.

Individuals/ Communities Disproportionately Impacted by Hazard	
Individual/Community	**Description of Increased Impact**
Socially Vulnerable Populations (due to income, education, health care access, and housing)	• May live in locations that are prone to climate-related health hazards • May have greater rates of existing medical conditions, • May live in poorly maintained or aging infrastructure that may not be able to handle climate-related event • May struggle to access resources and care • May experience limited financial resources or cultural, language, or other barriers that restrict their access to health care, social services, and safe, nutritious food

Children	• Their developing bodies can make them more vulnerable to hazards like heat and poor air quality. • Children breathe at a faster rate, increasing their exposure to dangerous air pollutants. • Spending more time outdoors than adults, increases their exposure to heat and cold, rain and snow, outdoor allergens, and insect bites. • Dependance on others for care increases vulnerability
Individuals Aged ≥ 65 Years	• Older people are less able to compensate for the effects of certain environmental hazards, such as air pollution. • Older adults are more likely to have health conditions that make them more sensitive to climate hazards like heat and air pollution, which can worsen their existing illnesses. • Aging can impact the immune systems, increasing risk for extreme reactions related to heat, insect- and tick-related diseases, and water-related illnesses. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with a Disability/Disabilities	• Increased likelihood that they may have additional social and economic risk factors, such as poverty and unemployment, that put them at greater risk. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with Pre-existing or Chronic Health Conditions (including behavioral health)	• Chronic medical conditions may increase risk of illness and death, particularly exposure to heat, extreme weather events, water-related illnesses, and poor air quality. • Some conditions/medications compromise the immune system, increasing risk for extreme reactions related to heat, insect- and tick-related diseases, and water-related illnesses. • Individuals with chronic behavioral health conditions may be more vulnerable to trauma from extreme weather events, as well as disruptions to support networks and mental health care. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.

ENDNOTES – HAZARD: HIGH WIND EVENTS

[1] http://www.nssl.noaa.gov/education/svrwx101/tornadoes/
[2]http://www.nssl.noaa.gov/education/svrwx101/wind/types/
[3]https://www.weather.gov/cae/downburst.html
[4]https://www.weather.gov/cae/downburst.html

6.14 Tropical and Post-Tropical Cyclones

Hazard Overview: Tropical and Post-Tropical Cyclones	
HIRA Risk	**Medium**
Future Probability	**Medium**
Counties at Risk	**All**

Definition

A tropical cyclone is the generic term for a non-frontal synoptic scale low-pressure system over tropical or sub-tropical waters with organized convection (i.e., thunderstorm activity) and defined cyclonic surface wind circulation. Once formed, a tropical cyclone is maintained by the extraction of heat energy from the ocean at high temperature and heat export at the low temperatures of the upper troposphere.[1]
There are several stages throughout the life cycle of a tropical cyclone[2]:

- **Potential Tropical Cyclone:** Term used by the National Hurricane Center (NHC) in advisory products to describe a disturbance that is not yet a tropical cyclone, but which poses the threat of bringing tropical storm or hurricane conditions to land areas within 48 hours. This is a new term that was introduced by the NHC in the summer of 2017.[3]
- **Tropical Disturbance:** A tropical disturbance is a cluster of showers and thunderstorms that flares up over the tropics. It is typically about 100 to 300 miles in diameter and generally moves westward. Tropical disturbances last for more than 24 hours, so there's a clear distinction between diurnal convection and tropical disturbances. Lacking a closed circulation of winds, tropical disturbances do not qualify as tropical cyclones.
- **Tropical Storm:** Once the maximum sustained winds of a developing tropical cyclone reach 34 knots (39 MPH), the low-pressure system is typically called a tropical storm and is assigned a formal name. The tropical cyclone maintains a tropical-storm status as long as its maximum sustained winds are above 34 knots and less than 64 knots (74 MPH).
- **Hurricane:** Once a tropical cyclone's maximum sustained winds reach 64 knots (74 MPH), the storm becomes a hurricane (in the North Atlantic and Northeast Pacific Ocean basins).
- **Major Hurricane:** A tropical cyclone with maximum stained winds of 96 knots (111 MPH) or higher.
- **Post-tropical Cyclone:** A former tropical cyclone, this term is used to describe a cyclone that no longer possess the sufficient tropical characteristics to be considered a tropical cyclone. These post-tropical cyclones often undergo an extratropical transition and form frontal boundaries. Post-tropical cyclones can continue carrying heavy rains and high winds and cause storm surge.

A subtropical cyclone is a non-frontal low-pressure system that has characteristics of both tropical and extratropical cyclones. Like tropical cyclones, they are non-frontal, synoptic-scale cyclones that originate over tropical or subtropical waters and have a closed surface wind circulation about a well-defined center. In addition, they have organized moderate to deep convection, but lack a central dense overcast. Unlike tropical cyclones, subtropical cyclones derive a significant proportion of their energy from baroclinic sources and are generally cold-core in the upper troposphere, often being associated with an upper-level low or trough. In comparison to tropical cyclones, these systems generally have a radius of maximum winds occurring relatively far from the center (usually greater than 60 n mi), and generally have a less symmetric wind field and distribution of convection.[4]

Location

The entire State of New Hampshire is at risk for tropical cyclones. This hazard is very seasonally dependent: the Atlantic hurricane season officially runs from June 1st to November 30th each year. These dates were selected as they encompass over 97% of tropical activity; however, hurricanes have occurred outside of the official season dates. The peak of the Atlantic hurricane season falls in mid-September, followed by a lesser secondary peak in activity in mid-October.

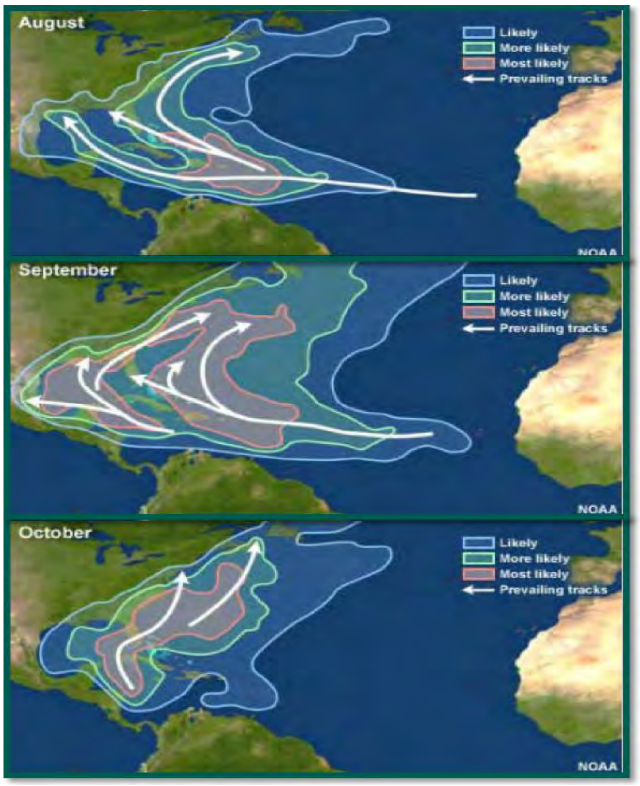
The below locations are examples which were highlighted through a combination of efforts which included a survey completed by the RPCs and NH HSEM field staff, historical data, and the National Risk Index.

New Hampshire's exposure to direct and indirect impacts from hurricanes is real, but modest, as compared to other states in the region. The probability of hurricanes occurring in Hampton (Rockingham County) and New Castle (Rockingham County) is possible. The largest impact is on the floodplain areas due to heavy rains. High winds cause trees to fall down causing power outages, structural damage to buildings, road closures, and debris management issues.

The NOAA National Climatic Data Center's Storm Events database does not list any hurricanes directly affecting Strafford County; however, Strafford County did experience impacts from Hurricane Sandy (2012) and Tropical Storm Irene (2011). Based on historical data and statistical predicators, the Atlantic Basin averages approximately 12 total named storms per year. It is anticipated that the region will be impacted by significant storm of tropical origin within the foreseeable future. Based on the high hazard ranking and assessed value of residential, commercial, and utilities structures, there is approximately $208,929,340 in estimate potential losses from hurricanes and tropical storms.

Background and evolving hazard information

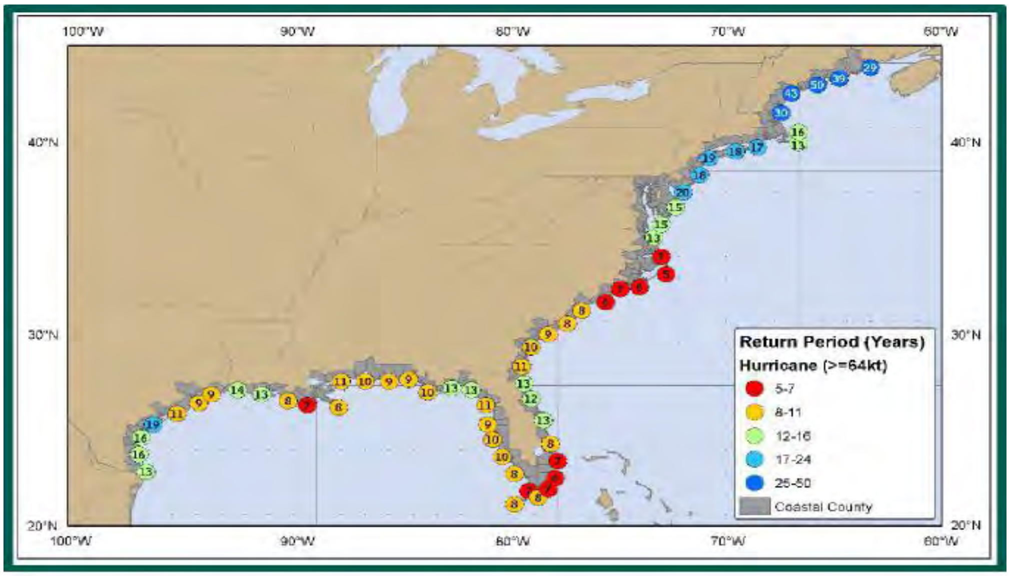
New Hampshire has been identified as a potential affected area for Hurricanes through the NWS National Hurricane Center's (NHC's) Risk Analysis Program (HURISK). Based on this information, the most likely time for New Hampshire to be impacted by a Hurricane is during the months of August through October.[5]

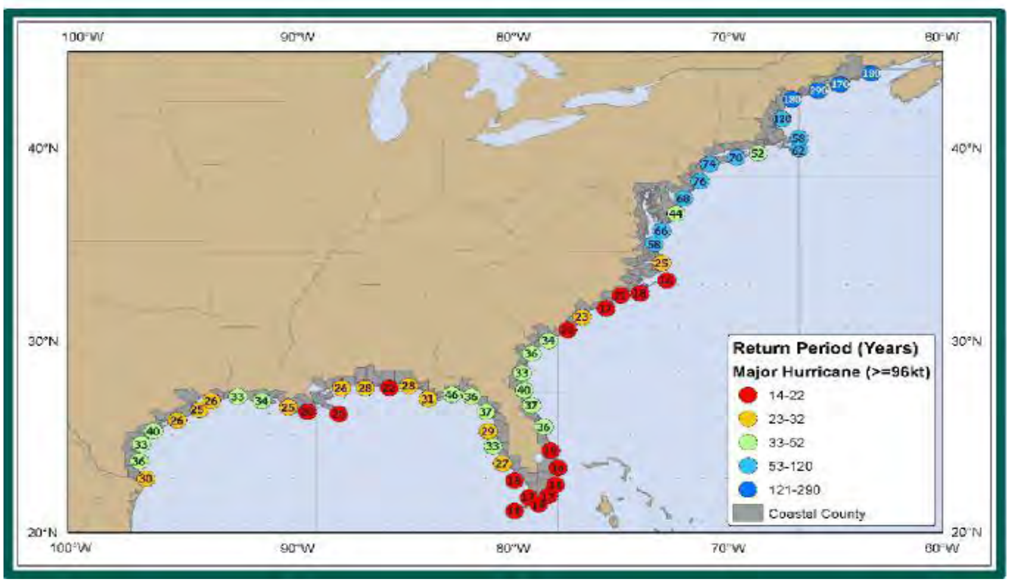


Most Likely Paths of Atlantic Tropical Cyclones (Source: NOAA)

The hurricane return period is the frequency at which a certain intensity of hurricane can be expected within a given distance from a given location. In simpler terms, a return period of 20 years for a major hurricane means that *on average* during the previous 100 years, a Category 3 or greater hurricane passed within 50nm (58 statute miles) of that location about 5 times. It is then expected that, on average, an additional five Category 3 or greater hurricanes would occur within that 50nm radius over the next 100 years. Through the HURISK program, it was determined that New Hampshire has a return period of 30 years for a hurricane and 120 years for a major hurricane.

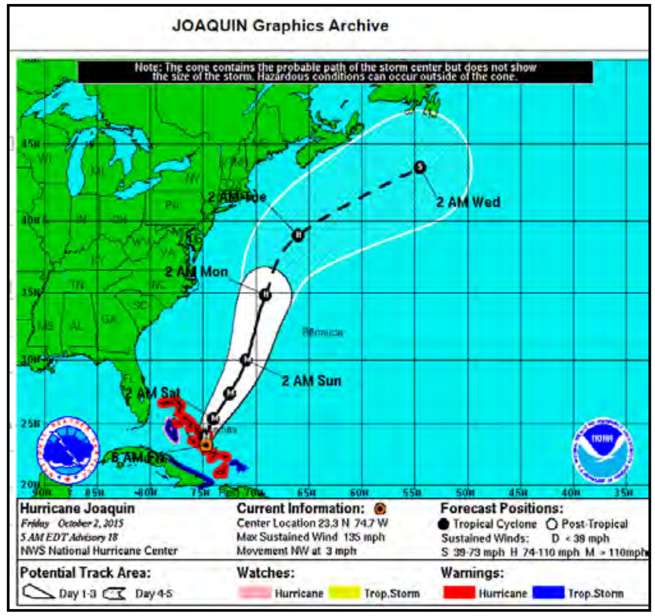
New Hampshire has experienced numerous hurricanes and post-tropical cyclones throughout its history. The most significant hurricanes in the recent past were Tropical Storm Irene in 2011 and Hurricane Sandy in 2012. New Hampshire has also experienced “near-misses” with hurricanes when the system has a northerly track towards the State but recurving away from New Hampshire and out over the Atlantic Ocean.





Return period, in years, for Atlantic hurricanes (top) and major hurricanes—category 3 or higher (bottom) (Source: NOAA)

The two most recent "near-misses" were Hurricane Joaquin in 2015 (shown below[6]) and Hurricane Hermine in 2016. This northeasterly recurvature of a hurricane's track out over the North Atlantic is the climatological norm for hurricanes in the Atlantic basin. In a 48-hour period, the storm went from potentially making a direct impact of New Hampshire to completely missing the east coast all together.



Recent storms and minor impact near misses:

- August 22, 2021: Tropical Depression Henri – no significant impacts https://www.nhc.noaa.gov/archive/2021/HENRI_graphics.php?product=3day_cone_no_line
- July 9, 2021: Tropical Depression Elsa – Heavy rain, no significant impacts https://www.nhc.noaa.gov/archive/2021/ELSA_graphics.php
- Aug 4, 2020: Tropical Storm Isaias – Heavy rain, gusty winds, one fatality in North Conway. Tropical Storm Warning Issued for the state. https://www.nhc.noaa.gov/archive/2020/ISAIAS_graphics.php
- Sept 7, 2019: Hurricane Dorian – Near Miss https://www.nhc.noaa.gov/archive/2019/DORIAN_graphics.php

Extent

The life cycle of a hurricane beings at a Potential Tropical Cyclone and progresses through a variety of phases prior to the actual formation of a hurricane. New Hampshire is not immune from the impacts of these phases. Tropical Depressions impact the state with windspeeds of 38 mph or less. Tropical Storms impact the state with windspeeds of 39 mph to 73 mph or higher.[7] Historically, these two types of storms bring heavy rains and the potential for coastal and inland flooding to New Hampshire.

The Saffir-Simpson Hurricane Wind Scale is a 1 to 5 rating 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.[8]

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.

Impacts

Some of the potential impacts that may occur as a result of a tropical cyclone (depending on its magnitude, track, and forward speed) include, but are not limited to:

- Coastal and inland flooding
- Erosion (coastal erosion due to storm surge, and river erosion as result of heavy rainfall)
- Flooding of roadways, roadway washouts, and culvert washouts
- Dam and bridge failures
- Partial or complete damage of buildings
- Extensive vegetative damage
- Loss of utilities for an extensive period of time
- Loss of life and injuries

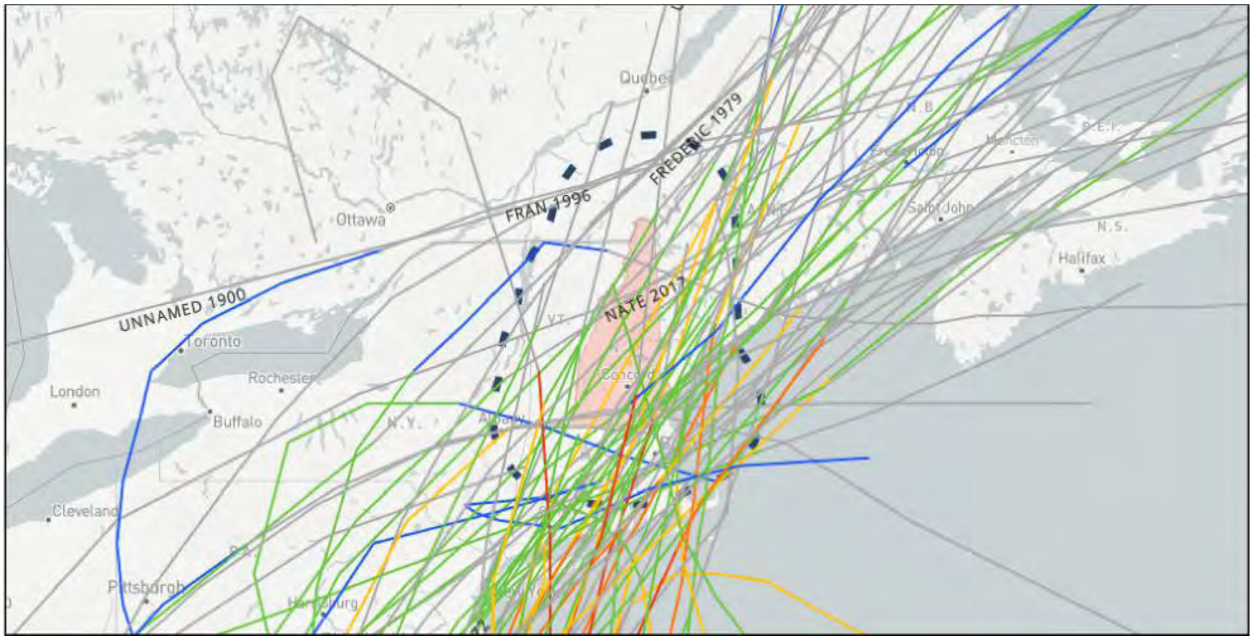
For all United States hurricanes, Hurricane Katrina (2005, $190.0B) is the costliest storm on record.[9] Hurricane Harvey (2017, $151.3B) ranks second, Hurricane Ian (2022, $112.9B) ranks third, Hurricane Maria (2017, $108.9B) ranks fourth, and Hurricane Sandy (2012, $83.9B) ranks fifth. These values are based on the 2022 Consumer Price Index.

Although classified as a distinct hazard due to its unique weather pattern, the effects of a tropical cyclone are like other low-pressure systems, which may include heavy rainfall and potential flooding, high winds, lightning, tornadoes, and hail.

Coastal flooding information, including models and specific coastal impacts due to tropical and post-tropical cyclones, is detailed, and referenced in the Coastal Flooding section of the 2023 NH SHMP.

Safety and Security	Food, Water, Shelter	Health and Medical	Energy (Power & Fuel)	Communications	Transportation	Safety and Security
Local rescue efforts will outstrip immediate resources requiring mutual aid. Government facilities may be unusable due to flood waters.	Shelters will be required around the state, as flooding and wind impacts are not limited to the coastal area. Lack of utilities will increase the need for food and water. Ground water sources may become contaminated from run off, or as wastewater plants are overwhelmed.	Medical facilities across the state can be impacted due to power outages and flood waters. EMS will see an increase in response time due to weather impacts and potential road closures.	Widespread utility outages are likely. Long term utility outages are likely. Fuel delivery via Piscataqua River may be impacted due to debris or damaged infrastructure. Gas stations without power will impact individual abilities to run generators and vehicles.	Private and state communications infrastructure may be limited due to power outages or equipment damage. Privately operated cell phone towers will be inoperable, limiting communication. Internet capabilities will be restricted, due to downed lines.	Flooding and culvert washouts will close roads and can damage bridges. Rail and airport infrastructure may be damaged, leading to delays or shut down of services.	Local groundwater can become contaminated from wastewater; stored hazardous materials will impact groundwater sources as well if leaks are present.

Previous Occurrences[9]



Hurricane Paths through New England (Source, NOAA/NHC)

History of Hurricanes In New Hampshire				
Event Date	**Category**	**Impacts**	**Location**	**Additional Information**
3/15/2021 – 3/24, 2021	1	Henri made landfall in Rhode. Island as a 55-kt tropical storm on 8/22. Henri is the strongest tropical cyclone to pass over New England since Tropical Storm Bertha in July of 1996. Flooding occurred in some Western NH communities.	Western and Central NH	Hurricane Henri
8/9/2021 – 8/20/2021	TS	flash flood warning was issued for southern Rockingham County. Rainfall of 1”-3” fell in southwestern NH.	Southwestern NH and coast	Fred
6/30/2021 – 710/2021	1			Elsa

7/28/2020 – 85/2020	1	The center of Isaias crossed Vermont as it lost its tropical characteristics. Wind gusts of 40–45 kt were observed in Vermont, New Hampshire, and Maine as the system moved quickly through the area. A 60-year-old woman died in North Conway, NH, when these winds blew a tree down on her apartment home. Winds blew down limbs and power lines, resulting in nearly 70,000 power outages in NH, about 18,000 in Vermont, and 64,000 in Maine.	Central NH	Isaias
8/30/2018 – 9/18/2018	4	3" – 4" of rain across Northern Hillsborough County	Central NH	Florence
10/3/2017 – 10/11/2017	1	Made landfall in Mississippi on 10/7. Traveled north to Ohio where it became extratropical. Crossed through Central NH.	Central NH	Nate
9/6/2016	1	Closed Hampton Beach due to aftereffects of Hurricane Hermine made landfall as a TS south of the State, but still had impacts in New Hampshire	Coastal New Hampshire	Hurricane Hermine
10/29/2012	1	EM-3360 $646,243.08 in Public Assistance and DR-4095 $2,113,605.92 in Public Assistance. 1 fatality in Lincoln.	Statewide	Hurricane Sandy
08/26 – 9/6/2011	TS	DR-4026 $18,091,902.88 in public assistance and $1,262,644.95 in Individual Assistance	Statewide	Tropical Storm Irene
09/16 – 18/1999	TS	DR-1305 $594,693.82 in public assistance	Statewide	Tropical Storm Floyd
8/19/1991	2	3 persons were killed and $2.5 million in damages were suffered along the coast	Coastal New Hampshire	Hurricane Bob
8/30/1988	TD	Unknown	Coastal New Hampshire	Tropical Storm Chris
9/27/1985	2	This hurricane weakened upon striking Long Island with heavy rains, localized flooding, and caused minor wind damage in New Hampshire.	Statewide	Hurricane Gloria

8/10/1976	1	Rain and flooding	Statewide	Hurricane Belle
8/28/1971	TS	Heavy rain and damaging winds	Statewide	Tropical Storm Doria
10/7/1962	TS	Heavy swell and flooding along coastal New Hampshire.	Southern and Central New Hampshire	Tropical Storm Daisy
9/12/1960	3	Heavy flooding in Massachusetts and Southern New Hampshire.	New England	Hurricane Donna
7/31/1960	TS	Unknown	New England	Tropical Storm Brenda
9/11/1954	3	This hurricane moved offshore but still took 21 lives and caused $40.5 million in damages throughout New England. It followed so close to Carol it made recovery difficult for some areas. Heavy rain in New Hampshire.	Southern New England	Hurricane Edna
8/31/1954	3	Extensive number of trees blown down and property damage	Southern New England	Hurricane Carol
9/2/1952	TD	Unknown	Southern New England	Hurricane Able
9/21/1938	3	13 Deaths, 1,363 families received assistance, interruption of electric and telephone services for weeks, 2 billion feet of marketable lumber blown down, flooding throughout the State, in some cases equaling and surpassing the Flood of 1936. Total Direct Losses - $12,337,643 (1938 Dollars) This does not include indirect losses, such as loss of trade and the impact to the timber industry.	Southern New England	The Great New England Hurricane
1858-1934	TD-1	Unknown	Statewide	Between 1858 and 1934, NWS has a record of 17 unnamed storms which ranged from Tropical Depressions to a Category 1 Hurricane that impacted New Hampshire.

Impact of Climate Change on Hazard	
Climate Change Projection	**Impact on Hazard**
Increase in Sea Level	A rise in sea level will produce a strong impact from any tropical storm that moves along the state seacoast. This will result in increased coastal flooding, potential flash flooding, storm surges, increased coastal erosion, and marsh migration.
Increase in Precipitation	Storms that produce a higher level of precipitation will lead to an increase in flooding and potential flooding damage along affected areas along the coast.
Increase in Temperature	An increase in temperature could potentially lead to stronger, and more frequent storms along our state coast line

Individuals/ Communities Disproportionately Impacted by Hazard	
Individual/Community	**Description of Increased Impact**
Socially Vulnerable Populations (due to income, education, health care access, and housing)	• May live in locations that are prone to climate-related health hazards • May have greater rates of existing medical conditions, • May live in poorly maintained or aging infrastructure that may not be able to handle climate-related event • May struggle to access resources and care • May experience limited financial resources or cultural, language, or citizenship barriers that restrict their access to health care, social services, and safe, nutritious food
Children	• Their developing bodies can make them more vulnerable to hazards like heat and poor air quality. • Children breathe at a faster rate, increasing their exposure to dangerous air pollutants. • Spending more time outdoors than adults, increases their exposure to heat and cold, rain and snow, outdoor allergens, and insect bites. • Higher water intake can increase exposure to certain contaminants in recreational waters and the risk of developing gastrointestinal or other illnesses. • Children can experience mental health impacts from extreme events that are expected to increase with a changing climate. • Dependance on others for care increases vulnerability

Individuals Aged ≥ 65 Years	• Older people are less able to compensate for the effects of certain environmental hazards, such as air pollution. • Older adults are more likely to have health conditions that make them more sensitive to climate hazards like heat and air pollution, which can worsen their existing illnesses. • Limited mobility, increasing their risks before, during, and after an extreme weather event. • Some medications can change the body’s ability to respond to heat, increasing risk for heat illnesses and death as the climate warms. • Aging can impact the immune systems, increasing risk for extreme reactions related to heat, insect- and tick-related diseases, and water-related illnesses. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with a Disability/Disabilities	• Decisionmakers may not fully consider people with disabilities in their planning. • Emergency warnings and other important messages may not be available in formats that are accessible to individuals with certain disabilities (such vision or blindness, hearing loss, or mobility issues). • Necessary medical care may be disrupted before, during, and after an event, including due to evacuations, transportation system or health infrastructure damages, or power outages. • Increased likelihood that they may have additional social and economic risk factors, such as poverty and unemployment, that put them at greater risk. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.
Individuals with Pre-existing or Chronic Health Conditions (including behavioral health)	• Chronic medical conditions may increase risk of illness and death, particularly exposure to heat, extreme weather events, water-related illnesses, and poor air quality. • Necessary medical care may be disrupted before, during, and after an event, including due to evacuations, transportation system or health infrastructure damages, or power outages. • Some medications can affect the body’s response to heat, increasing risk for heat illnesses.

	• Some conditions/medications compromise the immune system, increasing risk for extreme reactions related to heat, insect- and tick-related diseases, and water-related illnesses. • Individuals with chronic behavioral health conditions may be more vulnerable to trauma from extreme weather events, as well as disruptions to support networks and mental health care. • Dependance on others for medical care and assistance with daily life, increases vulnerability to extreme weather events.

END NOTES – TROPICAL AND POST-TROPICAL CYCLONES

[1] Glossary of National Hurricane Center Terms; http://www.nhc.noaa.gov/aboutgloss.shtml
[2]Quick Guide to the Stages of Tropical Cyclones; https://courseware.e-education.psu.edu/courses/meteo241/Images/Section1/tropical_cyclones0103.html
[3] Update on National Hurricane Center Products and Services for 2017; https://www.nhc.noaa.gov/news/20170309_pa_2017SeasonChanges.pdf
[4] Glossary of National Hurricane Center Terms; http://www.nhc.noaa.gov/aboutgloss.shtml
[5] Tropical Cyclone Climatology; http://www.nhc.noaa.gov/climo/
[6] Hurricane Joaquin Graphics Archive, NOAA; https://www.nhc.noaa.gov/archive/2015/graphics/al11/loop_5W.shtml
[7] Saffir-Simpson Hurricane Wind Scale, NOAA; http://www.nhc.noaa.gov/aboutsshws.php
[8] NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2023). https://www.ncei.noaa.gov/access/billions/, DOI: 10.25921/stkw-7w73
[9] Historical Hurricane Tracks, NOAA (2022). https://coast.noaa.gov/hurricanes/

6.15 High Hazard Potential Dams

The New Hampshire Department of Environmental Services (NHDES), through its Dam Bureau, is responsible for the regulation of the State's dams to ensure that they are constructed, maintained, and operated in a manner to promote public safety. This is accomplished through the review, approval, and permitting of plans, specifications for the construction and reconstruction of dams, as well as, the regular inspection of all dams that pose a hazard to downstream lives or property. NH DES's Chief Dam Safety Engineer provided the information provided in this section. NH DES maps and fact sheets were utilized for information, charts, diagrams, and maps. NH Water Sustainability maps were utilized for information regarding the quantity and relative locations of dams within the State.

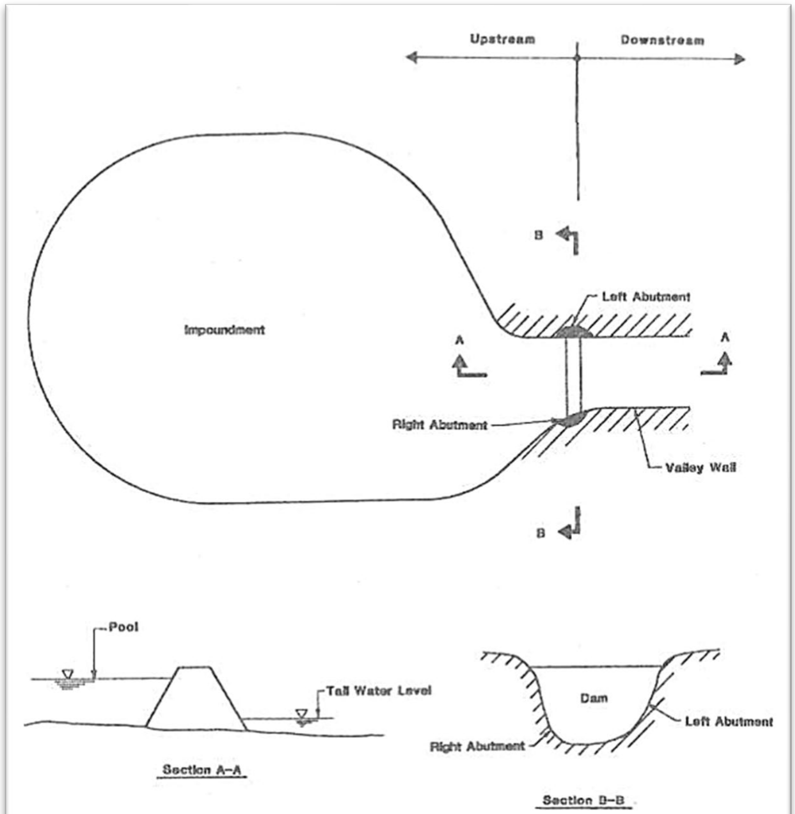
Definition

New Hampshire is vulnerable to the impacts of Dam Failure throughout the State, consistent with the locations of those dams in the State's dam inventory. There are more than 2,600 dams in the inventory, approximately 800 of which may be expected to cause impacts lives, infrastructure, or property (see Appendix J for Active Dams).

New Hampshire Code of Administrative Rules, Chapter Env-Wr 100-800 addresses New Hampshire's Dam Program, run by the Dam Bureau. Of note for this plan, Env-Wr 100-200 defines dam-specific terms utilized by the Bureau, Departmental Duties, Procedures, Waivers, Proceedings, Decisions and Appeals. Env-Wr 300-600 addresses existing Dams, including inspections, requirements, construction and Emergency Action Plans and Dam Removal. These rules are the guiding principles used to ensure the State and dam owners meet safety requirements. They also establish inspection guidelines and dam classifications.
There are a total of 2,605 dams in the State of New Hampshire that are subject to New Hampshire's Dam Safety Rules, and an additional 32 federally owned dams that are not subject to New Hampshire's Dam Safety Rules. Of the 2,605 active dams, 1,784 are classified as Non-Menace, 472 as Low, 175 as Significant and 174 as High. The State of New Hampshire owns 254, with 76 classified as non-Menace, 81 as Low, 34 as Significant and 63 as High. Currently, to be subject to State jurisdiction, dams must be over 6' in height or meet other specific criteria. The State of New Hampshire also owns and is responsible for an additional two dozen or so impounding structures which are less than 6 feet in height.

Owner Classification	Percent of Total
Private	78%
Local Government	12%
State	8%
Federal	1%
Public Utility	Less than 1%

Within the State of New Hampshire dams are categorized into one of four 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.



Basic Nomenclature Of A Dam

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 mis operation of the dam would not result in probable loss of life or loss to property, provided the dam is:

- Less than 6 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 mis operation 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 mis operation 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 mis operation 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.

Hazard Classification	Percent of Total
High	3%
Significant	6%
Low	17%
Non-Menace	74%

Background Information

Although they have occurred, dam failures resulting in notable downstream damages are not common in New Hampshire. Damages to dams themselves are more frequent, oftentimes resulting from an unusually heavy rain event or a rain event that produces significant discharge through spillways and outlets which causes related erosion to adjacent embankment sections or discharge channels. The most likely failure mechanism is related to overtopping – when the runoff produced from a storm event exceeds the maximum capacity of a dam's outlet works. In such cases, the dam will likely be overtopped, that is, have water flow over or through areas that are not designed to pass water. This condition generally leads to erosion damage to earthen sections, which limits access to operate gates or other outlet works, and oftentimes leads to complete failure of the dam.

Dams can also fail due to poor design and/or construction, as well as, from poor or inadequate maintenance. These types of failures are less common, which may be the result of the generally high degree of dam owner stewardship and the State's permitting regulations and periodic inspection program. Some notable failures have occurred, however, and information related to some of these is provided below.

Another flooding potential relating to dams has to do with improper manipulation of the dams' discharge or outlet works. This can occur both during dry (normal) conditions, as well as, during flood events. It is extremely important for dam owners to understand the impacts related to both routine and emergency operations. NHDES works with both owners and local response officials to ensure that information and data are available and properly communicated so that all parties are making informed decisions based upon ongoing conditions and potential impacts.

Inspections
All hazardous dams in the State are inspected as required by NH RSA 482:12, at regular intervals, according to their assigned hazard classification. Inspections include a review of design, repair and maintenance history, detailed visual assessments of all dam components and a review of areas downstream of the dam to identify the potentially affected development that exists. Dams are subject to reclassification during any inspection. These inspections are carried out with guidance provided in Administrative Rule Env-Wr 302.02, Dam Inspections; Repair; Alternatives to Repair. This rule states High Hazard dams are inspected every two years, and New Hampshire provides for Significant Hazard dams to be inspected every four years. Individuals may also submit requests in writing to request a dam inspection to the NH Dam Bureau.

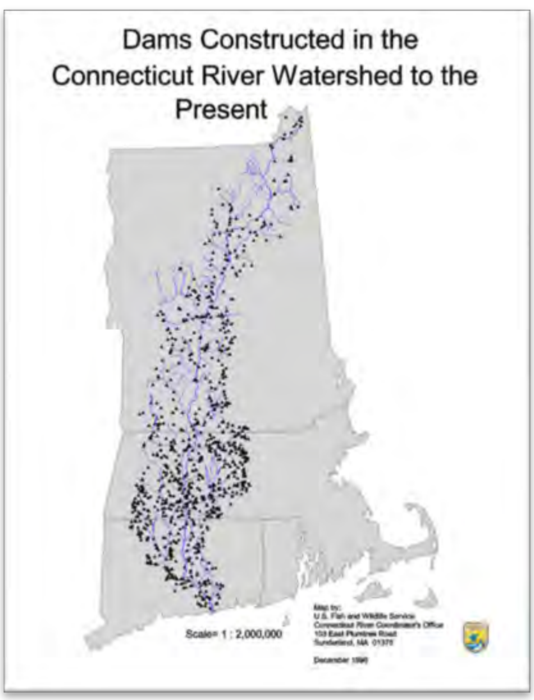
Hazard Classification	Inspection Interval in Years
High	2
Significant	4
Low	6
Non-Menace – (if certain height and/or storage criteria are met)	6

Impacts

The most common form of dam related hazards in the State, over the last 20 years, has been overtopping which has historically had a low hazard impact with localized minor flooding.
Full or partial dam failures, in addition to threatening human life, can create significant impacts both upstream and downstream of the dam. Property losses to private owners, businesses and municipality, among others, can be substantial. Impacts to roadway, bridge and other types of infrastructure can also affect both individual livelihoods, as well as, local and regional commerce. Damages to channel beds and banks from breach wave scour can displace soil and sediment, including the sediment released from the dam impoundment. Such impacts can have

devastating effects on flora, fauna and aquatic life.

The State-wide impact of dam failures range from high to catastrophic. The Connecticut River contains dams, to include Vernon Dam, Wilder Dam, Bellows Falls Dam, Moore Reservoir Dam, Comerford Dam, McIndoes Reservoir Dam, and the First Connecticut Lake Dam. However, as the map to the left indicates, there is a vast number of dams that impact the watershed area. According to the U.S. Energy Information Administration (2022), approximately 15% (9.1 trillion BTU) of the States electricity is provided by hydroelectric dams. The impact of the hydroelectric dams failing, or dams upriver from them failing could have a major impact on the State's utilities. Due to the vast number of dams State-wide, virtually all the State's major roadways are impacted by one of the 2,605 dam's inundation areas. I-89 and I-93 would both be impacted by dam failure along the Connecticut River. I-91, while not in the State, is a major evacuation route for the State and carries many tourists into the State to support the economy. I-91 would likewise be heavily impacted by dam failure along the Connecticut River. I-93 and I-293 in Manchester would experience potential damage should a Manchester-area dam fail. Due to the historical development of the State, many of the State and Community lifelines would be heavily impacted by dam failure and the subsequent inland flooding it would cause as many town and city centers are built along major rivers and bodies of water.



Overall, the impact to the State would vary depending greatly upon which dam, or dams failed. However, many of the State regional centers are in or near river and lake corridors, such as, Berlin, Claremont, Concord, Epping, Keene, Laconia, Littleton, and Manchester whose combined communities represent every State Department and several medical facilities. The damage to major roadways, and the impact on the State's bodies of water would cripple the State's leading industry – tourism. Given the major infrastructural damage dam failures cause, the economic impact on the State would be immense as manufacturing would have to cease and employees would be severely hindered in their ability to get to work.

The New Hampshire Department of Environmental Services (NHDES) continues to refine population at risk (PAR) data for its high hazard dams. Though such data may not exist for a large number of them, more than 90% have emergency action plans (regulatory requirement) that include inundation maps showing the areas downstream that are likely to be impacted by both sunny day and 100-year storm breach scenarios (see Appendix K for Watershed Area Base Maps). HHPD rules do not require PAR data to be included in EAPs. Letters of Intent for HHPD funding do require PAR data to be included and NH DES retains that information as part of their effort to obtain and track PAR data. Currently, PAR data is only available for applicants of the HHPD Grant Program, which New Hampshire became a participant of in 2019.

High Hazard Potential Dam	People at Risk
Milton Three Ponds Dam, Milton	492 (High Consequences)
Bow Lake Dam, Strafford	430 (High consequence)
Goose Pond Dam, Canaan	150 (High Consequences)
Mendums Pond Dam, Nottingham	85 (Moderate Consequences)
Pawtuckaway Lake Dam, Nottingham	80 (Moderate Consequences)
Alton Power Dam, Alton	70 (Moderate Consequences)
Pickpocket Dam, Brentwood	70 (Moderate Consequences)
Goffstown Upper Reservoir Dam, Goffstown	45 (Moderate Consequences)
Dells Pond Dam, Littleton	30 (Moderate Consequences)
Upper Wilson Pond Dam, Swanzey	15 (Moderate Consequences)

According to the information provided by the National Risk Index (see Appendix H), the combined average social vulnerability, as derived from the Centers for Disease Control's social vulnerability index, for the communities most heavily impacted by watershed areas places them above the 75 percentile State-wide. The areas of Manchester, Berlin, and Nashua that are also impacted by High Hazard Potential Dams hold social vulnerabilities that range from the 81 to 97 percentile Nation-wide and represent the most vulnerable population areas in the State at the 100 percentile State-wide.

As noted, high hazard and significant hazard dams are required by NH RSA 482:12 to have emergency action plans that, among other things, include the identification of potentially impacted areas. Assessment of risk is primarily made through detailed visual inspections of dams and examination of downstream areas that could likely be impacted by dam failures. For the latter, NHDES uses a standards-based approach, using available climatological data and computer-based analytical methods. Though NHDES believes that a standards-based approach has been effective in determining the general risk associated with its population of dam, it is recognized that not all dams or the areas potentially impacted by dam failure are the same. We expect to evaluate other methods, including such parameters as construction type, condition, population/property at risk and others to refine risk understanding. The expectation is that such information could result in targeted/prioritized dam safety regulation, as well as a more efficient use of resources.

The focus of NHDES's Dam Safety & Inspection program is to protect public safety – to minimize life loss and impacts to infrastructure and property. We achieve this by concentrating efforts on those hazards that have a higher likelihood of occurrence – with inland flooding being chief among them. Design standards related to earthquakes are applied to new and existing dams, when appropriate. New Hampshire does not formally require assessment specific to dams related to hazards such as drought, severe winter weather, high winds, wildfire, etc.

Emergency Action Plans (EAPs), are required for all high and significant hazard dams that could impact life or result in significant threat to life or property, are meant to serve this function. Such plans include procedures to notify entities with a role in responding to such events. In some cases, direct notice is also provided to uniquely vulnerable property owners or managers of critical infrastructure. Further, plans include preventive actions to be taken by dam owners, as well as, detailed information related to and maps of potentially impacted areas to aid emergency responders in creating evacuation plans or otherwise supporting their roles in responding to such events. EAPs and Inundation Maps are available through the State's WebEOC platform and can be accessed by registered users, which include community Emergency Management Directors. Administrative Rule Env-Wr 303.06 'Emergency Action Plan Required' establishes that EAPs for High Hazard Dams to be developed and maintained in accordance with Env-Wr 500, 'Emergency Action Plans'. The same Administrative requires low, significant and high hazard dams to submit Operation and Maintenance Plans. The Administrative rule provides for dams that fall under Federal Regulation to follow the Federal Energy Regulatory Commission (FERC) guidelines.

Local Impact

New Hampshire's western boarder is determined by the Connecticut River with several dams. This river and its dams alone accounts for 11% of the State's communities, and over 38% of the State's communities fall within the Connecticut River's watershed area.[1] In addition to the Connecticut River communities, more than 20 communities have heavy population areas within watershed areas in the State (Appendix K). While not every town along the Connecticut River would experience extreme damage and loss of life due to dam failure along the river, many would. Due to the State's historical development along rivers and lakes, local communities are heavily impacted by the various dams throughout the state.

While local communities defer to the state's laws and rules to govern dam sites themselves, local policy can develop land-use ordinances to reduce or halt development in inundation areas. Dam owners are specifically responsible for any mitigation actions necessary on site; however, communities can develop their own mitigation strategies for impacted areas. Local zoning ordinances and the adoption of flood plain ordinance can prohibit or limit new developments in potential inundation areas. As an example, Winchester, NH requires homes built or significantly improved in the 100-year flood plane to be elevated at least one foot above the 100-year flood elevation. The City of Nashua has a similar ordinance that requires the same 'one foot above' standard, but also requires 'two feet' above the highest known flood elevation if no depth number is specified.

The impact of dam failure would be catastrophic for most local communities. On average, local communities recognize the impact as extremely high, however, determine the probability of failure as relatively low. This creates an overall risk for most communities of low to medium. Due to the varying ownership of high hazard potential dams in the State, local communities' ability to mitigate vulnerabilities to these dams is limited. Additionally, only larger communities have dedicated town staff to help inspect, maintain, and enforce local and State codes. Local communities value the potential monetary loss due to dam failure to between $2,000,000 to $85,000,000. Even communities that do not themselves have a high hazard potential dam within their community all recognize inland flooding as a high impact risk to their community with hundreds of millions of potential losses valued, and every community notes the concern of loss of life as a priority of risk with inland flooding. For nearly all communities with high hazard potential dams, a dam failure would impact their emergency services facilities and the community primary and secondary evacuation routes.

High Hazard Dam Information

HSEM and the NHDES Dam Bureau work together to provide funding and mitigation strategies through the High Hazard Potential Dam Grant (HHPD). The Dam Bureau works with HSEM to rank and score potential projects for HHPD eligible projects. In 2022, the State of New Hampshire requested $8 million in HHPD funding, and received just under $1 million in funding. HSEM will continue to request funding over what has been allocated in an attempt to bring more grant funding to the HHPD program.

A total of $35 million in ARPA funds were received by the State to apply specifically to dams. Approximately $6 million were used to create and fund a Dam Rehabilitation/Removal Grant for municipally owned high hazard dams in poor condition, and the remainder will be allocated to 11 State owned dams in need of comprehensive reconstruction or significant rehabilitation.

New Hampshire does not currently have any state-supported funding programs available to owners of high hazard (or other) dams, but rather facilitates the management and distribution of federally funded programs like the High Hazard Potential Dam program that targets assistance to owners of high hazard dams.

NH DES Dam Bureau has started to request capitol funds for improving and or repairing state owned dams. According to a 2023 report from the Association of State Dam Safety Officials, New Hampshire's estimated cost of rehabilitation for all dams is $99 billion. For High Hazard Potential Dams, the cost is $33 billion. NH DES will continue to pursue increases capitol funds in future budget cycles for state owned dams.

High Hazard Structures Eligible for HHPD Grants.				
STATE DAM#	**NID#**	**TOWN**	**NAME**	**OWNER**
D009003	NH00056	ANTRIM	GREGG LAKE DAM	Municipality
D029007	NH00267	BRENTWOOD	EXETER RESERVOIR DAM	Municipality
D033006	NH00921	BROOKLINE	PIERCE POND DAM	Municipality
D051013	NH00360	CONCORD	PENACOOK LAKE DAM	Municipality
D082002	NH00267	EXETER	EXETER RESERVOIR DAM	Municipality
D140010	NH00145	LITTLETON	DELLS POND OUTLET DAM	Municipality
D150006	NH00103	MANCHESTER	MASSABESIC LAKE DAM	Municipality
D150009	NH00518	MANCHESTER	DORRS POND DAM	Municipality
D209008	NH00030	SALEM	MILLVILLE LAKE DAM	Municipality
D232006	NH00202	SWANZEY	UPPER WILSON POND DAM	Municipality
D258001	NH00309	WOLFEBORO	CRESCENT LAKE DAM	Municipality
D010002	NH00060	ASHLAND	GRIST MILL POND DAM	Private
D021003	NH00086	BELMONT	SARGENT LAKE DAM	Private
D091001	NH00016	GILMANTON	SAWYER LAKE DAM	Private
D093006	NH00490	GOFFSTOWN	GOFFSTOWN UPPER RESERVOIR DAM	Private
D109004	NH02080	HARRISVILLE	CHESHIRE MILLS LOWER DAM	Private
D134009	NH00155	LEBANON	RIVERMILL DAM	Private
D149001	NH00284	MADISON	PURITY LAKE DAM	Private
D151006	NH00104	MARLBOROUGH	MINNEWAWA DAM	Private
D155001	NH00306	MEREDITH	LAKE WAUKEWAN DAM	Private
D165004	NH00330	NASHUA	BOWERS POND DAM	Private
D189002	NH00527	PELHAM	GUMPAS POND DAM	Private
D203001	NH00381	RINGE	LOWER DAMON RESERVOIR DAM	Private

D203010	NH00384	RINGE	ISLAND POND DAM	Private
D006001	NH00010	ALTON	SUNSET LAKE DAM	State
D006002	NH00011	ALTON	ALTON POWER DAM	State
D010001	NH00059	ASHLAND	SQUAM LAKE DAM	State
D014003	NH00013	BARNSTEAD	SUNCOOK LAKE DAM	State
D014008	NH00229	BARNSTEAD	BARNSTEAD PARADE DAM	State
D031001	NH00137	BRISTOL	NEWFOUND LAKE DAM	State
D036001	NH00118	CANAAN	GOOSE POND DAM	State
D043001	NH00149	CHATHAM	UPPER KIMBALL POND DAM	State
D065001	NH00168	DIXVILLE	LAKE GLORIETTE DIKE	State
D065002	NH00171	DIXVILLE	LAKE GLORIETTE DAM	State
D079001	NH00285	EPSOM	NORTHWOOD LAKE DAM	State
D091011	NH00018	GILMANTON	CRYSTAL LAKE DAM	State
D093002	NH00020	GOFFSTOWN	HADLEY FALLS DAM	State
D130002	NH00465	LACONIA	AVERY DAM	State
D134001	NH00153	LEBANON	MASCOMA LAKE DAM	State
D150002	NH00299	MANCHESTER	KELLEY FALLS DAM	State
D161006	NH00320	MILTON	MILTON THREE PONDS DAM	State
D170001	NH00342	NEW DURHAM	MERRYMEETING LAKE DAM	State
D170002	NH00345	NEW DURHAM	JONES DAM	State
D184001	NH00133	NOTTINGHAM	MENDUMS POND DAM	State
D184002	NH00134	NOTTINGHAM	PAWTUCKAWAY LAKE DOLLOF DAM	State
D195011	NH00120	PITTSFIELD	PITTSFIELD MILL DAM	State
D223001	NH00054	STODDARD	HIGHLAND LAKE DAM	State
D224001	NH00055	STRAFFORD	BOW LAKE DAM	State
D225004	NH00074	STRATFORD	STRATFORD BOG POND DAM	State
D241006	NH00223	WAKEFIELD	LOVELL LAKE DAM	State
D241014	NH00111	WAKEFIELD	GREAT EAST LAKE DAM	State
D241015	NH00226	WAKEFIELD	HORN POND DAM	State
D247001	NH00114	WEARE	WEARE RESERVOIR DAM	State
D255011	NH00301	WINCHESTER	PISGAH RESERVOIR DAM	State
D259007	NH00317	WOODSTOCK	MIRROR LAKE DAM	State

Previous Occurrences: History of Dam Events in New Hampshire

Name	Year	Hazard Classification	Cause of Failure
Weeks Pond Dam, Warren, New Hampshire	July 2017	Low	Overtopping failure and wash-out of earthen embankment
Deer Run Pond Dam, Campton, New Hampshire	April 2017	Low	Non-overtopping, structural failure of outlet works/ internal erosion.
Nottingham Lake Dam, Nottingham, New Hampshire	May 2006	Low	Overtopping failure and wash-out of earthen embankment.
Ashuelot Paper Mill Dam, Winchester, New Hampshire	October 2005	Low	Overtopping failure and wash-out of earthen embankment.
Lower Robertson Dam, Winchester, New Hampshire	October 2005	Low	Overtopping failure and wash-out of earthen embankment.
Ox Bow Campground Dam, Hillsborough, New Hampshire	April 2004	Non-Hazardous	Overtopping failure and wash-out of earthen embankment.
Cold Brook Pond Dam, Lempster, New Hampshire	October 1996	Significant	Progressive and complete erosion of the vegetated auxiliary spillway due to high flows through spillway.
Meadow Pond Dam, Alton, New Hampshire	March 1996	Significant	Non-overtopping, structural failure/internal erosion.
Nash Bog Pond, Odell, New Hampshire	May 1969	Significant	Non-overtopping, structural failure/internal erosion.
Abenaki Lake Dam, Dixville, New Hampshire	April 1960	Significant	Non-overtopping, structural failure/internal erosion.

END NOTES – HIGH HAZARD POTENTIAL DAMS

[1]Connecticut River Conservancy. (2022). Detailed River Maps. Retrieved from https://www.ctriver.org/recreation-resources/maps-guides/

[2]Federal Emergency Management Administration. (2023). National Risk Index. Retrieved from https://hazards.fema.gov/nri/map.

[3]NH Department of Environmental Services. (2020). Classification of Dams in New Hampshire. *Environmental* https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/db-15.pdf

[4]NH Department of Environmental Services. (2019). Environmental Fact Sheet: The Connecticut River. Retrieved from https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/rl-4.pdf#:~:text=Acclaimed%20as%20both%20the%20largest%20river%20in%20New,Connecticut%20on%20its%20way%20to%20Long%20Island%20Sound.

[5] NH Department of Environmental Services. (2019). Environmental Fact Sheet: The Connecticut River. Retrieved from:https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/2020-01/rl4.pdf#:~:text=Acclaimed%20as%20both%20the%20largest%20river%20in%20New,Connecticut%20on%20its%20way%20to%20Long%20Island%20Sound

[6]U.S. Energy Information Administration. (2022). New Hampshire State Energy Profile. Retrieved from https://www.eia.gov/state/print.php?sid=NH#:~:text=In%202021%2C%20renewable%20resources%20provided%20about%2016%25%20of,electricity%20generation%2C%20mostly%20from%20hydroelectric%20power%20and%20biomass.

[7]https://damsafety-prod.s3.amazonaws.com/s3fs-public/files/2023%20ASDSO%20Costs%20of%20Dam%20Rehab%20Report.pdf

7. State - Owned Assets

7.1. Summary of State-Owned Real Property

The Department of Administrative Services (DAS) produces a real property data report every three years, with the last report dated 2021 https://apps.das.nh.gov/RPMS/Welcome.aspx that listing over 4,000 state-owned or leased properties. The State does maintain catastrophic insurance policies with a $1,000,000 deductible and has identified specific buildings valued over the deductible. There is no comprehensive listing of all state property values. For this plan, and for these reasons, properties valued under $1,000,000 are not included in the tables below.

The following tables are of known amounts of state assets valued over $1,000,000 tracked by the Department of Administration by county and by State Agency. The 2018 Multi-Hazard Mitigation plan only identified properties by counties and provided general hazard information. For the 2023 plan, individual counties hazards are discussed, property values by county as available, and a listing of all property valued over $1,000,000 is listed with individual hazards identified. In addition, the NH HSEM Hazard Mitigation Team has identified the individual risks associated with the state owned and state operated facilities and identified the critical infrastructure and community lifeline impacted at each location if applicable. This determination was achieved through the outlined county hazards, utilizing publicly available information published by the relevant government authorities, and analysis of the assets' location via mapping data. Certain hazards, such as infectious disease and severe winter storm, have been identified as statewide risks and are indicated in report. The determination of some of these hazards for specific locations are subjective and based on assumed and inferenced information.
State owned and operated facilities found at: https://prd.blogs.nh.gov/dos/hsem/wp-content/uploads/2023/08/State-Property-Risks-v3.pdf

State leased and operated facilities report found at: https://prd.blogs.nh.gov/dos/hsem/wp-content/uploads/2023/08/20230731-NH-State-Assets-Lease_List-COMPLETED.pdf

Belknap County	State Agency	Building Value
	Administrative Services	$22,061,086.00
	Courts	$5,093,760
	Department of Safety	$9,964,313
	Veterans Home	$31,896,813
	Total	$69,015,972

Carroll County	State Agency	Building Value
	Courts	$11,032,000

	Department of Transportation	$4,874,721
	Total	$15,906,721

Cheshire County	State Agency	Building Value
	Adjutant General	$5,034,560
	Department of Transportation	$1,697,812
	Liquor Commission	$5,566,622
	Total	$12,298,994

Coos County	State Agency	Building Value
	Adjutant General	$8,663,361
	Courts	$9,408,000
	Department of Corrections	$52,055,876
	Department of Natural and Cultural Resources	$7,176,879
	Total	$77,304,116

Grafton County	State Agency	Building Value
	Adjutant General	$14,020,254
	Courts	$7,084,000
	Department of Health and Human Services	$17,249,694
	Department of Natural and Cultural Resources	$9,112,370
	Department of Transportation	$2,006,715
	Liquor Commission	$750,000
	Total	$50,223,033

Hillsborough County	State Agency	Building Value
	Adjutant General	$46,933,184
	Courts	$69,869,560
	Department of Corrections	$5,724,200
	Department of Health and Human Services	$44,297,090
	Department of Natural and Cultural Resources	$2,036,736
	Department of Safety	$1,128,138
	Department of Transportation	$8,560,007
	Liquor Commission	$2,295,000
	Total	$180,843,915

Merrimack County	State Agency	Building Value
	Adjutant General	$122,989,440
	Administrative Services	$261,485,722
	Courts	$7,747,040
	Department of Corrections	$144,699,159
	Department of Health and Human Services	$135,193,279
	Department of Natural and Cultural Resources	$2,322,007
	Department of Safety	$28,275,663
	Department of Transportation	$33,302,564
	Fish and Game	$7,374,887
	Liquor Commission	$22,000,000
	Police Standards & Training	$14,420,000
	Total	$779,809,761

Rockingham County	State Agency	Building Value
	Adjutant General	$11,596,796
	Courts	$36,476,480
	Department of Natural and Cultural Resources	$10,234,095
	Department of Safety	$600,288
	Department of Transportation	$9,732,938
	Fish and Game	$1,963,122
	Liquor Commission	$8,195,788
	Port Authority	$3,976,704
	Total	$82,776,211

Strafford County	State Agency	Building Value
	Adjutant General	$27,458,941
	Courts	$8,710,520
	Department of Transportation	$9,144,626
	Fish and Game	$714,738
	Total	$46,028,825

In 2018, the SHMPC added new mitigation action #11, “Expand upon current descriptors used for State asset inventory to include data such as location, building material, and hazard vulnerabilities”. A module has been added to the State’s real property database to add insurance information in an attempt to fulfill the mitigation action #11, but has not been fully adopted by DAS, and was not available for use with this plan.

- The updated total value of all the State-owned buildings and land is $1,397,688,920.76.

- There is no interface between State Agency Asset Inventories and State-owned Universities except where noted. University risk analysis are done by private insurance companies and were not made available to the state when requested.

- The two counties with the highest level of risk (as derived in Appendix G: National Risk Index) comprise more than 20% of the total value of state-owned buildings ($215,242,265.00).

- The two counties with the highest level of risk do not reflect the heaviest populated counties. (726,794)

- There is no detailed information available to determine the potential loss to state facilities on a hazard specific basis. This requires an extensive assessment and is not within the funding capabilities of this Plan update.

- Further information regarding State owned facilities (building types, building use and number of staff) is still in the process of being gathered and should be available at the next revision of this Plan.

- The State does have a 'Whole State Building Permit System' implemented within the last 10 years. The State Fire Marshal is responsible for state building code enforcement. Buildings owned by the state were built according to the code that was in place at the time of construction. Buildings undergoing renovation or new construction are required to comply with the current building code.

- Life/Safety inspections are conducted regularly at state facilities by the State Fire Marshal, identifying gross violations of the Fire Safety Code

- The 2013 State Hazard Mitigation Plan included significantly more state owned property values than this plan. The 2013 plan contains information gathered in 2011 that has not been maintained to account for market changes and devaluation.

  The table on the following page provides an inventory of State-owned critical facilities to be noted in the event of a natural or human caused disaster and therefore have an inherent value that cannot be assigned. The figures, however, reflect the assessed value of the building and the land that it is on. All Critical Infrastructure and Key Resources in New Hampshire are susceptible to all of the hazards that impact the State.

State of New Hampshire *Inventory of State-Owned Critical Facilities*						
Facility	**Name/Location**	**Owner**	**Size (sq.ft.)**	**Building Value***	**In 100-year Floodplain**	**# of Occupants**
Capital Building	State House & Annex – Concord	Admn. Services	161,348	5,497,552	No	No Data Avail.
Primary EOC	Bureau of Emergency Management	Dept. of Safety	27,840	439,900	No	33
Secondary EOC	NH National Guard Training Center, Center Stafford, NH	Adjutant Gen.	29,155	2,248,065	No	No Data Avail.
State Police	Hayes Building	Dept. of Safety	117,113	7419396	No	1,450
	Airport Building	Dept. of Safety	8210	230,000	No	No Data Avail.
	State Police Troop Station D: Concord	Dept. of Safety	Not Avail.	101,370	No	41
	State Police Troop Station B: Milford	Dept. of Safety	5,810	671,408	No	52
	State Police Troop Station E: Tamworth	Dept. of Safety	7865	473,226	No	No Data Avail.
	State Police Troop Station F: Carroll	Dept. of Safety	7533	373560	No	No Data Avail.
	Police Standards & Training Facility	Dept. of Safety	33,400	4,357,929	Land/Yes	24
Fire Facilities	Richard M. Flynn Fire Academy	Dept. of Safety	Not Avail.	4,708,605	No	No Data Avail.
	Fire Standards & Training Comm. Bldg.	Dept. of Safety	Not Avail.	359,899	No	No Data Avail.
	Fire Standards & Training Dormitory	Dept. of Safety	Not Avail.	2,610,674	No	No Data Avail.
	Ladder Training Tower	Dept. of Safety	Not Avail.	406,418	No	No Data Avail.
	Aircraft Rescue Facility	Dept. of Safety	Not Avail.	730,812	No	No Data Avail.
Communications	State Police Radio – Clinton Street	Dept. of Safety	1,680	85,000	No	No Data Avail.
	State Police Radio System Towers – on various NH Mts.	Dept. of Safety	N/A	4,979,119	No	No Data Avail.
	State Police Microwave System	Dept. of Safety	N/A	2,400,000	No	No Data Avail.
Hospital	NH Veterans home	NH Veterans Home	Not Avail.	7,544,421	No	No Data Avail.
	NH Hospital – Hospital Grounds	Div. of Mental Health	337,611	9,920,911	No	
	NH Hospital	NH Hospital	750,496	3,841,108	No	857
Public Works Facilities	District 1 Facilities	Dept. Transport.	208421	2,998,328	Unknown	1,273
	District 2 Facilities	Dept. Transport.	191,885	1,966,836	Unknown	536
	District 3 Facilities	Dept. Transport.	175,264	2,673,896	Unknown	499
	District 4 Facilities	Dept. Transport.	149,958	3,159,511	Unknown	199
	District 5 Facilities	Dept. Transport.	177,457	3,813,812	Unknown	230
	District 6 Facilities	Dept. Transport.	100,891	1,833,041	Unknown	200
Transportation	Portsmouth Port Authority	NH Port Authority	50,000	2,619,480	Land/Yes	No Data Avail.
Prison Facilities	Berlin Correctional Facility	Dept. Corrections	Not Avail.	30,604,945	No	180

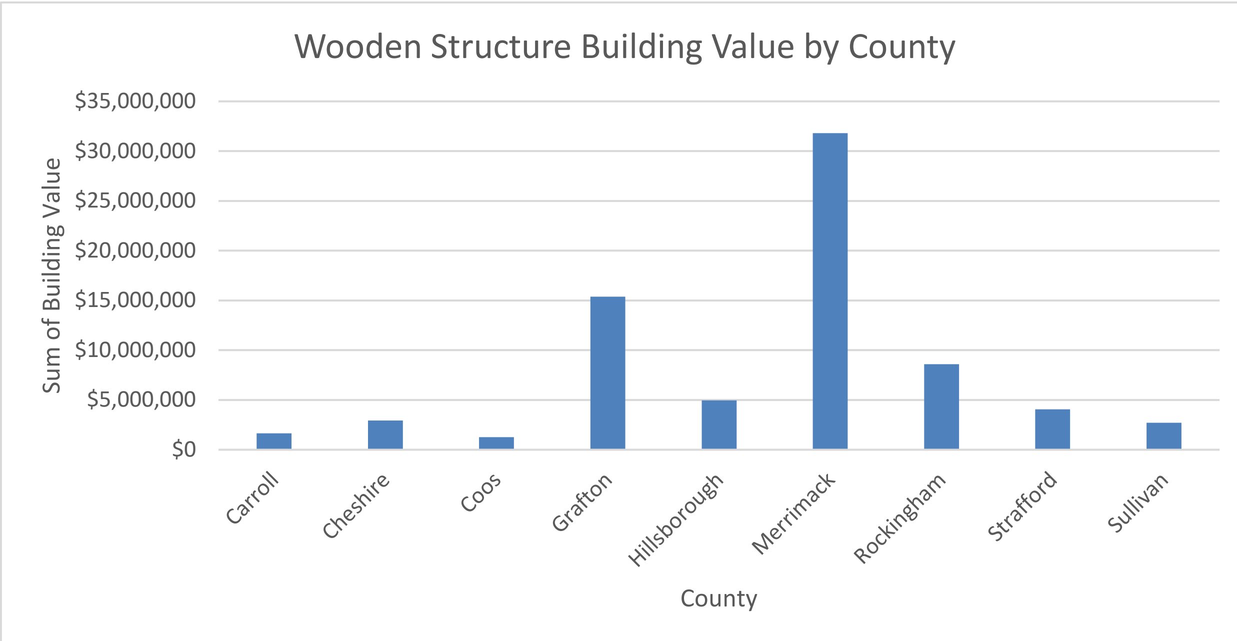
State of New Hampshire *Inventory of State-Owned Critical Facilities*						
Facility	**Name/Location**	**Owner**	**Size (sq.ft.)**	**Building Value***	**In 100-year Floodplain**	**# of Occupants**
	NH State Prison: Concord Compound (all major bldgs.)	Dept. Corrections	N/A	49,019,617	No	568
	NH State Women's Prison	Dept. Corrections	8,350	1,940,178	No	41
	Lakes Region Facility	Dept. Corrections	335,793	9,712,879	Land/Yes	113
Education Facilities	NHCTC System Office-Concord	NHCTC	63,000	619,972	Land/Yes	47
	NHCTC – Manchester Campus	NHCTC	145,000	8,450,442	No	475
	NHCTC – Stratham Campus	NHCTC	92,000	6,992,953	No	311
	NH Technical Institute – Concord	NHCTC	213,457	20,788,623	Land/Yes	890
	NHCTC – Berlin Campus	NHCTC	94,513	3,484,201	Yes	298
	NHCTC – Laconia Campus	NHCTC	60,000	2,953,743	No	240
	NHCTC – Claremont Campus	NHCTC	68,698	2,594,823	No	257
	NHCTC – Nashua Office	NHCTC	106,738	8,134,829	No	356
Historic Treasures	Contoocook Covered Railroad Bridge	Historical Res.	N/A	33,000	Yes	n/a
	Native American Burial Ground-Shelburne	Historical Res.	N/A	7,800	Unknown	n/a

Statewide, all NH Wastewater Engineering Bureau's wastewater treatment facilities are to be considered at high flood risk due to positioning next to rivers at the lowest point in the system to allow for and promote gravity flow. The State owns two facilities, which are a part of the Winnipesaukee River Basin Program (WRBP), operated by NH Department of Environmental Services.

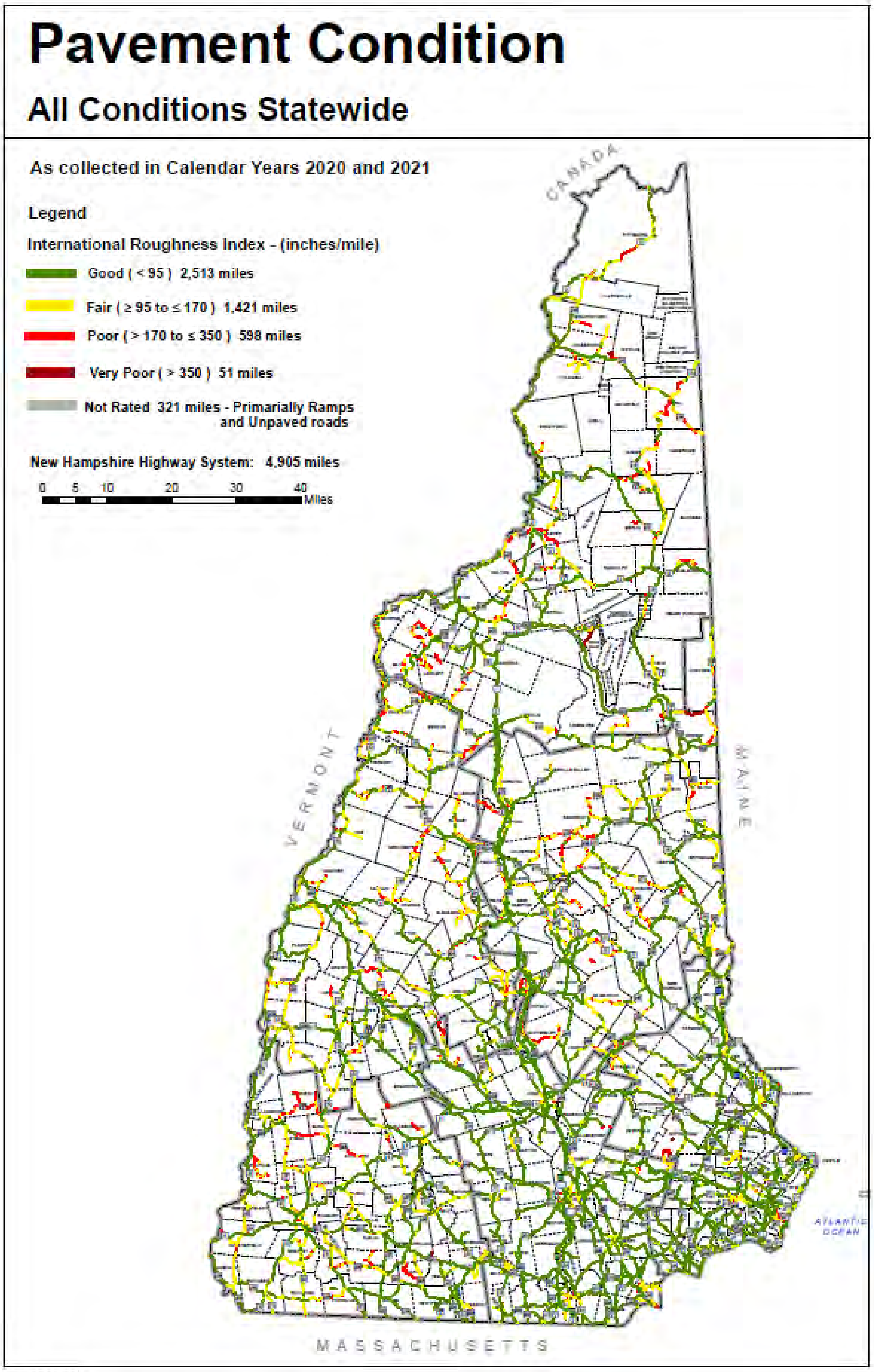
Current lists of non-State-owned essential facilities for individual communities can be found within the Local Hazard Mitigation Plans, which are also updated on a five-year cycle. Each community identifies vulnerability of such assets in comparison to the identified hazards within their plan. Based upon current information contained in local plans, communities and their infrastructure most vulnerable to identified hazards is contained in Section 9.3.

Based upon the previously identified locations at which each hazard type could occur, it can be assumed that the entire State is vulnerable to the following hazards: inland flooding, drought, earthquakes, extreme temperatures, high wind events, infectious diseases, landslides, lightning, severe winter weather, solar storms and space weather, tropical and post-tropical cyclones, wildfire, aging infrastructure, conflagration, and dam failure. If the State were to experience a total loss of all the State-owned property listed above, the cumulative amount would well over the known value of $1,397,688,920.76.

Wooden structures are the most vulnerable to the analyzed hazards within this plan. Based on the available data from the State owned and operated facilities list, Merrimack County has the most wooden structures with a total estimated building value of $31,821,781.00, followed by Grafton County with a total estimated building value of $15,377,393.32. Statewide wooden buildings account for twenty-six (26) structures with a total estimated value of $73,357,118.28, out of this total seventeen (17) structures have been identified as critical infrastructure with a total estimated value of $44,250.303.28. These wooden structures are specifically susceptible to wildfires. As mentioned above, Merrimack and Grafton counties have the highest number of wooden buildings and the highest estimated building value with these structures. The year the structure was built is another factor in determining wildfire susceptibility due to changing building codes and standards, and limited fire safety features. Concord, NH in Merrimack County has the most state-owned structures built between 1819 and 1960 with an estimated building value total of $332,897,015.44 for all building structure types.



In addition, the state owns 16,689 miles of public roads and highways throughout the state[1]. Overall, according to the New Hampshire Department of Transportation, 68% of all NH's roads are classified as good to fair.[2] This translates to 32% of NH's roads are classified as poor or below. Despite the condition rating supplied by the New Hampshire Department of Transportation, roads in good condition are susceptible to flood damage and other hazards as much as roads in poor condition in hazard prone areas. Interstate 95 and US Route 1 follows New Hampshire's seacoast and is an important transportation connection between Northern Massachusetts and Southern Maine. Due to the location of these vital highways, there are vulnerable to coastal flooding and high wind events. In addition, Route 93 travels through mountainous regions within state including the Franconia Notch's Pass. Due to this fact, this important throughfare is vulnerable to landslides and avalanche hazards.



Date: 9/20/2022

Highly Ineffective Ineffective Neutral Effective Highly Effective **Capability** (Program, Policy, Regulation, etc.)	**Agency** (Federal, Regional, State, Local, Private)	**Hazard**	**Pre-Disaster**	**Post-Disaster**	**Capability Assessment 2023** **Description of Capability**	**Effectiveness**	**Changes / Improvement Since 2018 Plan**	**Suggested Improvements and Abilities to Improve**
Laws & Regulations								
2018 International Residential Code (IRC) and the **2018** International Building Code (IBC)	State	All Hazards	X	X	Building codes which govern both residential and non-residential structures. Formally Adopted by the State in 2022.	Effective	Use of updated building codes.	Formally Adopted by the State on July 1, 2022
Senate Bill 374	State (NHDES)	Coastal Flooding	X		Requires NHDES to update storm surge, sea-level rise, precipitation, and other relevant projections recommended in the 2014 Coastal Risk and Hazard Commission, Science and Technical Advisory Panel (STAP) report, "Sea-Level Rise, Storm Surges, and Extreme Precipitation in Coastal New Hampshire: Analysis of Past and Projected Future Trends" at least every 5 years, commencing July 1, 2019	Effective	N/A	No suggested improvements at the time of this Plan update
Senate Bill 452	State (Multi-Agency)	Coastal Flooding	X	X	Senate passed bill 452 in 2016, which requires agencies that do any planning/construction in coastal regions to consult the coastal program. Also requires state agencies involved in planning, siting, and design of state-funded structures and facilities, public works projects, and transportation projects, as well as land acquisition and management and other environmental activities in the coastal and Great Bay regions to reference the 2014 Coastal Risk and Hazard Commission, Science and Technical Advisory Panel (STAP) report, "Sea-Level Rise, Storm Surges, and Extreme Precipitation in Coastal New Hampshire: Analysis of Past and Projected Future Trends."	Effective	N/A	
State Executive Order 96-4	State (Multi-Agency)	Coastal Flooding; Inland Flooding	X	X	Mandates all State agencies comply with the flood plain management requirements of all local communities participating in the National Flood Insurance Program (NFIP) in which State-owned properties are located	Effective	Currently working to improve capability.	OSI is working on an updated draft which will incorporate freeboard, focus on specific FEMA requirements, and update flood maps.

RSA 21-P:37-C	Disaster Relief Assistance for Municipalities	All Hazards		X	Provides state aid in the form of a loan to municipalities that have applied for federal emergency assistance not to exceed 50 % of the non-federal share of projects eligible for public assistance disaster grants or hazard mitigation grants.	Neutral	**NEW** This RSA has not been utilized by a municipality as of 3/1/2023	
RSA 141-C	State (NH DHHS)	Infectious Diseases	X	X	Provides limited authority to the department to mitigate and control the spread of infectious diseases. Authorities include surveillance and investigation activities, as well as implementation of control measures such as mandatory testing, treatment, isolation, and quarantine.	Effective	N/A	No suggested improvements at the time of this Plan update
Funding								
Building Resilient Infrastructure and Communities Program (BRIC)	State (NH HSEM), Federal (FEMA)	Natural Hazards	X		Building Resilient Infrastructure and Communities (BRIC) is a continuation of PDM, provides funding to states, local communities, federally recognized tribes, and territories for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. (Nationally	Highly Effective	**New** Capability expanded upon since 2018 Plan	Build upon educational outreach to eligible applicants.
CDC (and ASPR) GRANTS - PHEP (and HPP), and any others that can be used to address any infectious/communicable disease that is listed in the plan. This includes the public health crisis response grant, which is awarded, but unfunded, until federal grant money is awarded for a specific emergency public health response (ie. Mpox, Covid, etc.)	State (NH DHHS/DPHS), Federal (DHHS/ASPR/CDC)	All-Hazards	X	X	The federal HHS (PHEP and HPP) grants provide states and local jurisdictions with funding and technical support to build and sustain public health and healthcare preparedness and response capacity. The capability standards are a vital framework for jurisdictional public health and healthcare agencies to organize and evaluate emergency responses and exercises, ensure the public health/healthcare consequences of jurisdictional and state emergencies are a response priority, and promote collaboration of by establishing a common language among preparedness professionals. HPP is the primary source of federal funding for health care system preparedness and response and, in collaboration with state and local health departments, prepares health care delivery systems to save lives through the development of health care coalitions (HCCs).	Highly Effective	**Updated PHEP** Capabilities issued from CDC in October 2018. **Updated HPP** capabilities issued for the federal grant fiscal period 2017-2022. Granite Trace added.	Suggestion to build upon this plan with an understanding of the roles of health care and public health agencies in mitigating risks related to CBRNE incidents as well as cyberattacks.
Clean Water Revolving Fund	State (Multi-Agency)	Drought / Inland and Coastal Flooding	X	X	The Clean Water State Revolving Fund (CWSRF) program is a federal-State partnership that provides communities a permanent, independent source of low-cost financing for a wide range of water quality infrastructure projects.	Effective	N/A	No suggested improvements at the time of this Plan update
Coastal Resilience Grant Projects	State (NHDES), Federal (NOAA)	Coastal Flooding	X	X	The NHDES Coastal Program has additional funding to provide annual technical assistance to local planning commissions and communities.	Effective	N/A	No suggested improvements at the time of this Plan update

Community Development Block Grant (CDBG)	State, Federal (HUD)	All Hazards		X	HUD provides flexible grants to help cities, counties, and States recover from Presidentially Declared Disasters, especially in low-income areas. In response to Presidentially Declared Disasters, Congress may appropriate additional funding for the Community Development Block Grant (CDBG) Program as Disaster Recovery grants to rebuild the affected areas and provide crucial seed money to start the recovery process.	Neutral	N/A	Improve upon communication and collaboration between State agencies, as CDBG funds can fulfill cost share requirements for potential HMA funded projects
Contribution to Damage Losses	State (NH DOT)	All Hazards		X	(RSA 235:34) is available to any municipality which suffers damage to its highways through a disaster which is estimated to exceed one-eighth (1/8) of one percent (1%) of its assessed valuation providing the Commissioner of Transportation is notified and requested to investigate the damage.	Effective	N/A	No suggested improvements at the time of this Plan update
Emergency Management Performance Grant (EMPG)	State (NH HSEM), Federal (FEMA)	All Hazards	X	X	The Emergency Management Performance Grant (EMPG) Program supports building and maintaining a comprehensive, all-hazards emergency preparedness system. New Hampshire's EMPG Program focuses on planning, organization/administrative (project-driven), equipment, and maintenance/sustainment.	Highly Effective	N/A	
Flood Mitigation Assistance (FMA) Program	State (NH HSEM), Federal (FEMA)	Coastal Flooding; Inland Flooding	X		The FMA program is authorized by Section 1366 of the National Flood Insurance Act of 1968, as amended with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). FMA provides funding to States, Territories, federally-recognized tribes and local communities for projects and planning that reduces or eliminates long-term risk of flood damage to structures insured under the NFIP. (Nationally Competitive)	Effective	N/A	Continue to build upon educational outreach to eligible applicants.
Hazard Mitigation Grant Program (HMGP)	State (NH HSEM), Federal (FEMA)	Natural Hazards		X	The purpose of HMGP is to help communities implement hazard mitigation measures following a Presidential Major Disaster Declaration in the areas of the state, tribe, or territory requested by the Governor or Tribal Executive. The key purpose of this grant program is to enact mitigation measures that reduce the risk of loss of life and property from future disasters.	Highly Effective	N/A	Continue to build upon educational outreach to eligible applicants.

Hazard Mitigation Grant Program Post-Fire	State (NH HSEM), Federal (FEMA)	Wildfire		X	The purpose of HMGP is to help communities implement hazard mitigation measures following a Presidential Major Disaster Declaration related to wildfire disasters in the areas of the state, tribe, or territory requested by the Governor or Tribal Executive. The key purpose of this grant program is to enact mitigation measures that reduce the risk of loss of life and property from future disasters.	Highly Ineffective	N/A	While the State has the ability to oversee HMGP Post-Fire funding the State does not currently have an approved FMAG Agreement and has not historically experienced or declared FMAG disasters. The State is working towards the creation and approval of a FMAG Agreement.
High Hazard Potential Dam Grant Program (HHPD)	State (NH HSEM), Federal (FEMA)	Aging Infrastructure	X		The purpose of HHPD is to provide for the rehabilitation of high hazard potential dams, provide technical assistance, planning, design, and construction assistance.	Effective	HHPD added under the WIIN Act in 2016.	Educational outreach to eligible applicants
Legislative Pre-Disaster Mitigation (LPDM)	State (NH HSEM), Federal (FEMA)	Natural Hazards	X		Pre-Disaster Mitigation (PDM) provides funds to states, territories, Indian tribal governments, and communities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. (Nationally Competitive & Congressionally Directed)	Effective	Much of PDM has been reprogrammed as BRIC. Funds are still available for Congressionally directed projects	Continue to progress and close out plans and projects funded under PDM FFY 2018 and 2019. Education and outreach to eligible applicants.
Public Assistance and 406 Mitigation	State (NH HSEM), Federal (FEMA)	Natural Hazards		X	Following a Presidential Disaster Declaration, assistance is provided to aid communities within the declared counties. Communities are provided financial reimbursement at a 75/25 cost share to help alleviate some of the expenses that were associated with the incident. All permanent work is assessed for the implementation of potential 406 mitigation by FEMA.	Effective	N/A	Process can be very drawn out resulting in a delay in funds returning to the communities. Consider working with FEMA to improve upon the current process in place.
Public Health Emergency Response	State (General Funds)	Infectious Diseases	X	X	Limited amount of general funds for public health and infectious disease emergency response activities.	Effective	New for SFY23	No suggested improvements at the time of this Plan update
State Aid Bridge Program for Communities	State (NH DOT)	All Hazards	X	X	(RSA 234) provides 80/20 funding for the construction or reconstruction of structures on Class IV and Class V highways, as well as municipally-maintained bridges on Class II highways. If a town is successful getting FEMA funds for a bridge project, they get 75% to an agreed scope of project. Typically NH DOT will use State Aid Bridge (SAB) to fund 80% of the 25% local match (=20% of project), town pays 20% of 25% (=5% of project). When project costs are greater than scope agreed to with FEMA, SAB pays 80% of that additional cost and locals pay 20%.	Effective	N/A	Consider incorporating use of Cornell precipitation tables

CDC (and ASPR) GRANTS - PHEP (and HPP), and any others that can be used to address any infectious/communicable disease that is listed in the plan. This includes the public health crisis response grant which is awarded, but unfunded, until federal grant money is awarded for a specific emergency public health response (ie. Mpox, Covid, etc.)	NH DHHS/DPHS; US DHHS/ASPR/CDC	All-Hazards	**X**	**X**	The federal HHS (PHEP and HPP) grants provide states and local jurisdictions with funding and technical support to build and sustain public health and healthcare preparedness and response capacity. The capability standards are a vital framework for jurisdictional public health and healthcare agencies to organize and evaluate emergency responses and exercises, ensure the public health/healthcare consequences of jurisdictional and state emergencies are a response priority, and promote collaboration of by establishing a common language among preparedness professionals. HPP is the primary source of federal funding for health care system preparedness and response and, in collaboration with state and local health departments, prepares health care delivery systems to save lives through the development of health care coalitions (HCCs).	Highly Effective	**Updated PHEP** Capabilities issued from CDC in October 2018. **Updated HPP** capabilities issued for the federal grant fiscal period 2017-2022. Granite Trace added.	Suggestion to build upon this plan with an understanding of the roles of health care and public health agencies in mitigating risks related to CBRNE incidents as well as cyberattacks.
Volunteer Fire Assistance Grant Program	State (NH DNCR - Division of Forests and Lands), Federal (USDA)	Wildfire	**X**	**X**	This program provides Federal financial, technical, and other assistance to State Foresters and other appropriate officials to organize, train and equip fire departments in rural areas and rural communities to prevent and suppress fires. A rural community is defined as having 10,000 or less population. There is a 50/50 cost share to the community.	Effective	N/A	No suggested improvements at the time of this Plan update
Program and Plans								
211 New Hampshire	State (NH HSEM, Granite United Way)	All Hazards	**X**	**X**	211 NH is a statewide, comprehensive, information and referral service. Provide residents with health and human service, utility, or emergency information as well as resources to meet their needs from the impacting hazard.	Effective	**New -** Capability added since 2018 Plan	Moved from 2018 Mitigation Actions to State Capabilities

Automated Hospital Emergency Department Data (AHEDD).	State (NH DHHS)	All Hazards	X		This system was implemented in 2005 and automatically collects real-time Emergency Department (ED) electronic data from hospitals using chief complaint and diagnosis codes (ICD-9 codes) from hospitals statewide. All 26 acute care hospitals in NH participate in the system. Two types of alerts are system generated (8 broad syndrome alerts based on historic data, and reportable disease diagnosis code alerts). Additionally, the system is used to monitor a number of communicable disease and health-risk conditions, and track Influenza-Like-Illness. A custom query tool feature, allows the rapid development of queries to meet unexpected health risk situations, such as the 2009-10 GI Anthrax case investigation and the recent Hepatitis C investigation.	Highly Effective	Technological improvements were applied to the system since the 2013 Plan update	No suggested improvements at the time of this Plan update
Backcountry Avalanche Warning Relay	Federal (NWS), Volunteer (Mount Washington Avalanche Center)	Avalanche	X		NWS Gray began relaying backcountry avalanche warnings from the Mount Washington Avalanche Center to the public through established outreach channels.	Effective	N/A	No suggested improvements at the time of this Plan update
BioSense	State (NH DHHS), Federal (CDC)	Infectious Diseases	X	X	A CDC maintained national integrated syndromic surveillance system that was launched in 2003, which monitors NH resident Veterans Administration and Department of Defense facility patient encounters for 11 syndromes and related LabCorp laboratory test results. NH also sends ED data from the AHEDD system to contribute to national situational awareness.	Neutral	Expansion to include Emergency Department data.	No suggested improvements at the time of this Plan update
Community Rating System (CRS)	State (NH OSI)	Coastal Flooding; Inland Flooding	X	X	The Community Rating System (CRS) is a voluntary incentive program that encourages communities to adopt and enforce floodplain regulations and activities that go beyond the NFIP minimum requirements.	Neutral	Changes in the scoring of flood plan regulations and activities.	Currently only four communities participate within the State. Many communities lack the capacity to successfully join the program. NH OSI is planning on launching a CRS user grid.
Culvert Inspection Program	State (NH DOT, NHDES, NH F&G, NH HSEM)	Coastal Flooding, Inland Flooding, Tropical Cyclones	X		New Hampshire's stream crossing (culvert) assessment initiative began in earnest in 2014 through a partnership inclusive of the four agencies mentioned, with the University of New Hampshire Technology Transfer Center included as a full partner. The five entities developed a statewide stream crossing assessment database (Statewide Asset Data Exchange System; SADES), and approximately 7000 culverts have been assessed to date statewide. Local towns have expressed an interest in this information to identify and prioritize their most problematic infrastructure from a public safety, condition, and geomorphic compatibility perspective in order to assist in applying for grant funds to upsize culverts.	Effective	N/A	No suggested improvements at the time of this Plan update

Dam Safety Emergency Action Program	State (NHDES)	Dam Failure	X	X	This program generates plans for all hazardous dams that not only includes response information, but also floodplain mapping and potential downstream impacts (cascading effects).	Effective	N/A	No suggested improvements at the time of this Plan update
Dam Safety Program	State (NHDES)	Dam Failure	X		The primary focus of the program is to ensure that all hazardous dams in the State are inspected at an interval appropriate to the severity of the hazards posed should failure occur.	Effective	N/A	No suggested improvements at the time of this Plan update
Death Data Surveillance	State (NH DHHS)	Infectious Diseases	X		NH maintains a unique query tool that facilitates access and prompt analytic capacity to electronically filed death records. These data are accessed from the NH Bureau of Vital Records database for the purpose of monitoring unusual or infectious death occurrences.	Highly Effective	N/A	Suggestion to improve database technology.
DES Master Program Document	State (NHDES)	All Hazards	X	X	Tim Drew (NHDES) created a document that lists all of the programs (including pre-and post-disaster) that the department can offer.	Effective	N/A	Make the document easily accessible.
Emergency Alert System (EAS)	State (NH HSEM)	All Hazards	X	X	The EAS incorporated digital technology allows emergency messages to be broadcast automatically (or manually) to a specific area.	Effective	N/A	No suggested improvements at the time of this Plan update
Estimated Influenza Activity	State (NH DHHS)	Infectious Diseases	X	X	Overall influenza activity in the State, reported weekly to CDC, is based on reports of ILI, reported numbers of patients with ILI or with fever and/or respiratory symptoms through the emergency department syndromic surveillance systems, reported outbreaks in facilities, and reports of laboratory-confirmed influenza.	Highly Effective	N/A	No suggested improvements at the time of this Plan update
Family Preparedness Presentations	State (NH HSEM, DHHS/DPHS/RPHNS)	All-Hazards	X	X	NH DHHS/DPHS/RPHNs and NH HSEM has been conducting Family Preparedness Presentations for over 15 years collectively emphasizing the five phases of emergency management (prevention, mitigation, preparedness, response, and recovery), vulnerability to all-hazards, as well as mitigation and preparedness actions that can be taken before, during, and after an incident.	Highly Effective	N/A	No suggested improvements at the time of this Plan update
Fire Weather and Class Day	State (NH DNCR - Division of Forests and Lands)	Wildfire	X		NH DNCR keeps daily track of weather conditions and uses the National Fire Danger Rating System to compute the fire class day based on a scale from one to five. Weather observations are collected from remote automated weather stations and tower staff. The department works closely with the NWS for fire weather predictions and the issuance of Fire Weather Watches and Red Flag Warnings when conditions warrant. Class day and expected fire weather conditions are broadcast to fire departments and dispatch centers each day from spring through fall.	Highly Effective	Recently updated notification system to include listservs.	No suggested improvements at the time of this Plan update
FirstNet	State	All Hazards	X	X	Governor Sununu "Opted-in" to FirstNet on December 28, 2017, a Nationwide Public Safety Broadband Network. This network will improve citizen and responder safety and increase the efficiency and effectiveness of emergency response.	Effective	N/A	No suggested improvements at the time of this Plan update

Heat Index Study	State (NH DHHS/DPHS), Federal (NWS)	Extreme Temperatures	**X**		Revised Heat Advisory threshold. In December 2016, the National Weather Service (NWS) Northeast Region changed its policy on when to issue an official heat advisory. NWS forecast offices in the region will issue heat advisories when the heat index is forecast to reach 95 degrees on two or more consecutive days or 100 on any single day. The previous NWS regional threshold was a maximum daily heat index of 100. This was done as a result of the findings in a study completed by NH DHHS.	Highly Effective	**NEW** DPHS initiative started in early February 2023 to develop extreme cold response annex.	Suggested improvement - develop a comprehensive "extreme weather" operational response plan that includes annexes for cold, heat, drought, flooding, high winds, and hurricanes.
HURREVAC/HVX	State (NH HSEM), Federal (FEMA)	Tropical and Post-Tropical Cyclones	**X**		Each hurricane season, FEMA Region I provides a review course of the HURREVAC software. The software has now been upgraded by the National Hurricane Program to a web-based platform known as HURREVAC Extended (HVX).	Highly Effective	N/A	No suggested improvements at the time of this Plan update
Hurricane Outreach Pre-Storm	State	Tropical and Post-Tropical Cyclones	**X**		Various State Agencies will work together to message regional, local counterparts and the public. The SEOC will address preparedness and response activities at the local level.	Effective	N/A	No suggested improvements at the time of this Plan update
Information Sharing	State (NH HSEM, DHHS/DPHS/RPHNS)	All Hazards	**X**	**X**	Well established lines of communication with federal, State, and local law enforcement, public health, and healthcare through the NH IAC. DPHS issues health alert networks (HAN) to communicate with providers on emerging public health guidance. DPHS maintains ability to communicate with DHHS/DPHS and local emergency public health responders.	Effective	N/A	Continue to establish lines of communication with entities within the private sector. US DHHS public health and healthcare capabilities include information sharing and require reporting on this capability.
Landslide Risk Mapping	State (NHDES, NH HSEM)	Landslide	**X**	**X**	Based upon information provided in Local Hazard Mitigation Plans, NH DES Geological Survey has been able to map identified areas where landslides have or are likely to occur.	Effective	N/A	No suggested improvements at the time of this Plan update
Lidar Inundation Zone Mapping	State (NH OSI)	Coastal Flooding	**X**	**X**	Lidar data has been used to remap flood zones and to create updated Digital Flood Insurance Rate Maps (DFIRMS). This is a joint venture between NH OSI and the NFIP.	Effective	N/A	No suggested improvements at the time of this Plan update
National Flood Insurance Program (NFIP)	State (NH OSI)	Coastal Flooding; Inland Flooding;	**X**	**X**	NH OSI administers and coordinates the State's role in the National Flood Insurance Program (NFIP).	Effective	In process of working on updated	Currently 219 communities participate with the NFIP.
National Warning Alert System (NAWAS)	Federal (NAWAS)	Natural Hazards	**X**		NAWAS provides NH HSEM and NHSP with a backup link to the National Warning Center (NWC), the Alternate National Warning Center (ANWC), and National Weather Service (NWS) offices in Gray, ME and Taunton, MA via protected landline circuits in the event of an emergency.	Effective	N/A	No suggested improvements at the time of this Plan update

New England Seismic Network (NESN)	Regional (NESN), Private (Boston College)	Earthquake	X		Purpose of the NESN is to monitor all earthquake activity in the vicinity of New England and to use the data from this seismic monitoring to better understand the seismic hazard of the region. NESN includes Weston Observatory at Boston College, which is a geophysical research and science education center that conducts research on earthquakes and related geoscience and has been recording earthquakes since the 1930s. Currently, New Hampshire has two seismic stations within the State.	Effective	N/A	No suggested improvements at the time of this Plan update
New Hampshire Drought Management Plan	State (NHDES)	Drought		X	NHDES and numerous supporting agencies composed the Drought Management Plan in 2016 in an effort to coordinate the State's assessment and response activities in the case of a drought emergency.	Effective	N/A	Continue to build upon this plan and identify potential mitigation actions to plan for the future.
New Hampshire Electronic Disease Surveillance System	State (NH DHHS)	Infectious Diseases	X	X	Under RSA 141-C, approximately 60 conditions are required to be reported by health care providers and laboratories to the NH DHHS. These reported infections are investigated and monitored in this surveillance system, which allows for identification of outbreaks and monitoring of potential health threats. Data are transmitted to CDC for national situational awareness.	Highly Effective	N/A	No suggested improvements at the time of this Plan update
New Hampshire Seacoast Tidal Gauges	New Hampshire Coastal Adaptation Working group (CAW)	Coastal Flooding	X	X	Two new tidal gauges have been put in on the seacoast—one in Hampton Harbor and another at Fort Point. These are being used to create flooding predictions for high tide and storm surge events. Locals use these forecasts to move assets ahead of coastal flooding events in an effort to prevent damage to property and close roads as a public safety measure. This data is also being used to document the recurrence of tidal events that cause minor, moderate, and major flooding. These trends will be extremely valuable data for future mitigation studies and actions.	Highly Effective	N/A	Create the ability to archive the tidal gauge data at Hampton Harbor (Fort Point already has this ability).
New Hampshire Trauma and Emergency Medical Services Information System (NH TEMSIS):	FSTEMS	Infectious Diseases	X		This web-based system collects data from patient care reports entered by pre-hospital providers after each emergency medical response. This system is maintained by the NH Bureau of Fire Standards & Training and Emergency Medical Services (FSTEMS) and provides real-time data from across the state.	Highly Effective	N/A	No suggested improvements at the time of this Plan update
NH Alerts	State (NH HSEM)	All Hazards	X	X	Opt-in program utilized for both public application and State Employee notification. Provides current information about hazard events or potential hazard events.	Highly Effective	**New -** Capability added since 2018 Plan	Moved from 2018 Mitigation Actions to State Capabilities
NH DNCR - Division of Forests and Lands - Mutual Aid Agreements (RSA 227-L:5)	State (NH DNCR - Division of Forests and Lands)	Wildfire	X	X	New Hampshire is a member of the Northeast Forest Fire Protection Compact (NFFPC). It is a large mutual aid organization for the sharing of resources for the purposes of wildland fire training, prevention, and suppression.	Highly Effective	N/A	No suggested improvements at the time of this Plan update

NH HSEM Online Resources	State (NH HSEM)	All Hazards	**X**	**X**	The Department of Safety and Homeland Security and Emergency Management maintains various websites and social media with information on all-hazards and emergency preparedness.	Effective	This capability now includes social media platforms such as Twitter, Facebook, and	Suggestions include introduction of multi-lingual and inclusion of higher education in outreach strategy.
Non-Commercial Service Announcements	State (NH HSEM)	All Hazards	**X**	**X**	The NH HSEM Public Information Officer (PIO) manages the agency's public information outreach.	Neutral	N/A	Work on creating a method to measure outreach effectiveness.
Post-Flooding Event Private Well Testing	State (NH DES)	Emerging Contaminates Inland Flooding, Coastal Flooding	**X**	**X**	Program that tests private wells to show when wells are back to normal (free of contaminates) following flooding events	Effective	N/A	No suggested improvements at the time of this Plan update
Redundant Communications Planning	State (NH HSEM)	Long-Term Utility Outage		**X**	Government Emergency Telecommunications Service (GETS) cards and priority lines in place	Effective	N/A	Continue to build out redundancy and un-conventional communications methods, especially with public health and healthcare entities.
Reverse 911 System	State (NH E911)	All Hazards	**X**	**X**	This program provides information of hazardous situations and emergency events.	Effective	**New -** Capability added since 2018 Plan	Moved from 2018 Mitigation Actions to State Capabilities
Risk MAP Program	State (NH OSI), Federal (FEMA), Private (Earth Systems Research Center at UNH).	Coastal Flooding and Inland Flooding	**X**	**X**	This program delivers quality flood hazard data and maps that increase public awareness about flooding and lead to action that reduces risk to life and property. This program strengthens partnerships with local communities and emphasizes seeking innovative ways to both identify hazards and input this information into local and regional decision-making processes.	Effective	N/A	No suggested improvements at the time of this Plan update
Programs Removed from the 2018 Plan								
Over-the-Counter Pharmaceutical Surveillance (OTC)	State (NH DHHS)				In NH, a system that contains OTC data from over 150 pharmacies statewide is in use to monitor for health threats in the community.		Deleted - Program no longer exists.	
Emergency Management Academy	State (NH HSEM)				Online platform available to all emergency management personnel and the public that allows individuals to complete training on and enhance awareness of a multitude of emergency management related topics.		This capability is currently not available as it is under revision.	
State Aid Bridge Program for Communities	State (NH DOT)	All Hazards			(RSA 234) provides 80/20 funding for the construction or reconstruction of structures on Class IV and Class V highways, as well as municipally-maintained bridges on Class II highways.		This capability pertains to technological hazards.	
Bureau of Special Operations and Communications	State (NH FMO)	Hazardous Materials			The Bureau of Special Operations is responsible for four major functional areas. The sections within the bureau include the Hazardous Materials Section, Fireworks Section, Public Education Section and Data Analysis Unit.		This capability pertains to technological hazards.	
Cyber Training Program	State (NH DoIT)	Cyber Event			SANS Securing the Human Cyber Security Training for State Employees		This capability pertains to technological hazards.	

9. COORDINATION OF LOCAL HAZARD MITIGATION PLANNING

9.1 LOCAL CAPABILITY ASSESSMENT

New Hampshire Homeland Security and Emergency Management has been actively working with Regional Planning Commissions, contracted planners, and local communities to develop Local Hazard Mitigation Plans and identify cost-effective mitigation measures. The State has adopted NH Revised Statues Annotated - RSA 674:2, which states that a Master Plan adopted under this statute may include a "natural hazards section which documents the physical characteristics, severity, frequency, and extent of any potential natural hazards to the community. It should identify those elements of the built environment at risk from natural hazards, as well as, extent of current and future vulnerability that may result from current zoning and development policies."[1] The information in this section in provided in conjunction with NH HSEM Mitigation and Stakeholder Partners with Regional Planning Commissions and Planning Contractors.

9.2 SUMMARY OF LOCAL CAPABILITY ASSESSMENT

Local Hazard Mitigation Plans that are submitted to New Hampshire Homeland Security and Emergency Management (NH HSEM) include their own individual local capability assessments. These local assessments contain a review of the effectiveness of each community's programs by the local hazard mitigation committees. NH HSEM provides technical assistance and recommendations for improving a given community's programs, but the local government policies, programs, and the implementation of their hazard mitigation plans is the responsibility of the local government. Local towns and cities, however, are not required by law to implement the State's recommendations.

The matrix below provides an overview of programs and regulations for most of the communities in New Hampshire. The overall effectiveness of these programs are assessed at the local level in the Local Hazard Mitigation Plan. NH HSEM has reviewed the local plans and has determined that these common actions in local hazard mitigation plans are reflected in the matrix below and has determined that all of these programs range from adequate to effective in quality with no changes needed. The individual assessment by the local plans identifies whether or not they need improvement. If a problem is identified NH HSEM will provide technical assistance to those individual communities.

Local capability efforts toward High Hazard Dam specific vulnerabilities have included the generation of dam-failure specific evacuation plans, the creation of "all hazards" plans that include impacts and response information related to dams within (and outside, if impacts exist) their communities. To a lesser degree, zoning regulations to limit or define more appropriate development within floodplains have been created. Though this latter effort may not be specific to the inundation created by dam failures, general management of floodplain activities can limit such impacts. As with most communities, prioritizing the allocation of resources to address the myriad of typical (roadway, water, wastewater, etc.) infrastructure maintenance and repair needs is a constant challenge. Those that own dams have yet another important asset that competes for routine operation and maintenance costs, as well as, periodic and significantly more costly rehabilitation projects. In July of 2022, NHDES created a grant program using qualifying Federal Covid-19 pandemic funds as received by the State to assist municipalities that own high hazard dams rated to be in poor condition. Nine communities were awarded a share of approximately $5.8M to either perform assessments, develop design plans or implement rehabilitation projects aimed at improving these structures to make them compliant with current state dam safety regulations.

NH RSA RSA 673:1 allows for the establishment of local planning boards that can adopt zoning ordinances and building codes. Municipalities that do not have zoning ordinances have opted to adopt floodplain development ordinances so that their community can participate in the National Flood Insurance Program. 220 communities participate in the National Flood Insurance Program. Results from the 2021 Survey surveyed 234 municipalities and 9 village districts. Of note, there are only 18 municipalities without zoning codes.

- 173 municipalities have adopted local enforcement of State Building Codes
- 255 municipalities, including 25 unincorporated areas have Planning Boards in place
- 154 communities have Ground Water Protection Ordinances
- 179 have Wetland Protection Ordinances.

Adequate <40% Local Participation Good 40%-74% Local Participation Effective >75% Local Participation	Local Capabilities					
Current Protection Program or Activity	**Local Responsible Department/Staff**	**Funding** Local (Bold) ***State/Federal***	**Description**	**Supporting State Agency**	**Effectiveness**	**Challenges & Recommendations for Improvements**
Emergency Operations Plan	EMD Fire & Rescue Department Police Department	*Emergency Management Performance Grant,* **Personnel Support / Administrative Budget**	Ensures an efficient response to a disaster, thus minimizing the impact and recovery of a disaster.	NH HSEM	Effective	N/A
Building Code	Building Inspector and Code Enforcement Officer, Fire Dept (Fire Codes)	**Personnel Support / Administrative Budget**	2018 International Residential Code (IRC) and the 2018 International Building Code (IBC)	NH Building Code Review Board & NH HSEM	Good	Most NH communities follow the state's adoption of IRC and IBCs as well as NHPA Fire Codes. It would be beneficial for the local communities if the state would adopt the most recent year's codes in a more quickly. Towns want to be able to employ the most recent codes.
Floodplain Ordinance	Planning Board	**Personnel Support / Administrative Budget**		NH NFIP Coordinators & NH OSI	Effective	N/A
Elevation Certificates	Building Inspector/ Code Enforcement Officer	**Personnel Support / Administrative Budget,** *State Personnel*			Effective	N/A
Community Rating System	Selectboard	**Personnel Support / Administrative Budget,** *State Personnel Support*		NH OSI	Adequate	Few NH communities are involved in the CRS because it is time consuming and requires

						heavy administration to maintain. Providing more State resources to support the local communities would be beneficial.
Emergency Warning System	Selectboard and Emergency Management Director	*Emergency Management Performance Grant,* **Personnel Support / Administrative Budget**		NH HSEM	Effective	N/A
Subdivision Regulations	Planning Board	**Personnel Support / Administrative Budget**			Effective	Regulations vary by community and can be more restrictive or more permissive.
Site Plan Regulations	Planning Board	**Personnel Support / Administrative Budget**			Effective	Regulations vary by community and can be more restrictive or more permissive.
Road Design Standards	Road Agent, Planning Board, Selectboard	**Personnel Support / Administrative Budget**	Road design standards will be used by the Planning Board when approving new developments. The standards will be monitored by the Road Agent to be sure the new roads are constructed to standards. New roads will be accepted by the Selectboard.		Effective	N/A
Bridge Design Standards	Consultant, or Public Works Director	**Personnel Support / Administrative Budget**	NHDOT standards are followed and towns depend on their	NH DOT	Effective	Few non-city communities will have an engineer on staff to be able to

			inspections to gage when it is time to rehabilitate or reconstruct.			recommend and construct bridge plans. Contractors are selected by bid or Towns engage "Town Engineers" to do this work.
Bridge Maintenance Program	Road Agent, Selectboard	*State Aid Bridge Program Funding,* **Personnel Support / Administrative Budget**		NH DOT & NH HSEM	Good	This 80/20 program is highly needed and supported by communities, but the backlog is so long (10 years), construction costs will drastically increase while on the wait list. Sometimes towns are unable to rehab their bridges or must do so without state / federal support at great local cost.
Storm Drain/Culvert Maintenance	Road Agent	*Culvert Inspection Program,* **Personnel Support / Administrative Budget**		NH HSEM, NH DOT, NH DES, NH F&G	Good	N/A
Aquifer Protection District	Planning Board and Conservation Commission	*Clean Water Revolving Fund,* **Personnel Support / Administrative Budget**	About half of NH communities have an aquifer protection or groundwater protection ordinance in place.	NH DES & NH DOT	Effective	As with all zoning, the ordinance is community dependent for both existence and content.
Shoreland Protection Program	Planning Board and Conservation Commission	*Coastal Resilience Grant Projects,* **Personnel Support / Administrative Budget**	Towns follow NH DES Comprehensive Shoreland Water Quality Act and related guidance.	NH DES	Good	Enforcement at a local level is lacking since there is no local funding to monitor and few DES staff are available to

						canvas the entire state.
Haz. Materials Plan/Team	Fire Chief	**Personnel Support / Administrative Budget,** *State Personnel Support/Administrative Budget*	Most communities join their regional hazardous materials team (e.g., Central NH or Lakes Region).	NH HSEM	Effective	Most towns (not cities) have volunteer chiefs and on-call volunteer fire fighters. Few non-city Fire Depts have any staff trained in Haz Mat levels. These volunteers must pay for their own training and take time out of their paid jobs to attend training and to respond to hazardous materials calls. NH DES usually responds to hazardous materials calls. Towns need this resource and are grateful to have it available.
Public Education Programs	School District, EMD, Fire Dept, Police Dept	**Personnel Support / Administrative Budget,** *State Personnel Support*		NH HSEM & NH Dept of Education	Effective	N/A
Master Plan	Planning Board	**Personnel Support / Administrative Budget**		NH HSEM	Effective	N/A
Wetland Conservation District	Planning Board and Conservation Commission	**Personnel Support / Administrative Budget,** Private Funding		NH DES	Effective	The ordinance is community dependent for both existence and content.
Capital Improvement Program	Planning Board	**Personnel Support / Administrative Budget**			Good	N/A
Emergency Backup Power	EMD, Fire & Rescue Department, Police Department, School District	*EMPG Funding & LPDM Funding,* **Personnel Support / Administrative Budget**		NH HSEM	Good	EMPG funding is available to communities to provide Emergency Backup Power to local EOC's and

						Critical Facilities.
Fluvial Erosion Hazard Zoning	Planning Board	*HMA & HMGP Funding*, **Personnel Support / Administrative Budget**			Adequate	All zoning ordinance districts are Planning Board responsibilities. FEH zoning has not been used in the Central NH region. The program is no longer available (was a NH DES/ NH Geological Survey program funded by Pre-Disaster Mitigation program).
High Hazard Potential Dam and Dam Monitoring	Department of Public Works, EMD	*HMA, HHPD, and DES Funding,* **Personnel Support/ Administrative Budget**	Monitor and schedule maintenance for dams. Maintain HHPD Emergency Action Plans for dams within community and in neighboring communities	NH HSEM, NH DES, U.S. Army Corps of Engineers	Adequate	Communication and warning systems currently in place are outdated and need revision. Spillway area evacuations are not frequently drilled. Neighboring community involvement with neighboring EAPs and tabletop exercises involving multiple communities would be beneficial.

9.3 STATE ASSISTANCE FOR LOCAL PLAN DEVELOPMENT

Homeland Security and Emergency Management (HSEM), Planning Section, provides technical assistance to Regional Planning Commissions, contracted planners and local communities that request support in the development of their Local Hazard Mitigation Plans. HSEM staff distributes the Local Mitigation Plan Review Guide (Summer, 2022) document both in paper and digital format, and mitigation planning documents offered through the Federal Emergency Management Agency (FEMA). A skill-share workshop was held October 3rd & 4th, 2022 for the purpose of learning about and receive training for the application of the 2023 Local Mitigation Plan Guidance. However, HSEM has largely relied upon the nine Regional Planning Commissions (RPCs) as well as the contracted planners to facilitate and develop hazard mitigation plans for local communities. Many communities in New Hampshire are all volunteer do not have the staff and resources available to develop a plan. The RPC's and contracted planners have been trained over the years by HSEM and FEMA and have developed the experience and expertise to assist in the development of local Plans.

The State Hazard Mitigation Officer, the State Hazard Mitigation Planner, NH HSEM Field Representatives, the NFIP Coordinator, Regional Planning Commissions and contracted planners work with local governments by providing the following:

- Model zoning ordinances
- Local hazard mitigation planning guidance and assistance
- Local mitigation planning workshops
- Sharing examples of good mitigation planning methods and products that have been approved by FEMA
- Assistance in the identification of cost-effective and environmentally sound mitigation projects
- Natural hazard, demographic and economic data for communities to use in their local plans
- Vulnerability assessment and loss estimation modeling data, as well as benefit-cost analysis guidance
- Workshops on Mitigation Project Identification & Development

Funding for planning assistance is provided by grants from FEMA. These include annual planning grants through the Flood Mitigation Assistance (FMA) program, Emergency Management Performance Grants (EMPG) and the Building Resilient Infrastructure and Communities (BRIC) grants. The RPC planning initiative mentioned above is funded completely by the PDM grant program. Since 2010 over one hundred communities have received a formal approval from FEMA for their Hazard Mitigation plan, and over ninety-five communities are adopting their plans or are in the process of updating their plans. All of these were funded through a combination of the aforementioned grant programs.

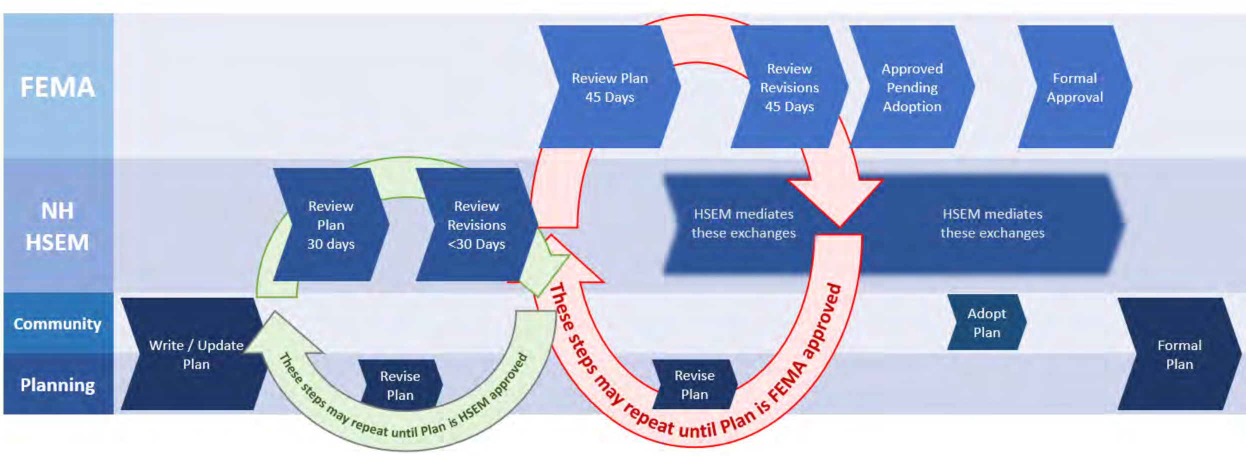
Summary of Funding Sources for Local Mitigation			
Funding Source	**Program Description**	**Eligible Projects**	**Responsible Agency**
Emergency Management Performance Grant (EMPG)	Federal grants to assist State, local, territorial, and tribal governments in preparing for all hazards.	Funding assistance to update all-hazards Emergency Operations Plans, assist with local emer. management capabilities, and serve as the foundation for first responder activities.	Homeland Security and Emergency Management (HSEM)
Building Resilient Infrastructure and Communities (BRIC)	Federal grants to assist State, local, territorial, and tribal governments in mitigating natural hazards through cost effective measures.	Drainage improvements, planning initiatives, acquisitions and elevations	HSEM
Pre-Disaster Mitigation Grant (PDM)	Congressionally directed Federal grant to assist local governments in mitigation natural hazards through cost effective measures	Drainage improvements, planning initiatives, acquisitions and elevations, assist with local mitigation activities and capabilities.	HSEM
Flood Mitigation Assistance Grant (FMA)	Implementing measures to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP.	Soil stabilization, dry flood-proofing, acquisitions and elevations	HSEM
Hazard Mitigation Grant Program	Structural Mitigation Projects due to a Presidential Disaster Declaration.	Drainage improvements, planning initiatives, acquisitions and elevations	HSEM
FEMA Supplemental Funding	Funding assistance to State and Locals to assist financially for eligible projects	Clearance, removal, and/or disposal of storm-generated debris such as trees, sand, gravel, building materials, wreckage, vehicles and personal property.	HSEM
Citizen Corp	To support the formation of state and local Citizen Corps Councils to help drive local citizen participation by coordinating Citizen Corps programs.	Education, training and volunteer services to help prepare for the response to threats natural and human caused.	HSEM
School Emergency Response and Crisis Management Plan Discretionary Grant Program	To provide school districts with funds to strengthen and improve current school crisis plans in preparation for emergencies including potential terrorist attacks.	Emergency response and crisis plan writing and updating.	Department of Education

Community Development Block Grant (CDBG)	Provides annual grants on a formula basis to entitled cities, urban counties and states to develop viable urban communities by providing decent housing and a suitable living environment, and by expanding economic opportunities, principally for low- and moderate-income persons	Improvements for Public Infrastructure and Housing. Property Acquisitions	Housing and Urban Development (HUD)
High Hazard Potential Dam Grant Program (HHPD)	Federal grants to assist State and local governments in mitigation of high hazard potential dams through cost effective measures to reduce vulnerabilities.	Mitigation efforts, including engineering and planning initiatives.	HSEM and Department of Environmental Services (DES) Dam Bureau

9.4 Review Process of Local Plans and Projects

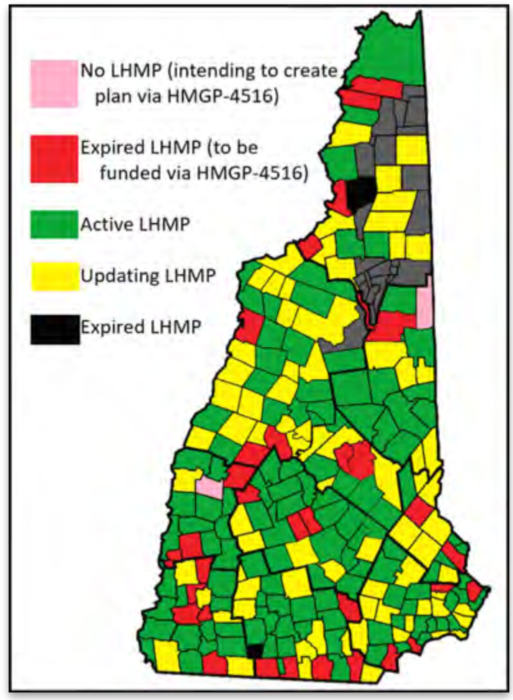
Plan Review

All Local Hazard Mitigation plans completed by the Regional Planning Commissions, contracted planners, and local communities, regardless of funding sources, are submitted to NH HSEM for initial review. As of August 2022, the State of New Hampshire's Program Administration by States (PAS) status was suspended. It is desirable for the State to regain NH's PAS status. The State Hazard Mitigation Planner (SHMP) and State Hazard Mitigation Officer (SHMO) will continue to review plans to our fullest capability and reestablish cause with FEMA for New Hampshire to have suspension ended and PAS status returned (Mitigation Action Item #13). Regaining this status will result in a more efficient review process and successfully increase opportunities for communities to receive funding through the Hazard Mitigation Assistance (HMA) Programs.



(Source: NH HSEM Mitigation)

The State Hazard Mitigation Planner (SHMP) and State Hazard Mitigation Officer (SHMO) review each plan using FEMA's [Local Hazard Mitigation Plan Review Guide](), released in the spring 2022 and became effective April 19, 2023. This initial review is completed within 30 days. If the State identifies revisions, the Plan is returned to the RPC, contracted planner, or local community for implementation and resubmission. Once revisions are made and approved by NH HSEM, the Plan is submitted to FEMA, who has 45 days for review and approval. Approvable Pending Adoption (APA) status is awarded to the community once revisions recommended by FEMA are made and approved by FEMA. In total, the review process can take, at minimum, 75 days. The community will formally adopt the Plan and the final adopted Plan will be forwarded to NH HSEM and FEMA for Formal Approval.



The official FEMA Approval Letter and date of the approved Plan is sent to NH HSEM, RPC/contracted planner, and community official. All formal approved plans are kept at NH HSEM via electronic file.

As NH HSEM staff reviews local Hazard Mitigation Plans, information that is applicable to a regional or State level of planning will be collected and available within 60 days for inclusion to future revisions of the State Hazard Mitigation Plan. Likewise, sections of the State Plan are posted on the NH HSEM Resource Center website for local communities, Regional Planning Commissions, contracted planners and the general public to incorporate into their Local Hazard Mitigation Plans. Out of 234 total communities, the State of New Hampshire has 231 plans that are currently within some form of review, approval, or adoption/implementation.

Project Review

The SHMO is responsible for project management and record keeping, including project files that contain all correspondence, applications, vouchers, reports, receipts, and related documentation. NH HSEM support staff will assist in the preparation of the state/local grant agreement, all correspondence and project files. Quarterly progress reports will be submitted to FEMA by the SHMO based on the reports provided by the Applicant's Agent. A final report will also be required from each applicant, and closeout documents will be submitted to FEMA by the SHMO.

- The State Hazard Mitigation Coordinator (SHMC) and SHMO will review all applications for completeness and to ensure they meet State and Federal eligibility criteria.

- A Cost Benefit Analysis will be conducted on all projects submitted utilizing FEMA BCA software.
- The Interagency Hazard Mitigation Team (IHMT) will review and make funding recommendations on the applications. This is to be based on communities with the highest risk and the greatest pressures caused by development.
- The SHMO will provide the Director of NH HSEM, in prioritized order; those grant applications recommended for FEMA approval by the IHMT.
- The Director of NH HSEM and the SHMO will forward applications to FEMA for funding approval.

Prioritization of Local Planning & Projects

Mitigation Planning is a high priority for New Hampshire Homeland Security and Emergency Management (NH HSEM). The RPC's or contracted planners complete the majority of mitigation plans within the State and select communities based on population, hazard risk, and a community's interest and involvement in mitigation. NH HSEM also provides direct technical assistance to communities that develop plans on their own.

Mitigation projects prioritization typically fall under the Hazard Mitigation Grant Program (HMGP). All BRIC project applications submitted to the State will also be reviewed under the following HMGP requirements:

Project Ranking Process and Criteria:
The IHMT will rank all eligible projects. Ranking will include consideration based on meeting the following:

- Objectives and criteria within the State Hazard Mitigation Plan
- Federal and State criteria as outlined earlier in this document
- 44 CFR Section 206.435 (b)
- Membership in the National Flood Insurance Program
- FEMA-approved Hazard Mitigation Plan
- Communities with the highest level of risk
- Repetitive Loss Property
- Communities feeling the highest pressures caused by development
- Available funding

Applicants will be formally notified of the results of the Committee's ranking and reviewing process, and of their recommended or non-recommended status by the SHMO. Applicants not being recommended for funding may appeal the Committee's decision under specific criteria.

The SHMO will submit to the Director of NH HSEM those projects that have been reviewed and ranked by the IHMT and are recommended for submission to FEMA for final approval and funding.

Challenges of Local Planning & Projects

Challenges for local mitigation planning and project efforts are similar to those at the State level, which include, but are not limited to, lack of personnel, staffing turn-over, funding, and varying political perspectives.

Numerous Local Hazard Mitigation Plans touch upon obstacles specific to their location and community. Local communities are dependent on residents, neighboring community representatives, local partners, and non-profit organizations all being invited to the planning process. For some communities the resources are lacking to coordinate at such a large scale. For the Planning Commissions and the Private Contractors who support the local communities in writing local hazard mitigation plans, funding is the largest obstacle when considering the requirements for updating, adopting and implementing FEMA-approved plans.

Local mitigation projects since the last SHMP update, have been beset by challenges that seem to be common to the majority of the State's communities. Due to the percentage of the State's Declared Disasters involving flooding, the mitigation projects to address these vulnerabilities are often extensive. Meanwhile, the awarded amounts for Disaster Declarations has only allowed NH HSEM the funds for one or two mitigation projects on average. HMA mitigation projects have more prerequisites for communities and engineers to meet and the potential projects within the State are extensive, creating a long waitlist for HMA project funds. NH HSEM has a list of 58 potential projects, with 45 different communities, ranging from requests for $52,000 to $2,500,000 for a single project.
Although challenges exist for local mitigation activities, successes continue to occur throughout the State, via implementation of the Hazard Mitigation Grant Program (HMGP), Pre-Disaster

Supporting Local Planning & Projects and Overcoming Challenges

Mitigation (PDM) Program, Building Resilient Infrastructure and Communities (BRIC) Program, and Flood Mitigation Assistance (FMA) Program. Such success stories can be viewed on the NH HSEM Resource Center webpage. Additionally, considerations of mitigation for all hazards continue to be integrated across all planning efforts at the State and local levels such as Continuity of Operations Planning (COOP), Recovery Planning, and Resilience Planning.

NH HSEM is intending to roll out a new formula to determine funding allocations for each community's Local Hazard Mitigation Plan (LHMP) updates. Additionally, the SHMO is working closely with communities who have never had a LHMP to ensure they have their LHMPs written using the Planning allotment through DR 4516 which provides a state-wide cost share split of 90% Federally funded and only 10% community match (Mitigation Action Items # 5&6**)**. NH HSEM has set communities on a funding rotation to ensure that NH communities do not experience their LHMPs expiring. NH HSEM will be holding quarterly meetings with the plan writers across the State to answer planning related questions and help train them in the FEMA guidance. NH HSEM's Mitigation Team offers frequent and thorough technical assistance at each step of the planning process, from application and award throughout quarterly reporting and reimbursements until the LHMP is submitted, reviewed, and formally approved by FEMA (Mitigation Action Item #22).

The State is also seeking to provide more standardized resources and guidances for local communities to be able to access and apply to Local Hazard Mitigation Plans, local mitigation projects, and other local mitigation strategies (Mitigation Action Items # 17&34).

NHDES continues to encourage communities to become or remain aware of the dams in and around their communities that could pose a risk to lives, infrastructure and property assets. Efforts suggested include one-on-one meetings with the owners of such dams to establish relationships and communication protocols both within and outside of those required for emergency action planning, and to learn more about how the dams are operated and maintained. Information related to the dam's construction, potential emergency conditions or other aspects specific to these dams could be used to tailor response activities. NH HSEM and NHDES will continue to encourage and equip communities to improve their alert systems through the use of the State's CodeRed capability, access to NH HSEM training and exercises to coordinate tabletop exercises and drills as necessary, and access the WebEOC for community leaders for dam emergency action plans.

COVID-19 DR 4516 was unprecedented in its awarded amount, both in recovery awards and mitigation available funds. NH HSEM is seeking to fund 12 hazard mitigation projects with this award to help lessen the impact of flooding for these communities. NH HSEM is maintaining a record of all potential projects to determine which HMGP funds or HMA funds the projects can be allocated toward.

History of Local Planning & Projects

Over the last 5 years NH HSEM has funded or submitted and is awaiting award of the following project types. These projects are funded using a combination of federally awarded grants, local cash matches, and local in-kind investment.

Project Type	Qty of Awards	Fed/Local Share	Funding Source
Local Hazard Mitigation Plans	178	75/25 90/10	PDM/BRIC, HMGP Local In-Kind Match
Culvert Repair	11	75/25 90/10	PDM/BRIC, HMGP Local Budget Cash Match
Bridge Repair	1	90/10	HMGP Local Budget Cash Match
High Hazard Potential Dam	5	65/35	HHPD Local Budget Cash Match
Slope Stabilization	1	75/25	PDM, ARPA Local Budget Cash Match

ENDNOTES – COORDINATION OF LOCAL HAZARD MITIGATION PLANNING

[1] http://www.gencourt.state.nh.us/rsa/html/LXIV/674/674-2.htm

10. MITIGATION STRATEGY & PRIORITIZATION

On February 17, 2023, the SHMPC held a meeting with stakeholders to review and update two areas of the 2018 State Hazard Mitigation Plan: Mitigation Strategies and Mitigation Activities. We have identified new mitigation actions for the 2023 SHMP in accordance with the goals and objectives listed below.

Additionally, we as participants needed to consider:

1. How might the hazards, strategies, and activities be impacted by climate change?
2. Who is inequitably impacted by natural hazards? We provided an overview of Whole Community planning and an introduction to the Social Vulnerability Index. How are we identifying and addressing equity and diversity? What else should we be doing? Who are the SMEs we need at the table to guide this work? How do we capture, measure, and improve on these efforts?
3. Which counties and jurisdictions are the State's most vulnerable to various natural hazards? Which jurisdictions' populations, infrastructure, and community lifeline experience a heightened vulnerability, and the impacts of these vulnerabilities? What State-level actions can be taken to mitigate these vulnerabilities?

Based upon analysis of risk assessments, review of local hazard mitigation plans, input from Regional Planning Commissions, and other subject matter experts in natural hazard assessment and mitigation, the SHMPC determined that the State is most vulnerable to the impacts of inland flooding and sever winter weather. As such, mitigation actions were assessed at the State-level to assist in mitigating the impact of this hazard and others. Each county was identified as high risk to inland flooding, this reflects the local risk to socially vulnerable populations, the impact of potential loss to local infrastructure, and the potential damage to community lifelines as outlined in Section 9 of this Plan. While the SHMPC did consider and implement mitigation actions addressing all of the natural hazards from Section 6, much of the SHMPC's attention was focused on mitigation of these highest risk hazards.

10.1 OVERARCHING GOALS

The following are the six overarching goals of this Plan:

1. Minimize loss and disruption of human life, property, the environment, and the economy due to natural hazards and high hazard potential dam failure through a coordinated and collaborative effort between federal, State, and local authorities to implement appropriate and cost-effective hazard mitigation measures.
2. Enhance protection of the general population, citizens, and guests of the State of New Hampshire 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 State.
3. Promote comprehensive hazard mitigation planning at the state and local levels to encourage data integration, alignment of plans, and identification of funding and other resources.
4. Identify how climate change impacts natural hazards, as well as mitigation strategies.
5. Strengthen Continuity of Operations and Continuity of Government across the State and local levels to ensure continuation of essential services through training, outreach, and education.
6. Promote equity by challenging state agencies and municipalities to incorporate Whole Community concepts during the planning and execution of mitigation projects, encouraging the identification and inclusion of vulnerable populations in the planning process.

Natural Hazard Objectives

1. Reduce long-term risks through assessment, identification, and strategic mitigation of at risk/vulnerable infrastructure (high hazard potential and other dams, stream crossings, roadways, coastal levees, etc.)
2. Minimize illnesses and deaths related to events that present a threat to human and animal health
3. Assist communities with plan development, outreach, and public education in order to reduce the impact from natural disasters
4. Ensure mitigation strategies consider the protection and resiliency of natural, historical, and cultural resources.
5. Effectively collaborate between federal, State, and local agencies as well as private partners, NGOs, and VOADs
6. Ensure that grant related funding processes allow for expedient and effective actions to take place at the community and State-level

Technological and Human-caused Hazard Objectives

The State of New Hampshire recognizes that Technological and Human-caused Hazards are important to consider at the state and local level. The State and local jurisdictions must prepare to respond to and monitor for these types of hazards. As such, they will remain included in this plan as an Annex for reference purposes. Strategies and action items for these hazards will not be included in this plan so that the focus can remain on Natural Hazards.

10.2 Prioritization of Action Items

Once the SHMPC compiled a list of new, ongoing, and deferred mitigation actions, the group utilized the SHMPC Prioritization Criteria Worksheet *(*Appendix D*)* to rank the actions based on the following criteria:

Life Safety

- Ensure Action Items contribute to life-safety.

Property Protection

- Ensure action items reduce property loss at a state, local and individual level.
- Ensure action items contribute to the safety of all community members, regardless of socio-economic factors.

Technical

- Is the action item technically feasible?
- Is it a long-term solution?
- Are their potential repercussions?

Political

- Is there overall public support?

Legal

- Does the State have the authority to implement the action?
- Do local jurisdictions have statutes that conflict with state statutes or project implementation?

Environmental

- What are the potential environmental impacts?
- Are action items consistent with State and Federal environmental laws?

Economic

- What are the costs and benefits?
- Is there a tax burden involved?

Social

- Will the proposed action adversely affect one segment of the population?
- Is there enough social capital to influence political support?

Administrative

- Does the state have the personnel in place to administer the project?
- Is there an appropriate State Agency that can take on the project?

These criteria were rated on a scale from 1-5, with 5 being the most effective and 1 being the least effective. Each score determined by individual stakeholders was used to calculate an average final priority value.

- Is there an appropriate State Agency that can take on the project?

These criteria were rated on a scale from 1-5, with 5 being the most effective and 1 being the least effective. Each score determined by individual stakeholders was used to calculate an average final priority value.

10.3 Action Plan for Implementation

The prioritized actions were compiled into the following table to identify a lead agency and potential funding source. Actions with a multi-agency lead include one or more of the agencies involved in the SHMPC. The SHMPC strives to complete actions within the lifespan of this Plan; however, due to funding and staffing restrictions, actions which are not completed within this time frame will be re-evaluated within the 2023 Plan update.

In-Kind funding will consist of obligated time/services from identified agencies.

10.4 POTENTIAL FUNDING OPPORTUNITIES

Potential funding opportunities are identified for each mitigation action shown in the following table. The State partners with the Federal Government in managing potential federal funding opportunities. The State itself does not budget funds outside of those outlined in the State Capability Assessment: Funding section of this Plan. *Note: This is not a complete list of potential mitigation funding opportunities and will continue to be expanded upon and revised during each Plan update cycle.*

Building Resilient Infrastructure and Communities (BRIC) Grant Program - Building Resilient Infrastructure and Communities (BRIC) is a continuation of PDM, provides funding to states, local communities, federally recognized tribes, and territories for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. (Nationally Competitive)

Community Development Block Grant (CDBG) Grant Disaster Recovery Program - Housing and Urban Development (HUD) provides flexible grants to help cities, counties, and States recover from Presidentially Declared Disasters, especially in low-income areas. These grants are subject to availability of supplemental appropriations. In response to Presidentially Declared Disasters, Congress may appropriate additional funding for the Community Development Block Grant (CDBG) Program as Disaster Recovery Grants to rebuild the affected areas and provide crucial seed money to start the recovery process.

Emergency Management Performance Grant (EMPG) Program - The purpose of the Emergency Management Performance Grant (EMPG) Program is to provide federal funds to states to assist state, local, territorial, and tribal governments in preparing for all hazards, as authorized by Section 662 of the Post Katrina Emergency Management Reform Act (6 U.S.C. § 762) and the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. §§ 5121 et seq.).The EMPG Program will provide federal funds to assist state, local, tribal, and territorial emergency management agencies to obtain the resources required to support the National Preparedness Goal's (the Goal) associated mission areas and core capabilities.

Flood Mitigation Assistance (FMA) Program - The FMA program is authorized by Section 1366 of the National Flood Insurance Act of 1968, as amended with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). FMA provides funding to states, territories, federally recognized tribes and local communities for projects and planning that reduces or eliminates long-term risk of flood damage to structures insured under the NFIP. FMA funding is also available for management costs. Funding is appropriated by Congress annually.

Hazard Mitigation Grant Program (HMGP) Program - The purpose of the Hazard Mitigation Grant Program (HMGP) is to help communities implement hazard mitigation measures following a Presidential Major Disaster Declaration in the areas of the state, tribe, or territory requested by the Governor or Tribal Executive. The key purpose of this grant program is to enact mitigation measures that reduce the risk of loss of life and property from future disasters.

Hazard Mitigation Grant Program Post-Fire Program – Similar to HMGP, the purpose of the Hazard Mitigation Grant Program Post-Fire is to help communities implement hazard mitigation measures following a declared FMAG disaster. While the State has the ability to oversee HMGP Post-Fire funding the State does not currently have an approved FMAG Agreement and has not historically experienced or declared FMAG disasters.
The State is working towards the creation and approval of a FMAG Agreement.

Homeland Security Grant Program (HSGP) - As appropriated by the Department of Homeland Security Appropriations Act, 2018 (Pub. L. No. 115-141), and authorized by the Homeland Security Act of 2002, as amended (Pub. L. No. 107-296), the Department of Homeland Security's (DHS)/Federal Emergency Management Agency's (FEMA) Fiscal Year (FY) 2018 Homeland Security Grant Program (HSGP) provides funding to states, territories, urban areas, and other local and tribal governments to prevent, protect against, mitigate, respond to, and recover from potential terrorist attacks and other hazards.

National Flood Insurance Program (NFIP) - The National Flood Insurance Program (NFIP) aims to reduce the impact of flooding on private and public structures. It does so by providing affordable insurance to property owners, renters, and businesses and by encouraging communities to adopt and enforce floodplain management regulations.

New Hampshire Coastal Resilience Grants (NHDES Coastal Program) - These funds are intended to support engagement to increase understanding of coastal hazards as well as planning, design, permitting, and construction projects that minimize hazards and enhance coastal community resilience. Projects must take place within one or more of the 17 coastal zone communities.

Pre-Disaster Mitigation (PDM) Program - This program awards planning and project grants and provides opportunities for raising public awareness about reducing future losses before disaster strikes. Mitigation planning is a key process used to break the cycle of disaster damage, reconstruction, and repeated damage. PDM grants are funded annually by Congressional appropriations and are awarded on a nationally competitive basis.

Public Assistance (PA) - FEMA's Public Assistance (PA) grant program provides federal assistance to government organizations and certain private nonprofit (PNP) organizations following a Presidential Disaster Declaration. Through the program, FEMA provides supplemental federal disaster grant assistance for debris removal, life-saving emergency protective measures, and the repair, replacement, or restoration of disaster-damaged publicly owned facilities, and the facilities of certain PNP organizations. The PA program also encourages protection of these damaged facilities from future events by providing assistance for hazard mitigation measures during the recovery process.

Individual Assistance (IA) – The Individual Assistance (IA) program's mission is to ensure that disaster survivors have timely access to a full range of authorized programs and services to maximize recovery through partnered coordination of local, state, territorial, and tribal governments, as well as other federal agencies, non-governmental organizations, and the private sector.

State Bridge Aid Program - A municipality desiring to manage the design and construction of a bridge rehabilitation or replacement project may receive State Bridge Aid in compliance with RSA 234. Bridge Aid provided to a municipality under this process shall consist of reimbursement at the rate of 80% of all qualifying costs that are found in compliance with the process, which includes costs incurred for design, construction, and construction engine.

High Hazard Potential Dams (HHPD Grant Program) - The purpose of HHPD is to provide for the rehabilitation of high hazard potential dams, provide technical assistance, planning, design, and construction assistance. The Water Infrastructure Improvements for the Nation Act or the "WIIN Act," of December 16, 2016, added HHPD under FEMA's National Dam Safety Program (33 U.S.C. 467f). New Hampshire does not currently have any state-supported funding programs available to owners of high hazard (or other) dams, but rather facilitates the management and distribution of federally funded programs like the High Hazard Potential Dam program that targets assistance to owners of high hazard dams.

10.5 2023 Mitigation Actions

State of New Hampshire Hazard Mitigation Plan 2023 Update 2023 Mitigation Actions								
Item #	**Action**	**Responsible Agency/ Party**	**Hazard(s)**	**Potential**	**Timeframe**	**Average**	**Status**	**Comments**
1	Utilize collaborative partnerships, including the NH Coastal Adaptation Workgroup to conduct outreach, technical assistance and assessments on current and future flood hazard mitigation. **All Goals** **Objectives: 1, 3, 4, 5**	NHDES	Coastal Flooding / Inland Flooding	Personnel Support/Administrative Budget	APA beyond 60 Months	**4**	Ongoing	Upper Valley Adaptation Workgroup is no longer a partner; developed a 5-year action plan
2	Increase understanding about flood risks and related impacts at the confluence where freshwater and tidal waters meet in estuarine systems, from wave action, and from changing sediment dynamics. **Goals: 1&6** **Objective: 5**	NHDES - Coastal Program	Coastal Flooding /Inland Flooding	Personnel Support/Administrative Budget, NH Coastal Resilience Grants	APA beyond 60 Months	**4**	Ongoing	Hampton Flood Study Model, completed 2021. Development on hydrodynamic coastal flood risk model for Coastal NH.
3	Identify and address sources of emerging contaminants. Where possible, provide	NHDES	Drought/Coastal Flooding/Inland	CWSRF, DWSRF, NH Trust Fund, WIIN , PFAS RLF, Other Specific Emerging Contaminant	APA beyond 60 Months	**4**	Ongoing	Updated funding sources. Program continues to build

	alternate water. **Goals: 2&6**		Flooding	Funds				new funding and contaminate evaluation. Data sharing with other states
4	Provide NFIP training and outreach to communities that encourages sound floodplain management practices and promotes flood hazard mitigation activities and available funding mechanisms. **Goals: 1&6** **Objective: 5**	NH BEA - OPD	Coastal Flooding / Inland Flooding / Tropical and Post-Tropical Cyclones	Personnel Support/Administrative Budget, Potential Federal Grants	APA beyond 60 Months	**4**	Ongoing	NH OSI continues to provide education through its website, webinars and by partnering with NH Silver Jackets.
5	The SHMO will provide State agencies, local communities, Regional Planning Commissions, private non-profit, and private entities with applicable hazard mitigation outreach regarding the State's initiatives and available resources. **Goals: 1&3** **Objective: 5**	NH HSEM	Natural Hazards	Personnel Support/Administrative Budget	APA beyond 60 Months	**4**	Ongoing	Recent meeting held with Regional Planning Commissions to discuss better collaboration and planning needs.
6	Provide technical assistance through funding and staff support to coastal communities to enhance current and future coastal hazard mitigation planning and	NHDES - Coastal Program	Coastal Flooding / Inland Flooding	Personnel Support/Administrative Budget, Federal HMA funding, NH Coastal Resilience Grant Program	APA beyond 60 Months	**4**	Ongoing	2021 Coastal Resilience Grant Program awards totaling $121, 279 for community and habitat resilience.

	activities. **Goals: 1&3** **Objectives: 5&6**							2023 Coastal Resilience Grant program will provide $200,000 for community and habitat resilience.
7	Maintain NHDES funding and coordinate with other funding sources to replace aging infrastructure. Promote asset management activities at drinking water and wastewater systems. **Goal: 2** **Objective: 6**	NHDES	Drought, Flooding	CWSRF, DWSRF, SAG	APA beyond 60 Months	**4**	Ongoing	Updated funding sources and action verbiage. This has become a permanent program in New Hampshire, providing grants to drinking and wastewater projects.
8	Incorporate multi-agency uses of LIDAR data to support mitigation activities, such as holistic watershed flood monitoring. **Goals: 1&2** **Objective: 2**	NHDES	Coastal Flooding / Inland Flooding / Tropical and Post-Tropical Cyclones	Personnel Support/Administrative Budget	APA beyond 60 Months	**4**	Ongoing	New LIDAR data sourced for Nashua River and Seacoast.
9	Work with high hazard and significant potential dam owners and local communities to update EAPs for their inclusion in community emergency operations and hazard mitigation plans. **Goals: 1&3**	NHDES Dam Bureau, NH HSEM	Inland Flooding / All Hazards	Personnel Support/Administrative Budget	APA thru 24-48 Months	**3**	New	Tied with Action #26 to be incorporated as dams are inspected, and then applied as LHMPs and LEOPs are updated.

	Objectives: 1&5							
10	Compile data within watershed and inundation areas for high hazard and significant potential dams to develop information regarding at-risk communities, State-owned properties, and/or major community lifelines (e.g., hospitals, community reception centers for Seabrook EPZ, major utilities). **All Goals** **Objectives: 1&4**	NHDES Dam Bureau, NH HSEM, NH DAS	Inland Flooding / All Hazards	Personnel Support/Administrative Budget	APA beyond 60 Months	**3**	New	Tied with Actions #9&26 to be incorporated as dams are inspected. Information will be compiled from State sources and updated from LHMPs.
11	HSEM will continue to host the Annual Emergency Preparedness Conference, which includes the promotion and education of mitigation. **All Goals**	NH HSEM	All Hazards	Personnel Support/Administrative Budget	APA beyond 60 Months	**3**	Ongoing	HSEM plans to host this event in 2024.
12	Continue to sustain the stream gauge program and identify funding resources to strategic installation of additional stream gauges. **Goal: 4** **Objectives: 1&5**	NHDES	Inland Flooding	Personnel Support/Administrative Budget	APA beyond 60 Months	**3**	Ongoing	Silver Jacket project to install gauges to supplement existing network. Data reporting to CrowdHydrology as a test pilot.
13	Re-Establishing Program Administration by State (PAS) status allowing for	NH HSEM	Natural Hazards	Personnel Support/Administrative Budget	APA beyond 60 Months	**3**	Ongoing	The State is currently in the process of re-

	the continued authority to Formally Approve Local Hazard Mitigation Plans. **Goals: 3&4** **Objective: 3&6**							assessment by FEMA to continue PAS activities.
14	Sustain NHDOT and UNH - TTC - T2 Program in the development of road design construction, storm water and road drainage standards, including culvert and bridge sizing. Provide training for local and State Officials. **Goals: 1, 2, 5, 6** **Objective: 1**	NH DOT, UNH	All Hazards	Potential Federal Grants, Privately Funded	APA beyond 60 Months	**3**	Ongoing	Current efforts provide training for Government Officials.
15	Provide generators at selected state-owned fuel locations to provide fuel to emergency vehicles during an extended power outage. **Goals: 1, 2, 5** **Objective: 1**	NH DOT	All Hazards	HMA Grant Funding or EMPG Grant Funding	APA beyond 60 Months	**3**	Ongoing	50 out of 87 sites have backup generators as of 2021.
16	NH DES to assist partners in maintaining existing tidal gauge networks data at Fort Point and Hampton and improve historical record keeping, forecasting and outreach. **Goal: 4** **Objectives: 1&5**	NHDES	Coastal Flooding	Personnel Support/Administrative Budget	APA beyond 60 Months	**3**	Ongoing	NHDES has been utilizing Hampton data and issued a report on high tide flooding in 2021. NERACOOS is working to secure additional funding, Data

								collected indicates further work in advance planning and investment is needed in Hampton. Fort Point gauge does not seem to be operational, and NWS would need to be asked for more information.
17	Expand upon current descriptors used for State assets inventory to include data such as location, building material, and hazard vulnerabilities. **Goal: 5** **Objective: 1**	Multi-Agency	All Hazards	Personnel Support/Administrative Budget	APA beyond 60 Months	**3**	Ongoing	DAS continues to develop this information.
18	Sustain the New Hampshire Department of Environmental Services and Water Division in the implementation of the State's Drought Management Plan. **Goals: 1, 4, 6** **Objective: 2**	NHDES / NH AGR	Drought	Personnel Support/Administrative Budget, Potential Federal Grants	APA beyond 60 Months	**3**	Ongoing	Drought Management Task Force coordination, new grants established to help homeowners. Situational Monitoring as needed.
19	Provide standardized	NHDES	Natural	Personnel	APA beyond	**3**	Ongoing	Updated

	guidance on temperatures, sea-level rise, and precipitation changes, to local communities for incorporation into planning efforts. **Goals: 2&3** **Objective: 3**		Hazards	Support/Administrative Budget	60 Months			statewide climate assessment efforts. NHDES hired a position to address these issues with the water/ wastewater utilities.
20	Evaluate the impacts of saltwater intrusion and changing groundwater table elevations as a result of sea-level rise and implications for water, waste, and asset/infrastructure management. **Goals: 1, 2, 6** **Objectives: 1&2**	NHDES / NH DOT	Coastal Flooding / Inland Flooding	Personnel Support/Administrative Budget, Potential Federal Grants, Privately Funded.	APA beyond 60 Months	**3**	Ongoing	Current mapping effort to project ground water rise; limited asset inventory
21	Training for communities to adopt floodplain management regulations that exceed the minimum NFIP requirements, incorporating higher standards (e.g., freeboard, setback, and compensatory storage requirements) that will improve local flood resilience. **Goals: 1, 2, 6** **Objectives: 3&5**	NH BEA - OPD	Coastal Flooding / Inland Flooding	Personnel Support/Administrative Budget, SJ/USACE	APA beyond 60 Months	**3**	Ongoing	Resources are available that support adoption of higher standards, including a menu of higher standards, template regulations, and annual trainings.
22	State agencies will	Multi-Agency	All Hazards	Personnel	APA thru	**3**	For the	N/A

	collaborate development of information dissemination opportunities via a variety of outreach methods, including broadcast media, social media platforms, ReadyNH.gov, Public Service Announcements, printed materials, direct outreach through NH HSEM's Community Outreach Office, programs for school aged children, and exhibits at conferences and workshops in an effort to educate the State in regards to mitigation. **Goals: 1&2** **Objective: 5**			Support/Administrative Budget	60 Months		Life of the Plan	
23	Implement the New Hampshire Coastal Risk and Hazard Commission recommendations related to hazard mitigation with immediate coastal communities. **Goals: 1, 2, 4** **Objective: 1&3**	NHDES - Coastal Program	Coastal Flooding /Inland Flooding	Personnel Support/Administrative Budget	APA thru 60 Months	**3**	Revisit - See 2022 Progress Report	As stated in previous input, this recommendation is too broad for the plan.
24	The State will closely support local communities, with assistance from	NH HSEM	Natural Hazards	Personnel Support/Administrative Budget, State Budget for Trainings	APA beyond 60 Months	**3**	Ongoing	The State is currently working with multiple jurisdictions on

	contractors and regional planning commissions, in the creation of single-jurisdiction and multi-jurisdiction hazard mitigation plans. **All Goals and Objectives**							two separate multi-jurisdiction plans
25	Provide education and outreach for mitigation strategies in reference to pre-event debris management. **Goals: 1, 3, 4** **Objectives: 3&4**	NHDES, NH DOT	Natural Hazards	Personnel Support/Administrative Budget	APA beyond 60 Months	**3**	Ongoing	Education and outreach continue at the municipal level.
26	The Dam Bureau will continue to execute dam safety inspections and enforcement programs as needed. **Goals: 1&2** **Objectives: 1&5**	NHDES	Inland Flooding / Dam Failure	Personnel Support/Administrative Budget, Privately Funded	APA beyond 60 Months	**3**	Ongoing	Administrative regulations are being updated and revised to address inconsistencies and advancements in industry practices.
27	Incorporate 500-year flood plain threshold for new construction of drinking water and wastewater facilities in accordance with NEIWPCC's TR-16 Guides for the Design of Wastewater Treatment Works and other similar documents (Revised 2011	NHDES	Coastal Flooding / Inland Flooding	Personnel Support/Administrative Budget, State Budget, Privately Funded	APA thru 30-60 Months	**3**	Ongoing	The TR-16 is currently being updated with an anticipated completion in 2025. The 10-State Standards was recently updated in 2022.

	Edition). **Goals: 1, 2, 6** **Objective: 1**							
28	Enhance of the gauging network as recommended by the USGS and NHDES-WD. **Goal: 1, 4, 6** **Objective: 2**	NHDES	Inland and Coastal Flooding	Personnel Support/Administrative Budget	APA thru 60 Months	**3**	For the Life of the Plan	N/A
29	Organize and train Road Agents, EMDs and "Skywarn" etc. volunteers in affected areas in ice monitoring activities that will enhance the NH-CRREL database. **All Goals and Objectives**	NH Silver Jackets / CRREL	Inland Flooding / Severe Winter Weather	Personnel Support/Administrative Budget	APA thru 60 Months	**3**	For the Life of the Plan	N/A
30	Propose a comprehensive planning and zoning policy such as development setbacks and limits on density and infrastructure in coastal and transitional zones to consider vulnerability to sea level rise and saltwater intrusion. **Goal: 3** **Objectives: 3&5**	NH CAW / NHDES	Coastal Flooding / Inland Flooding	Personnel Support/Administrative Budget, Potential Budget, Potential Federal Grants	APA beyond 60 Months	**3**	Ongoing	Developing Coastal Innovative Land Use Guide, June 2022.
31	Continue the development of local and regional river corridor stewardship programs such as the Rivers	Multi-agency	Inland Flooding	Potential Federal Grants, Personnel Support/Administrative Budget	APA thru 60 Months	**3**	For the Life of the Plan	

	Management and Protection Program. **Goals: 1, 2, 4** **Objectives: 1&5**							
32	Enhance existing Road Weather Information System (RWIS) through deployment of additional stations. **Goal: 4** **Objective: 3**	NH DOT	Natural Hazards	Personnel Support/Administrative Budget	APA thru 30-60 Months	**3**	Adapted / Expande d	38 RWIS stations statewide
33	Trian NFIP-participating communities that conduct floodplain management activities exceeding the minimum NFIP requirements to consider joining the Community Rating System (CRS), an NFIP incentive program that provides discounts to flood insurance premiums for some residents and businesses as a reward for the community's activities. **Goals: 1, 2, 6** **Objectives: 5&6**	NH OSI	Inland and Coastal Flooding	Personnel Support/Administrative Budget	APA beyond 60 Months	**3**	Ongoing	Continued quarterly state CRS Users Group
34	Continue to develop and maintain GIS layers as a muti-agency collaborative effort to capture data, including but not limited to: · NH DES: Stream	DNCR-DHR	All Hazards	Personnel Support/Administrative Budget, Privately Funded, Potential Federal Grants (FMA, BRIC, HMGP, EMPG)	APA beyond 60 Months	**3**		NHDES - 12,761 streams assessed. NHDNCR -DHR - continued use of EMMIT NHHSEM - continued research into

	Crossing Initiative geodatabase. · NH DNCR-DHR: Sensitive natural and cultural resources and historical and archeological properties, and incorporation of archeological site data in the new Electronic Mapping and Management Information Tool (EMMIT) and promote use by municipalities, local heritage commissions, historical societies, and preservation professionals. · NH DNCR-DFL: LANDFIRE data layers (used to determine statistical probabilities of wildland fires). · NH DES Coastal Program: Coastal hazards (maximum flooding extent, nuisance flooding extent, etc.), locations of natural and manmade protective systems and barriers (salt marshes, seawalls, etc.), ongoing study locations, and others. Data collected in							mapping HMA projects.

	partnership with NH Fish and Game, UNH Sea Grant, and GRANIT. · NH HSEM: Maintain Hazard Mitigation Assistance (HMA)Program funded project layer. **All Goals and Objectives**							
35	The State will work with local communities, contractors, and regional planning commissions to develop and maintain lists of public and private facilities considered essential to regional and local interests. **Goals: 2, 3, 6** **Objectives: 4, 5, 6**	NH HSEM	All Hazards	Personnel Support/Administrative Budget, Privately Funded	APA beyond 60 Months	**3**	Ongoing	The state is actively reviewing local plans prior to submission to FEMA for approval.
36	Promote and educate in the development of increased standards for those facilities that maybe at risk from natural hazards. **Goals: 1, 2, 5** **Objectives: 3, 5, 6**	Multi-Agency	All Hazards	Personnel Support/Administrative Budget	APA beyond 60 Months	**3**	Ongoing	Adjustments to frequency of building code changes allow for adjustments more frequently
37	NH DOT to identify, analyze, and create design solutions for repeated areas of road closures. **Goals: 1&6** **Objective: 1**	NH DOT	All Hazards	Personnel Support/Administrative Budget	APA beyond 60 Months	**3**	Ongoing	Currently pursuing mitigation projects for Hampton and Rye Harbors
38	Assist communities with cost-effective mitigation of repetitive loss	NH HSEM, NH BEA-OPD	Natural Hazards	Personnel Support/Administrative Budget, Potential	APA thru 60 Months	**3**	For the Life Of the Plan	NH OPD suggests either adding to, replacing, or

	properties through acquisition and demolition, relocation or elevation by overseeing HMGP, PDM and FMA funding. Develop and maintain the state's priority mitigation property list, which will include repetitive loss and severe repetitive loss properties. Encourage and assist communities where these priority properties are located to explore FEMA and other relevant grant sources to address the flood risk to these properties. **Goals: 1, 2, 6** **Objectives: 1&6**			Federal Grants (FMA, BRIC, HMGP)				creating a new priority with the new language.
39	Promote funding and resources for land acquisition, conservation planning, land management programs, and land stewardship in areas at risk of loss or degradation due to sea level rise. **Goals: 1, 3, 4** **Objectives: 3&6**	Multi-agency	Coastal Flooding / Inland Flooding	Personnel Support/Administrative Budget	APA thru 60 Months	**3**	For the Life Of the Plan	
40	Using materials supplied by National Fire Protection Association	NH SFMO	Conflagrati on, Wildfire,	Personnel Support/Administrative Budget	APA beyond 60 Months	**3**	Ongoing	Conduct training for community wildfire

	(NFPA) and others, the State will utilize and develop public information materials for distribution to appropriate State agencies, regional planning committees and local planning committees. Additionally, the NHSFMO will review and develop (as necessary) Public Service Announcements to alert interested parties to the existence of fire, life safety, and hazardous materials risks. **Goals: 2&4** **Objectives: 3&5**		Hazardous Materials					protection plans.
41	The Department of Natural and Cultural Resources will continue to assist in the development of the Community Wildfire Protection Plans (CWPP) and other plans and authorities to identify cost effective wildland fire hazard mitigation measures in accordance with the State's Forest Fire Protection Plan. **Goals: 1, 3, 4** **Objectives: 1, 3, 5**	NH DNCR, NH HSEM	Wildfire	Personnel Support/Administrative Budget	APA thru 60 Months	**3**	For the Life Of the Plan	

42	Incorporate projected sea-level rise, storm surge, and precipitation as well as associated changes in flood levels, currents, groundwater tables, stormwater runoff, and other related impacts into capital improvement projects, permitting, and other state actions. **Goals: 1, 3, 4, 6** **Objectives: 1, 3, 4**	Multi-Agency	Coastal Flooding / Inland Flooding	Personnel Support/Administrative Budget	APA thru 60 Months	**3**	For the Life Of the Plan	
43	Continue to develop and utilize within the Communicable Disease Control Section (CDCS) standard operating procedures for each reportable disease. **Goals: 1&6** **Objectives: 2&5**	NH DHHS	Infectious Diseases	Personnel Support/Administrative Budget	APA thru 60 Months	**3**	For the Life Of the Plan	
44	Continue to expand the use of NH Electronic Disease Surveillance System (NH EDSS) to all investigating staff members at the local and state level. **Goal: 5** **Objective: 2**	NH DHHS	Infectious Diseases	Personnel Support/Administrative Budget	APA thru 60 Months	**3**	For the Life Of the Plan	
45	Provide education to organizations on potential Mitigation Funding Sources through New	NH HSEM	All Hazards	Personnel Support/Administrative Budget	APA thru 30-60 Months	**3**	NEW	

	Hampshire Municipal Association **Goals: 3&6** **Objectives: 3, 4, 6**							
46	Research viability of a Statewide climate action plan including funding, appropriate State Agency and administrative capability. **Goals: 3&4** **Objectives: 1&3**	NH HSEM	All Hazards	Personnel Support/Administrative Budget	APA thru 30-60 Months	**3**	NEW	The SHMPC will work to divide the work of researching and implementing climate action plan tools to be applied in various State Plans, to include the 2028 SHMP update.
47	NH DNCR-DHR, including the State's Historic Preservation Officer (SHPO), will continue their efforts to improve the protection of important historical properties against fire, vandalism, and flooding, among other hazards. **Goals: 1&3** **Objectives: 1&4**	NH DNCR-DHR	All Hazards	Personnel Support/Administrative Budget, Potential Federal Grants, Privately Funded	APA thru 60 Months	**2**	For the Life Of the Plan	
48	The State's Historic Preservation Officer (SHPO) and the NH DNCR-DHR will continue to inventory, catalogue, and assess the State's important Archeological and Historical properties	NH DNCR-DHR / NH HSEM	All Hazards	Personnel Support/Administrative Budget	APA beyond 60 Months	**2**	Ongoing	Continued acceptance and review of archaeological site forms and individual inventory forms for posting to

	(including buildings, dams, bridges etc.). **Goals: 1&3** **Objectives: 1&4**							EMMIT
49	NH DNCR-DHR to enhance its State Conservation Rescue Archeology Program (SCRAP), which is the recruitment and training field survey teams to expedite historical site reviews in an emergency. **Goals: 1&3** **Objectives: 1&4**	NH DNCR-DHR	All Hazards	Personnel Support/Administrative Budget	APA beyond 60 Months	**2**	Ongoing	SCRAP has continued to host Field Schools to educate and train on basic methods, theory, and techniques.
50	NH DNCR-DHR to complete and maintain a statewide assessment of deficiencies in survey data (done by town, but phase by county if necessary) **Goals: 3&6** **Objectives: 1&5**	NH DNCR-DHR	Natural Hazards	Personnel Support/Administrative Budget	APA beyond 60 Months	**2**	Ongoing	EMMIT program continues to be updated with data of known cultural resources
51	Implement the development of public/private partnerships in the planning for post-event recovery to promote a more resilient State. **Goals: 2&5** **Objectives: 3, 5, 6**	NH HSEM / NHDES	All Hazards	Personnel Support/Administrative Budget, Potential Federal Grants, Privately Funded	APA thru 60 Months	**2**	For the Life Of the Plan	HSEM had begun work prior to 2020 to develop and hone its recovery planning efforts. The Silver Jackets developed an implementation plan for what it is to do in the event

								of the activation of RSF #6 (Natural and Cultural Resources), as the Silver Jackets is the implementing mechanism for that RSF. COVID-19 and subsequent staffing issues at both HSEM and NHDES have prevented further progress on recovery planning work. This is the rationale for some of the "Ineffective" ratings in this section.
52	Provide technical assistance and promote the installation of regionally and locally significant staff gauges, tidal gauges, and other such monitoring equipment as determined to be necessary by local EMDs, Road Agents, etc. **Goals: 1, 4, 6** **Objectives: 1&5**	USGS/NH HSEM	Coastal Flooding / Inland Flooding	Potential Federal Grants, Personnel Support/Administrative Budget	APA thru 60 Months	**2**	For the Life Of the Plan	N/A

53	Enhance syndromic surveillance in schools **Goal: 1** **Objective: 2**	NH DHHS	Infectious Diseases	Personnel Support/Administrative Budget	APA beyond 60 Months	**2**	Ongoing	Continued monitoring by NH DHHS Infectious Disease Control. Data submitted by schools on a volunteer basis and analyzed for base line and trends.
54	Evaluate the feasibility to implement legislatively or by providing general education the action polices derived from the Outthink Wildfire program administered by the NFPA. The tenants of this program focus on residences and businesses becoming more resilient to wildfires, updating codes and standards, ensuring adequate preparedness levels for response capabilities, increase the resources available for vegetative fuel management, and general educational outreach.	FMO/DNCR	Wildfire	Personnel Support/Administrative Budget	APA beyond 60 Months	**-***	New	
55	The Department of Natural and Cultural Resources will develop training for municipalities	DNCR	Wildfire	Personnel Support/Administrative Budget	APA beyond 60 Months	**-***	New	

	outlining the financial impacts of wildfires on local governments.							
56	Evaluate the feasibility to implement legislatively or by providing general education the recommendations or strategies that the Wildland Fire Mitigation and Management Commission provide. The Commission focuses on forming federal policy recommendations and strategies on ways to better prevent, manage, suppress, and recover from wildfires, and provide recommendations for aerial firefighting equipment needs.	FMO/DNCR	Wildfire	Personnel Support/Administrative Budget	APA beyond 60 Months	**-***	New	

* Items were added after the Stakeholder meeting which provided committee-wide ratings and as such do not have a priority rating for this update.

ENDNOTES – MITIGATION STRATEGY AND PRIORITIZATION

[1] https://www.hudexchange.info/programs/cdbg-dr/

[2] https://www.fema.gov/media-library-data/1464196875293-190ed88e1b63940c87121a3f0b97b8a5/EMPG_Multi_Year_Program_Guidance_Final.pdf

[3] https://www.fema.gov/flood-mitigation-assistance-grant-program

[4] https://www.fema.gov/hazard-mitigation-grant-program

[5] https://www.fema.gov/media-library-data/1526578922142-6e8ecdd336887cfb43062fcf7b374f4a/FY_2018_HSGP_Fact_Sheet_FINAL_508.pdf

[6] https://www.fema.gov/national-flood-insurance-program

[7] https://www.des.nh.gov/media/pr/2018/20180507-coastal-rfp.htm

[8] https://www.fema.gov/pre-disaster-mitigation-grant-program

[9] https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities

[10] https://www.fema.gov/emergency-managers/risk-management/dam-safety/rehabilitation-high-hazard- potential-dams

[11] https://www.fema.gov/public-assistance-local-state-tribal-and-non-profit

[12] https://www.nh.gov/dot/business/municipalities.htm

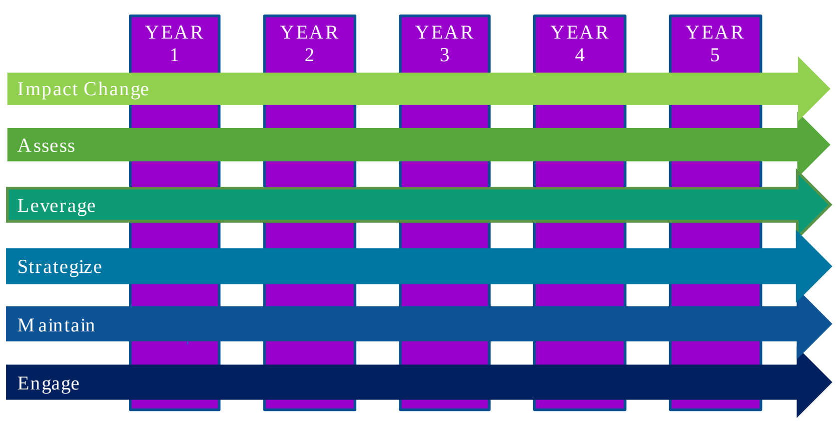
[13] http://www.gencourt.state.nh.us/rsa/html/LXIV/674/674-2.htm

11. Plan Implementation and Maintenance

NH SHMP Process

The SHMPC determined that although the current process for monitoring, evaluating, and updating the NH 2023 State Hazard Mitigation Plan met the criteria for the involved agencies, it did not meet the need for sufficient monitoring, evaluating, and updating the Plan. The Committee discussed possible changes to this process moving forward and is confident that it can be followed with greater success for the next planning cycle.

2023 SHMP Implementation and Maintenance Cycle



The implementation of the Plan shall be a continuous effort on the part of the NH HSEM Director, the SHMO, the HSEM Internal SHMP Working Group, and the SHMPC. The SHMO shall be responsible for annual Plan monitoring and maintenance.

SHMP Maintenance & Implementation
Recurring Deliverables

Monthly

- FEMA Region 1 Monthly Mitigation Planning Meetings
- Determine SHMPC meeting frequency change? Year4/5 Switch to monthly or bi -weekly?

Quarterly

- Submit Mitigation Grant Reports to FEMA
- SHMPC Meetings
- Mitigation meetings with RPCs
- Mitigation meetings with local EM
- Summary of the development of local mitigation plans

Dedicated time for reporting SHMP monitoring, maintenance, and progress – including suggested changes/additions, areas for improvement, and barriers to progress – will be built in to the SHMPC's meeting agenda on a quarterly basis or more frequently as needed, to ensure continuity with the Plan. Information contained in these reporting updates will be conveyed to the NH HSEM Director.

SHMP Maintenance & Implementation
Recurring Deliverables

Annually

- SHMP Review and Evaluation, including SHMPC and all plan contributors
- FEMA Consultation Meeting
- Update Capabilities Table to integrate new programs, policies, initiatives, and funding at the local, State and Federal level
- Summary of progress addressing equity for vulnerable populations
- Summary of progress engaging both new and existing SMEs
- Summary of Community Engagement Strategy progress, activities, feedback, and outcomes
- Mitigation Strategy Meeting with all contributors to review strategies and progress of actions/projects
- Meetings with Port Security – semi-annual?

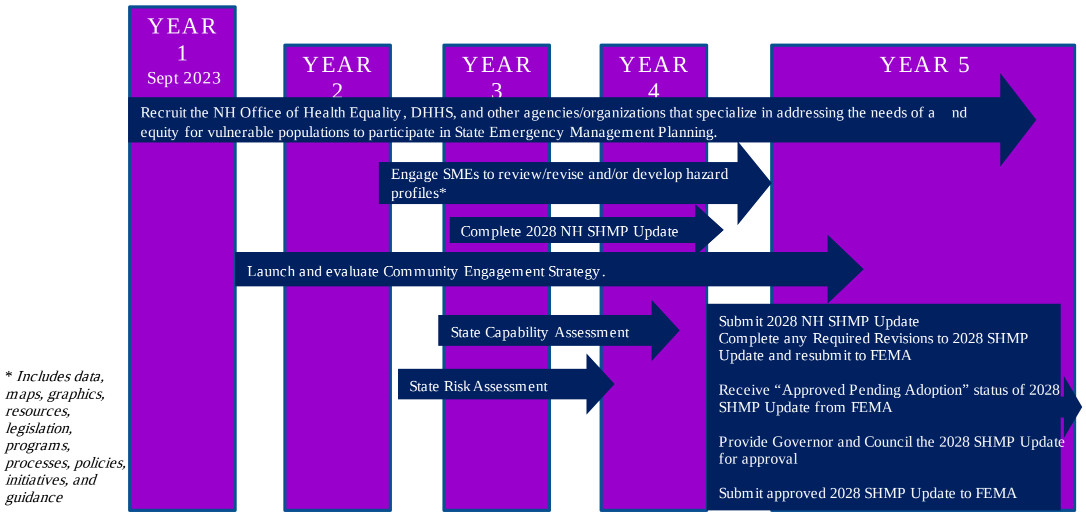
The Plan should be reviewed and evaluated following each declared/non-declared event and, at a minimum, on an annual basis.

The SHMP will be formally updated every five years in accordance with FEMA's State Mitigation Planning Policy Guide (FP 302-094-2), released April 19, 2022, or new guidance if available. The process for the annual review of the Plan is the responsibility of the SHMO and the SHMPC with all plan contributors, Subject Matter Experts being included, either in groups or individual meetings, to ensure consistency and continuity.

The NH HSEM Internal SHMP Working Group will ensure that the following revisions are made to the SHMP during the 5-year update:

- Review the *Capability Assessment*, to integrate new programs, policies, initiatives, and funding capabilities at the local, State and Federal level.
- Review the *Hazard Identification and Risk Assessment* to reflect new historical information for natural hazards.
- Review the *Hazard Identification and Risk Assessment*, to incorporate new data collected on State and local critical facilities, infrastructure, and population.
- Engage SMEs to review and revise existing Hazard Profiles for natural hazards that will remain in the Plan and develop Hazard Profiles for any hazards that are being added to the Plan.
- Collaborate with NWS/NOAA and other climate SMEs to obtain and include updated information regarding climate change science, including projections, impacts, priorities, and initiatives, as well as strategies to mitigate climate change impacts, especially Nature Based Solutions.
- In *Coordination of Local Mitigation Planning*, incorporate a summary of the development of local mitigation plans.
- Collaborate with the NH Office of Health Equality and other organizations specializing in addressing the needs of and equity for vulnerable populations to determine considerations and strategies to minimize or eliminate inequitable outcomes of natural hazards.
- Examine the progress and effectiveness of mitigation projects completed. Determine whether or not they meet the goals of the State's Mitigation Plan, and if not, whether or not the State's mitigation strategy should be modified.
- Incorporate changes in priorities from within the State's mitigation strategy.
- Review and incorporate any Suggested Future Improvement comments from FEMA and other federal agencies from the review of this plan into the next plan update in 2028.
- A minimum of 6 months prior to current plan expires, submit 2028 NH SHMP Update to FEMA.
- A minimum of 6 months prior to current plan expires, submit 2028 NH SHMP Update to FEMA.
- Upon return of 2028 SHMP Update Review and Required Revision from FEMA, complete any Required Revisions indicated and resubmit 2028 SHMP Update. Continue submitting and making any required revisions to plan until FEMA designates the plan "Approved Pending Adoption."
- Notification of APA for 2028 SHMP Update from FEMA
- Present APA 2028 SHMP Update to Governor for adoption.

2023 SHMP Implementation and Maintenance Cycle: Engage



- Submit signed and adopted 2028 SHMP Update to FEMA.
- FEMA formally approves adopted 2028 SHMP Update.

11.1 Plan Maintenance

The SHMO shall assure maintenance of the Plan and shall consider and approve projects that are submitted for HMGP, FMA, and PDM funding in accordance with the Plan's Goals and Objectives.

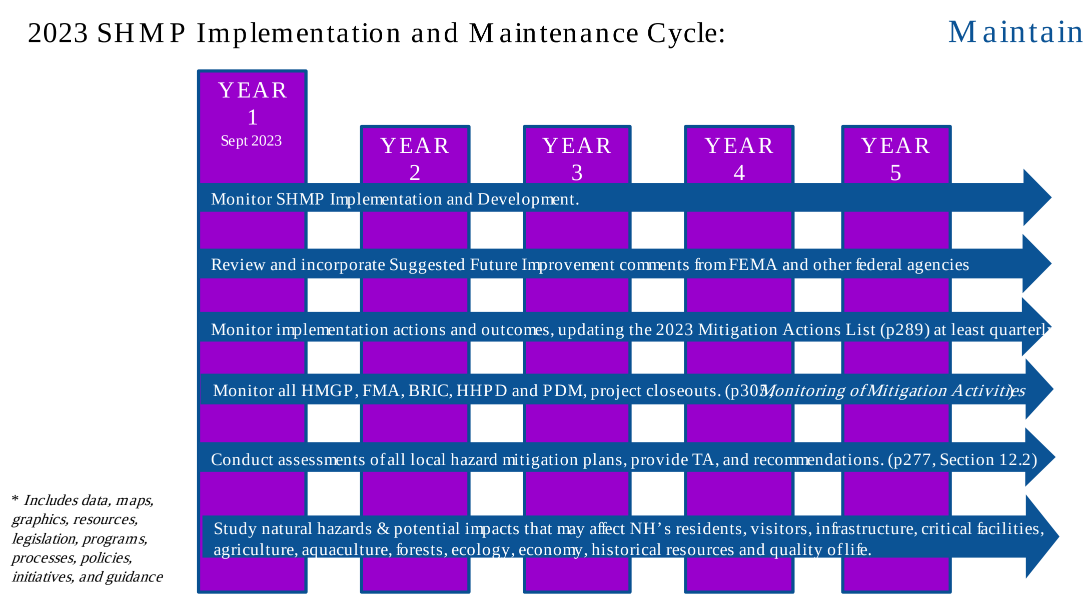
The SHMO will contact state and local-level stakeholders via email, surveys, and social media to gather information, discuss SHMP development, and solicit idea, strategies, and activities for inclusion in annual updates of the Plan. Stakeholders will include, at minimum:

- State Hazard Mitigation Planning Committee
- Regional Planning Commissions
- Representatives of local jurisdictions
- Private/Non-profit organizations
- Members of the general public
- Representatives from the following community sectors:
- Emergency management
- Agencies providing community lifelines (Safety and Security, Hazardous Materials, Food, Water, Shelter, etc.).
- Economic development.
- Land use and development, including the agency or department that regulates building codes.
- Housing (including Food, Water, Shelter community lifelines).
- Health and social services (including Health and Medical community lifelines).

- Infrastructure (including Energy, Communications, Transportation, and Food, Water, Shelter community
lifelines).
- Natural and cultural resources agencies.
- Organizations/Individuals with climate change and climate adaptation expertise.
- Agencies with programs, policies, and assistance that support underserved communities.
- Agencies serving underserved/vulnerable communities.

11.2 CONTINUING RELEVANCY OF GOALS AND OBJECTIVES

The SHMO and the SHMPC shall continually monitor the relevancy of the Plan's stated Goals and Objectives. They will take this step when considering any and all mitigation measures.

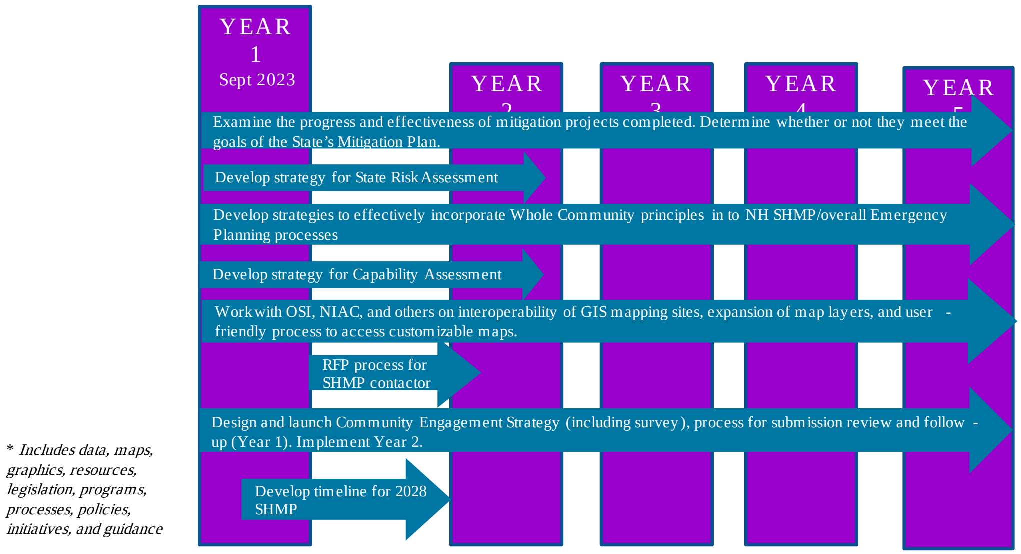


11.3 EFFECTIVENESS OF MITIGATION STRATEGIES AND MEASURES

The SHMO and the SHMPC shall work cooperatively to identify and evaluate the effectiveness of all existing Hazard Mitigation measures and assess and adjust the mitigation strategy accordingly.

Unless the NH HSEM Director and/or the SHMPC identify an adjustment as an emergency measure, adjustments requiring a modification to the State's Plan shall follow the procedure for Plan amendment. In all cases where an apparent departure from the Plan may have been initiated, at the earliest practical opportunity or within 30 days (whichever is less), the SHMO shall prepare and report the emergency measures and amendments undertaken and submit the Plan amendment to FEMA for amendment approval.

2023 SHMP Implementation and Maintenance Cycle: Strategize

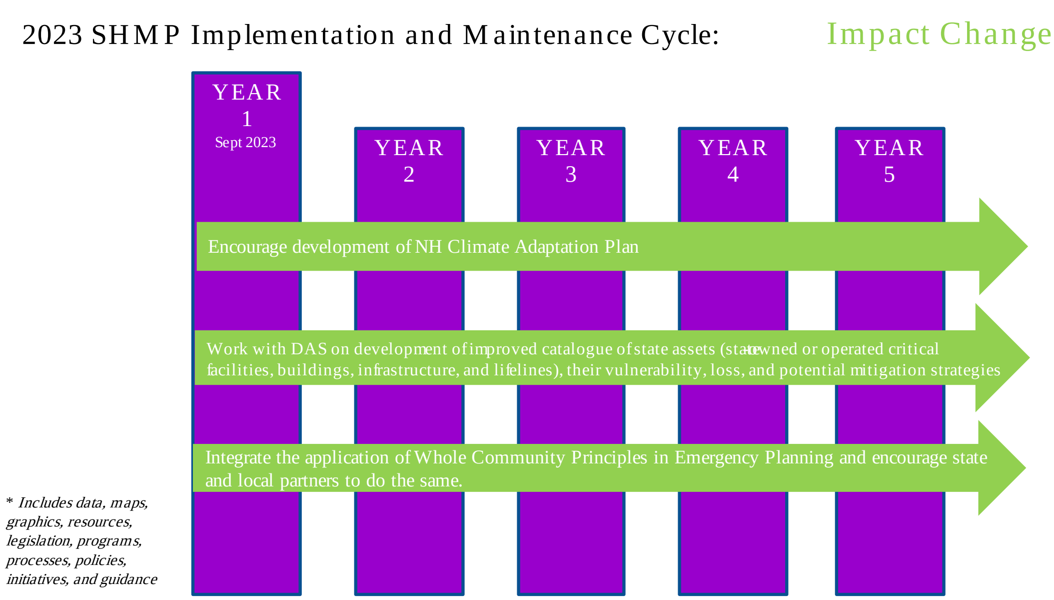


11.4 Monitoring of Mitigation Activities

Any HMGP, FMA, and PDM -funded projects will include the closeout procedures as identified in the Hazard Mitigation Assistance (HMA) Programs Guidance, 2021. The SHMO will monitor all HMGP, FMA, BRIC, HHPD and PDM, project closeouts. At a minimum, the following will occur for project closeouts:

- The subrecipient shall submit closeout information in the form of a final report on work done, expenditures, and other costs.
- Project closeouts will be noted in the project files.
- Final payments shall be made along with a closeout letter.

State agencies that are identified in the Mitigation Action Plan or are contributing to any of the mitigation measures identified in the Mitigation Strategy chapter of the Plan, will meet on an annual basis to determine if the strategies are still in effect, or if new items have been added. The SHMO will track progress of actions and projects identified in the State Hazard Mitigation Plan by meeting and maintaining contact with members of the SHMPC.



11.5 Future Enhancements

The SHMPC will review the need for improvements for the 2028 Plan. Funding sources considered for improvements will need to be reviewed and approved by the NH HSEM Director, as well as Governor and Executive Council. The 2023 Plan update was funded and written by NH HSEM. The SHMO and the SHMPC shall endeavor to develop appropriate and cost-effective Hazard Mitigation strategies as may be consistent with the achievement of the stated goals and objectives.

The SHMO and the SHMPC will continue to study the potential impacts of such hazard events that may affect the State's residents and guests as well as its infrastructure, critical facilities, aviation and navigation facilities, agriculture, aquaculture, forests, ecology, economy (e.g., tourism industry, forest products, etc.), historical resources and quality of life and endeavor to develop cost effective strategies to mitigate losses associated with these events.

The SHMPC will continue to expand upon our stakeholder group and pursue additional ways to engage with them, particularly in private and non-profit sections. Examples include: the University System of NH, organizations representing vulnerable populations and/or addressing health equity, and business owners.

ENDNOTES: PLAN IMPLEMENTATION AND MAINTENANCE

[1] https://www.fema.gov/sites/default/files/documents/fema_state-mitigation-planning-policy-guide_042022.pdf

[2] CDC, Social Determinants of Health at CDC. https://www.cdc.gov/about/sdoh/index.html

[3] CORE PRINCIPLES OF EQUITY IN EMERGENCY MANAGEMENT, NAACP. https://naacp.org/resources/core-principles-equity-an