TOWN COUNCIL – AGENDA REQUEST FORM

THIS FORM WILL BECOME PART OF THE BACKGROUND INFORMATION USED BY THE COUNCIL AND PUBLIC

Please submit Agenda Request Form, **including back up information**, 8 days prior to the requested meeting date. **Public Hearing requests must be submitted 20 days prior to the requested meeting date to meet publication deadlines** (exceptions may be authorized by the Town Manager, Chairman/Vice Chair).

MEETING INFORMATION

Date Submitted: Sept. 18, 2014
Date of Meeting: November 6, 2014
Submitted by: Jill Longval
Time Required: 10-15 minutes
Department: Nashua Regional Planning Commission
Background Info. Supplied: Yes ☒ No ☐
Speakers: Jill Longval, Ryan Friedman

CATEGORY OF BUSINESS (PLEASE PLACE AN "X" IN THE APPROPRIATE BOX)

Appointment:	☑	Recognition/Resignation/Retirement:	☐
Public Hearing:	☐	Old Business:	☐
New Business:	☐	Consent Agenda:	☐
Nonpublic:	☐	Other:	☐

TITLE OF ITEM

Fluvial Erosion Update

DESCRIPTION OF ITEM

Share results of Fluvial Erosion study and provide update on hazard mitigation plan

REFERENCE (IF KNOWN)

RSA:
Warrant Article:
Charter Article:
Town Meeting:
Other:
N/A: none

EQUIPMENT REQUIRED (PLEASE PLACE AN "X" IN THE APPROPRIATE BOX)

Projector:	☐	Grant Requirements:	☐
Easel:	☐	Joint Meeting:	☐
Special Seating:	☐	Other:	☐
Laptop:	☐	None:	☑

CONTACT INFORMATION

Name: Jill Longval
Address: 9 Executive Park Drive, Suite 201, Merrimack
Phone Number: 424-2240 x27
Email Address: jillL@nashuarpc.org

APPROVAL

Town Manager: Yes ☐ No ☐
Chair/Vice Chair: Yes ☐ No ☐

Hold for Meeting Date:

A Guide to Fluvial Erosion Hazards

What is Fluvial Erosion?

Fluvial (river-related) erosion is the wearing away of river beds and banks by the action of running water. Fluvial erosion is a natural process and is most active during flood events. It can result in significant changes to the physical location and dimensions of river and stream channels.

Souhegan River at Amherst, east of Boston Post Road. Photo: NH DES

Souhegan River at Milford. Photo: NH DES

Baboosic Brook, near mouth. Photo: NH DES

Why Should Communities be Concerned?

New Hampshire has more than 16,000 miles of rivers and streams. Communities have historically developed along these waterways, placing infrastructure and property in hazard prone areas. Riverine flooding is the most common disaster event in NH. In recent years, some areas of the State have experienced multiple disastrous flood events at recurrence intervals of less than 10 years. On October 3, 2008 Hillsborough and Merrimack Counties experienced severe storms and flooding that led to a Presidential Disaster Declaration and $1,050,147 in damages.

Transportation infrastructure and agricultural property are typically the most vulnerable to fluvial erosion hazards. Fluvial erosion events frequently cause culverts failures, undermine bridges and roads, and wash away stream banks. Residential, commercial, and municipal properties as well as utility infrastructure can also be impacted.

Project Background

The New Hampshire Department of Environmental Services (DES) and New Hampshire Geological Survey (NHGS) conducted an assessment to identify areas prone to river and stream erosion that could impact public health and safety. The assessment was conducted over the summer and fall of 2013 in the Souhegan River watershed. A private firm that specializes in the science of fluvial geomorphology, Field Geology Services, was contracted to conduct the field work. They assessed 32 miles of river and stream reaches in the Souhegan Watershed using field surveys, topographical maps, aerial photos, and historic archives.

How can Communities Use this Information to Address Public Safety?

Fluvial Erosion Hazard zone maps provide an important tool for planners, emergency management personnel, and municipal officials. They can be used to identify opportunities for bridge and culvert replacement, stream and flood-plain restoration projects, and areas where development may want to be avoided. The Nashua Regional Planning Commission has incorporated the Fluvial Erosion Hazard data generated by this study into the Town's 2014 Hazard Mitigation Plan Update. Specific mitigation actions that can address public safety and fluvial erosion hazards include:

Map & Assess Vulnerability to Erosion

- Conduct stream assessments and prepare fluvial erosion hazard zone maps
- Develop and maintain a database to track community vulnerability to erosion
- Use GIS to identify concentrations of at-risk structures and infrastructure

Structure and Infrastructure Projects

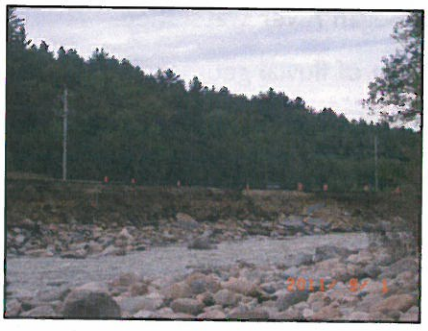
- Ensure adequate stormwater drainage
- Reduce encroachment of roads, bridges, and culverts into stream channels and flood prone areas
- Ensure culverts and bridges are adequately sized and properly aligned and graded
- Consider relocating at-risk buildings and infrastructure

Help Citizens and Emergency Management Officials become More Aware of Erosion Risks

- Notify property owners in high-risk areas
- Develop outreach materials describing erosion risks and potential mitigation techniques
- Offer GIS erosion hazard mapping online

Consider Fluvial Erosion Hazard Areas in Land Use Policy

- Adopt sediment and erosion control regulations
- Consider establishing fluvial erosion hazard overlay districts
- Develop and implement an erosion management plan
- Locate utilities and critical facilities outside of areas susceptible to erosion
- Provide rivers and streams the area they need to maintain or re-establish their natural equilibrium in order to minimize erosion hazards, protect public safety and welfare, and decrease property damage and loss.



Fluvial Erosion Hazard Results ~ Merrimack

Fluvial Erosion Hazard (FEH) zones attempt to identify lands most vulnerable to fluvial erosion. Each river reach assessed through this project was assigned a sensitivity rating. Sensitivity is defined as the potential of a river to respond to flood events, through bank erosion and migration across the floodplain. A number of factors contribute to sensitivity, including channel straightening, development and armoring (ex. riprap) along banks, and existing erosion.

- **Extreme** sensitivity generally means a reach is experiencing considerable erosion of its beds and banks. It typically has flood chutes and meander cutoffs that maximize potential for changing flow paths and further erosion during a large flood.
- **Very Low** sensitivity means that a reach's flow path will not change on a significant time scale.

Fluvial Erosion Hazard Zones in Merrimack

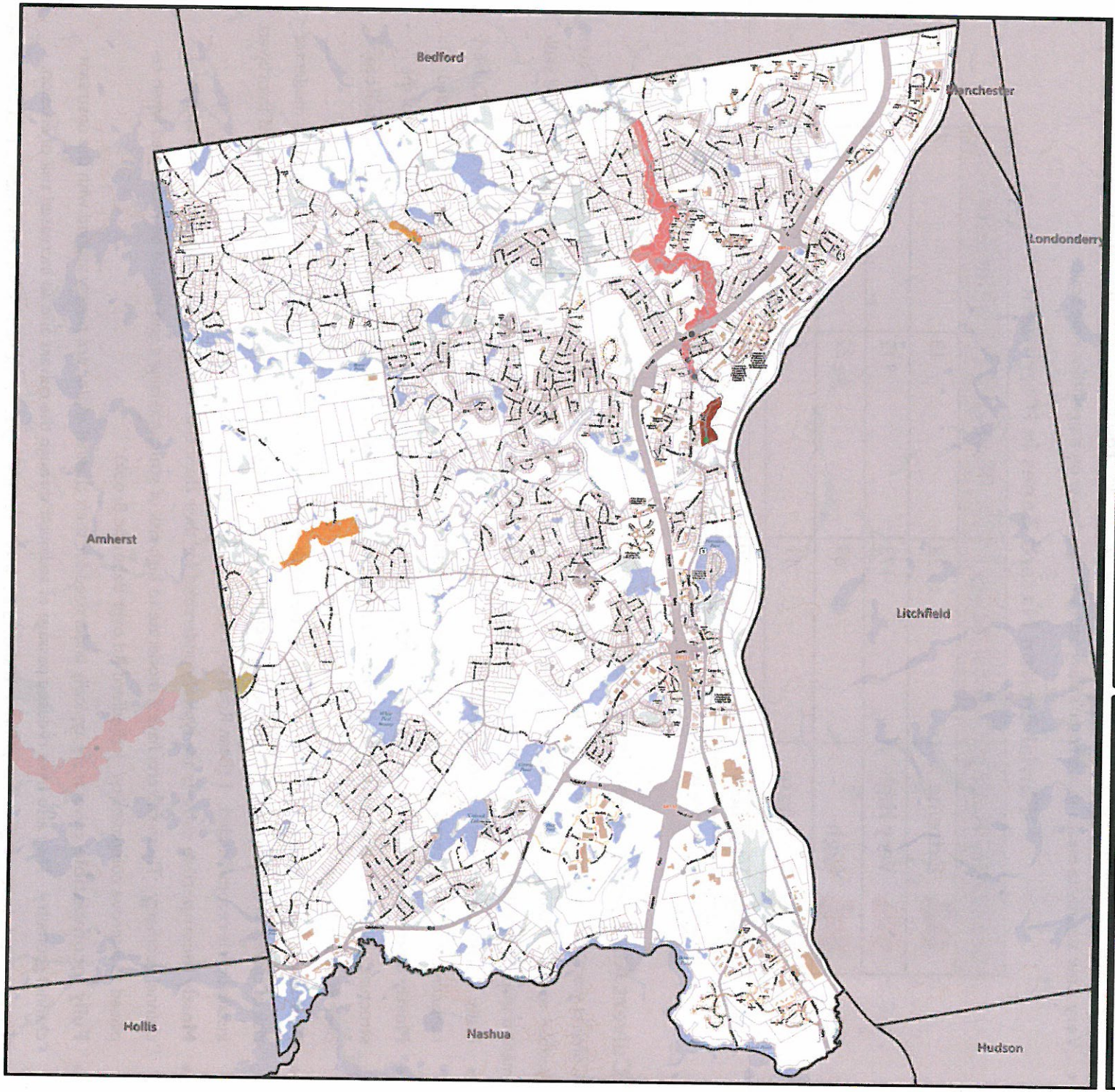
Sensitivity Rating	Total Acres	Parcels	Structures*
Extreme	23	13	7
Very High	173	112	59
High	69	32	14
Moderate	11	8	2
Very Low	0	0	0

**Includes all buildings, outbuildings, decks, pools, gazebos, and tennis courts as digitized by Nashua Regional Planning Commission*

Culvert Assessment Results in Merrimack

Culverts were also assessed as part of this project and each culvert was assigned a score ranking it on a scale from "fully compatible" to "fully incompatible." These rankings provide guidance on the long-term ability of culverts to handle flow and sediment transport processes and their risk of failure. Of the 3 culverts assessed in Merrimack:

- **Fully Compatible** culverts conform with natural river channel form and process and have a low risk of failure. Culvert replacement is not expected over the lifetime of the structure. When replaced, a similar structure is recommended. **0**
- **Mostly Compatible** culverts also have a low risk of failure and replacement is not expected over the lifetime of the structure. When replaced, minor design adjustments are recommended to achieve full compatibility. **1** (Access Road over Baboosic Brook)
- **Partially Compatible** culverts are either compatible with current form or process, but not both. There is a moderate risk of culvert failure and replacement may be needed during the design lifetime. When replaced, a redesign of the culvert installation is recommended. **1** (Bean Road over Baboosic Brook)
- **Mostly Incompatible** culverts are typically undersized for their channel and/or are poorly aligned with the upstream channel geometry. These culverts have a moderate to high risk of structural failure and should be redesigned when replaced to improve compatibility. **1** (Bedford Rd over Baboosic Brook)
- **Fully Incompatible** culverts are typically undersized for their channel and/or are poorly aligned with the upstream channel geometry. They also have reduced passage of sediment through the culvert and an increased risk of erosion. These culverts have a high risk of failure and should be prioritized for replacement with more compatible structures. **0** *(over)*



FLUVIAL EROSION HAZARD MAP

TOWN OF MERRIMACK

Fluvial Erosion Hazard Zones - Souhegan Watershed

Rating

- Extreme
- Very High
- High
- Moderate
- Very Low

Crossings - Souhegan Watershed

Geomorphic Compatibility

- Mostly Compatible
- Partially Compatible
- Mostly Incompatible
- No Value*
- Open Water
- Streams
- Wetlands
- Property
- Road/Right-of-Way
- Buildings in Hazard Zone
- Other Buildings

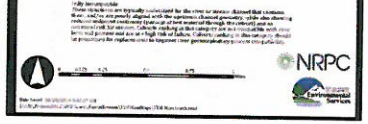
*Compatibility analysis not applicable for wetland crossings or bridges

BY THE NUMBERS

	TOTAL ACRES	PARCELS	STRUCTURES*
Extreme	23	13	7
Very High	173	112	59
High	69	32	14
Moderate	11	8	2
Very Low	0	0	0

*Includes all buildings, outbuildings, decks, pools, gazebos, and tennis courts, as digitized by NRPC

ABOUT THE DATA



NRPC

NRPC
NASHUA REGIONAL PLANNING COMMISSION

Jill Longval, Senior Environmental Planner
Nashua Regional Planning Commission
9 Executive Park Drive, Suite 201
Merrimack, NH 03054

November 6, 2014

Merrimack Town Council
Town of Merrimack, NH
6 Baboosic Lake Road
Merrimack, NH 03054

Dear Merrimack Town Council Members,

Attached, please find a DRAFT of the Town's Hazard Mitigation Plan Update 2014. The Town is required to update its Hazard Mitigation Plan every 5 years in order to maintain eligibility for federal mitigation grants. Your current Plan was written in 2010. The primary differences between the 2014 Plan and the 2010 Plan are 1) preparedness actions are not included in the 2014 Plan, 2) man-made hazards are not included in the 2014 Plan, and 3) fluvial erosion is included as a natural hazard in the 2014 Plan. As a reminder, the mitigation actions included in the Plan have been developed for planning purposes and the Town is not required by FEMA to implement them as a condition of adopting the Plan.

If you wish to review the Plan before I submit it to FEMA, please provide me with comments by Monday December 1, 2014. I will then incorporate any comments you might have and submit the Plan to FEMA. Once FEMA has reviewed the Plan they will issue an "Approval Pending Adoption." At that point the Town Council will formally adopt the Plan and sign the Adoption Resolution found in Section 5.1 of the Plan (this can be done during a regular meeting). I will then send the adopted Plan back to FEMA and they will issue the Town a Formal Approval letter.

Please feel free to contact me with any additional questions.

Sincerely,

Jill Longval
Nashua Regional Planning Commission

Town of Merrimack, New Hampshire

Hazard Mitigation Plan Update 2014

Date Submitted:

Date Approved Pending Adoption:

Date Adopted:

Date Final Approval:

Prepared with Assistance from the Nashua Regional Planning Commission

NRPC

Funded in part by the NH Department of Safety, Homeland Security and Emergency Management

Table of Contents

CHAPTER 1. PLANNING PROCESS

Section 1.1 ~ Overview of Planning Process

The Merrimack Hazard Mitigation Plan Update 2014 was prepared by the Nashua Regional Planning Commission (NRPC) for the Town of Merrimack, NH. NRPC staff worked closely with the Merrimack Hazard Mitigation Team to write this plan. The Merrimack Hazard Mitigation Team included:

- Brian Borneman, Assistant Fire Chief, Fire Department, Town of Merrimack, NH
- Michael Currier, Fire Chief, Fire Department, Town of Merrimack, NH
- Mark Doyle, Chief of Police, Police Department, Town of Merrimack, NH
- Michael Dudash, Police Captain, Police Department, Town of Merrimack, NH
- Ron Miner, Superintendent, Merrimack Village District
- Richard Pierson, Assistant Fire Chief, Fire Department, Town of Merrimack, NH
- Donna Pohli, Assistant Planner, Community Development Department, Town of Merrimack, NH
- Rick Seymour, Director, Department of Public Works, Town of Merrimack, NH

NRPC staff met with the Merrimack Hazard Mitigation Team for a series of 4 meetings in order to prepare the Merrimack Hazard Mitigation Plan Update 2014. Agendas from these meetings appear in the Appendix to this Plan. In between meetings, NRPC worked directly with Merrimack Hazard Mitigation Team members to obtain additional information needed to write the Plan.

The primary differences between the 2014 Plan and the 2010 Plan are 1) preparedness actions are not included in the 2014 Plan, 2) man-made hazards are not included in the 2014 Plan, and 3) Fluvial Erosion is included as a hazard in the 2014 Plan.

Section 1.2 ~ Involvement of Neighboring Communities and Local/Regional Agencies

At the first Hazard Mitigation Team meeting, held on October 23, 2013, the group discussed who should be invited to participate on the planning team that was not currently represented. It was determined that the current Team provided adequate representation and no additional members were necessary. The Team also discussed who should be informed about the Plan, such as neighboring communities, local and regional agencies involved in hazard mitigation, agencies with authority to regulate development, and others. It was concluded that the following entities should be informed of the Plan update:

- American Red Cross, Ashley Pushkarewicz, Emergency Services Director, Nashua, NH
- Anheuser-Busch Inc, Kris Scholl, Merrimack, NH
- BAE Systems, Christine Gillis, Facilities and EH&S Department, Merrimack, NH
- City of Nashua, NH, Steven A. Bolton, President, Board of Aldermen
- Daniel Webster College, Robert E. Myers, Nashua, NH
- Dartmouth-Hitchcock, Doris Dowell, Office Manager, Merrimack, NH
- Fidelity Investments, Facilities Department, Merrimack, NH

- Homeland Security and Emergency Management, Danielle Morse, Field Representative, Concord, NH
- Jones Chemical, Brian Danforth, Merrimack, NH
- Manchester-Boston Regional Airport, Mark P. Brewer, Manchester, NH
- Nashua Airport Authority, Royce N. Rankin, Jr. Nashua, NH
- Thomas Moore College, Dr. William Edmund Fahey, Merrimack, NH
- Town of Amherst, NH, George Infanti, Chairman, Board of Selectmen
- Town of Bedford, NH, Mike Izbicki, Chairman, Board of Selectmen
- Town of Litchfield, NH, Frank Byron, Chairman, Board of Selectmen

A copy of the letter that was sent to these entities appears in the Appendix to this Plan.

The update of this Plan included the incorporation of Fluvial Erosion Hazard data, which had not previously been available. As a result, additional efforts were made to involve neighboring communities and local and regional agencies involved in hazard mitigation. NRPC staff met with the Souhegan River Local Advisory Committee on January 17, 2013 to discuss the fluvial erosion hazard study and how the results would be incorporated into local hazard mitigation plan updates. NRPC staff held a second meeting with the Souhegan River Local Advisory Committee on November 20, 2014 to present the final results of the fluvial erosion hazard study and draft hazard mitigation plans. Agendas from these meetings appear in the Appendix to this Plan.

At the outset of this project, NRPC staff met with the Merrimack Town Council on August 15, 2013 to present on the hazard mitigation plan update process and discuss how the fluvial erosion hazard data would be incorporated into the plan update. NRPC staff made a second presentation to the Merrimack Town Council on November 6, 2014 to discuss the results of the fluvial erosion hazard study and the options available to community officials to use the fluvial erosion hazard zones as a public safety tool. Agendas and handouts from these meetings appear in the Appendix to this Plan.

Section 1.3 ~ Public Participation

During the first Hazard Mitigation Team meeting, held on October 23, 2013, the Team brainstormed all the methods currently employed to notify the public of Town meetings and news. These methods include the Town's website (http://www.merrimacknh.gov/), Merrimack Police Department Twitter account (https://twitter.com/MerrimackPD), Merrimack Police Department Facebook account (https://www.facebook.com/pages/Merrimack-Police-Department/104950052912992), and local cable access television (http://merrimacktv.com/). The Team determined that these methods should also be used to encourage public participation in the Hazard Mitigation Plan update process. In addition, announcements were made at various televised Town Council meetings regarding the update process. There was no public response to provide input to the Merrimack Hazard Mitigation Plan Update 2014 process.

NRPC staff also developed a webpage for the Merrimack Hazard Mitigation Plan Update 2014 (http://www.nashuarpc.org/energy-environmental-planning/hazard-mitigation-planning/), which allows members of the public to participate in the update process even if they cannot attend meetings. The webpage was updated throughout the planning process and includes the 2010 Merrimack Hazard Mitigation Plan, 2014 Hazard Mitigation Plan Outline, and Hazard Mitigation Plan Review Checklist. It also provides meeting times, locations, agendas, and homework assignments. The Town of Merrimack's website links to this webpage. The Nashua Regional Planning Commission will keep the website active and will add information about ongoing updates over the next 5 years. A screen shot of the website appears in the Appendix to this Plan.

In addition, NRPC staff organized and facilitated two watershed wide public workshops in the Souhegan River Watershed in order to provide information to residents about the fluvial erosion hazard study and the hazard mitigation plan updates. The Souhegan River Watershed includes the New Hampshire towns of Merrimack, Bedford, Goffstown, New Boston, Amherst, Mont Vernon, Lyndeborough, Milford, Brookline, Wilton, Greenfield, Temple, Mason, Greenville, and New Ipswich. These workshops were advertised through a variety of media, including announcements in NRPC's electronic newsletter, fliers in the communities, ads in the Milford Cabinet and Merrimack Journal, and emails to Conservation Commission members in the watershed. The first workshop was held on May 22, 2013 just prior to the start of the fluvial erosion field assessments. The second workshop was held on September 11, 2014 after the data collection was complete. Staff members from NH Dept. of Environmental Services and Field Geology Services were present at both workshops to answer questions from the public. Both meetings were well attended; 22 members of the public attended the May 22, 2013 workshop and 26 members of the public attended the September 11, 2014 workshop. Advertisements from both workshops can be found in the Appendix to this Plan.

Section 1.4 ~ Existing and Potential Authorities, Policies, Programs, and Resources

At the first Hazard Mitigation Team meeting, held on October 23, 2013, the Team discussed Merrimack's existing authorities, policies, programs, and resources related to hazard mitigation and its ability to expand and improve on these. The purpose of this discussion was to determine the ability of the Town to implement its hazard mitigation strategies and to identify potential opportunities to enhance specific policies, programs, or projects. The evaluation of Merrimack's existing authorities, policies, programs, and resources includes planning and regulatory capabilities, emergency management capabilities, floodplain management capabilities, administrative and technical capabilities, and fiscal capabilities. Each of these areas provides an opportunity to integrate hazard mitigation principles and practices into the local decision making process.

Planning and Regulatory Capabilities

Planning and regulatory capability is based on the implementation of plans, ordinances, and programs that demonstrate Merrimack's commitment to guiding and managing growth in a responsible manner.

The following is a summary of the relevant local plans, ordinances, and programs already in place in the Town of Merrimack. Each one should be considered as an available mechanism for incorporating the recommendations of the Merrimack Hazard Mitigation Plan Update 2014.

- Flood Hazard Conservation District—includes all Special Flood Hazard Areas designated by FEMA in its "Flood Insurance Study for the County of Hillsborough, NH" with an effective date of September 25, 2009, together with the associated Flood Insurance Rate Maps dated September 25, 2009.
- Wetlands Conservation District—this district limits construction in wetlands soils, wetlands, and buffer areas.
- Stormwater Management Standards—designed to protect water quality in the Town. Prior to any disturbance, the responsible party is required to submit a SWMP to the Community Development Department for any tracts of land that results in a total disturbance of 20,000 of more square feet of land.
- 2013-2020 Capital Improvement Program—6 year plan that outlines proposed capital expenditures from municipal departments, school board, library, and water district. Planning Board defines capital expenditures as the purchase, construction, or improvement of land, buildings, infrastructure, or equipment having an associated cost of $100,000 or more and an estimated useful life of at least 7 years.
- Zoning Ordinance and Building Code—revised September 11, 2014
- Subdivision and Site Plan Regulations
- Building Code—International Building Code and International Residential Code
- 2013 Master Plan Update—adopted January 7, 2014
- National Flood Insurance Program

Emergency Management Capabilities

Hazard mitigation is a key component of emergency management, along with preparedness, response, and recovery. Opportunities to reduce potential losses through mitigation practices are typically implemented before a hazard event occurs, such as enforcement of policies to regulate development that is vulnerable to hazards due to its location or design. Existing emergency management capabilities for the Town of Merrimack include:

Emergency Management Plans

- Merrimack Hazard Mitigation Plan 2010—this document provides a guide for the community to reduce the impact of natural hazards on its residents and the built environment. It addresses natural hazards in the Town, previous occurrences of these hazards, the probability of future hazard events, and the vulnerability of Merrimack's critical facilities to these hazards. The Hazard Mitigation Plan also identifies and prioritizes mitigation actions to reduce Merrimack's vulnerability to natural hazards.
- Merrimack Emergency Response Plan—this document outlines responsibilities and the means by which resources are deployed during and following an emergency or disaster, updated in 2013.

Emergency Management Departments, Facilities, Personnel, and Volunteers

- Merrimack Fire and Rescue Department—responds to all types of incidents including fires, automobile accidents, medical emergencies, hazardous materials response, and technical rescues. In addition, the Department promotes emergency preparedness, fire prevention, building code enforcement, emergency management, health division and other life safety programs.
- Merrimack Police Department
- CERT Team—organized through Police Department, primarily involved with vaccinations and public health issues
- Cooperation with City of Nashua Emergency Management—Merrimack and Nashua emergency management teams meet quarterly regarding emergency management and public health issues, all Nashua alerts (ex. storms, Red Cross, public health) are also sent to Merrimack.
- Souhegan Valley Mutual Aid, Border Area
- Police Mutual Aid—Hillsborough County, Londonderry, State Police, National Guard

Emergency Management Communications

- Nixle—connects public safety agencies to Merrimack residents via text, web, and email
- 411 for School subscribers
- Merrimack Police Department Twitter and Facebook accounts—emergency management announcements
- Local access TV—emergency management announcements
- Merrimack Town website—emergency management announcements and education
- Regional communications system, total interoperability of radio, officers have portable radios, interoperability with Mutual Aid, BAE interoperable system in command vehicle.

Floodplain Management Capabilities

The Town of Merrimack participates in the National Flood Insurance Program (NFIP). This provides full insurance coverage based on risk as shown on detailed Flood Insurance Rate Maps (FIRMs). Merrimack joined the NFIP on July 16, 1979. As a participant in the NFIP, communities must agree to adopt a floodplain management ordinance and enforce the regulations found in the ordinance. Merrimack has adopted the "Flood Hazard Conservation District," found in Section 2.02.8 of the Merrimack Zoning Ordinance and Building Code. The Flood Hazard Conservation District includes all Special Flood Hazard Areas designated by FEMA in its "flood Insurance Study for the County of Hillsborough, NH," with an effective date of September 25, 2009, together with the associated Flood Insurance Rate Maps dated September 25, 2009.

Additional information on the Flood Hazard Conservation District and Merrimack's participation in the NFIP can be found in Section 3.7 of this Plan.

Administrative and Technical Capabilities

Merrimack's ability to develop and implement mitigation projects, policies, and programs is closely related to the staff time and resources it allocates to that purpose. Administrative capability can be improved by coordinating across departments and integrating mitigation planning into existing Town procedures. The following departments, boards, and personnel are critical to Merrimack's hazard mitigation administrative and technical capabilities:

- Planning Board
- Planning Staff
- Building Inspector
- Building Official
- Health Officials
- Fire Department—FEMA ICS 300-700 trained
- Police Department—FEMA ICS 300-700 trained
- Department of Public Works
- Town Administrator
- Town Council
- Zoning Board
- Budget Committee

Fiscal Capabilities

In addition to administrative and technical capabilities, the ability of the Town of Merrimack to implement mitigation actions is closely associated with the amount of money available for these projects. Mitigation actions identified in this Plan, including those in Table 12—Implementation and Administration, may utilize the following funding sources:

- State and Federal Grants, including, but not limited to:
  - Congestion Mitigation and Air Quality (CMAQ) Program—this program is administered by the Federal Highway Administration and was implemented to support surface transportation projects and related efforts that contribute to air quality improvements and provide congestion relief.
  - FEMA Hazard Mitigation Grant Program—the Hazard Mitigation Grant Program provides grants to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the Program is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster.
  - FEMA Pre-Disaster Mitigation Program—the Pre-Disaster Mitigation Program provides funds for hazard mitigation planning and the implementation of mitigation projects prior to a disaster.
  - Community Development Block Grant Program—the Community Development Block Grant (CDBG) program, administered through the US Department of Housing and Urban Development, provides communities with resources to address a wide range of unique community development needs, including Disaster Recovery Assistance. HUD provides

flexible grants to help cities, counties, and States recover from Presidentially declared disasters, especially in low-income areas, subject to availability of supplemental appropriations.

    - NH Department of Transportation Bridge Aid Program
- Capital Improvements Plan
    - The Merrimack Planning Board was directed as a result of the 1984 Town Meeting to prepare and maintain a six-year capital improvements program (CIP) to aid the Budget Committee in its consideration of annual budgets.
    - RSA 674:7 requires municipal departments, the school board, the library, and the water district to submit statements of proposed capital expenditures to the Planning Board. For CIP purposed, the Planning Board defines capital expenditure as the purchase, construction, or improvement of land, buildings, infrastructure, or equipment having an associated cost of $100,000 or more and an estimated useful life of at least seven years.

Section 1.5 ~ Review and Incorporation of Existing Documents

A number of existing documents were reviewed and incorporated into the Merrimack Hazard Mitigation Plan Update 2014. The Merrimack Zoning Ordinance was used to provide information on where and how the Town builds. This was particularly helpful when mapping critical facilities corridors (Section 3.4). The Merrimack Capital Improvements Plan was used to help document the Town's fiscal capabilities (Section 1.4). The Merrimack Master Plan provided insight on future development patterns (Section 2.1) and helped to inform the analysis and prioritization of mitigation actions (Section 4.3). The Merrimack Emergency Response Plan was also used to inform the analysis and prioritization of mitigation actions. The State of New Hampshire Multi-Hazard Mitigation Plan Update 2013 provided insight when developing the description of natural hazards (Section 3.1), description of previous hazards (Section 3.2), probability of future hazards (Section 3.3), vulnerability by hazard (Section 3.5), and goals to reduce vulnerabilities (Section 4.1). Finally, the City of Nashua's Comprehensive Emergency Management Plan was referenced to write the hazard descriptions used to determine Merrimack's vulnerability by hazard (Section 3.5).

Section 1.6 ~ Updating the Plan

The Town of Merrimack is required to update its Hazard Mitigation Plan at least every five years. In order to monitor, evaluate, and update the Mitigation Strategies identified in Table 12—Implementation and Administration, the Merrimack Hazard Mitigation Team will meet annually. The Merrimack Police Chief is responsible for initiating this review and will consult with members of the Merrimack Hazard Mitigation Team and the community. During this meeting, the Team will identify mitigation actions that can be conducted in the current year as well as mitigation actions that will require budget requests for the following year. These mitigation actions will be monitored throughout the year by the Team.

Changes should be made to the Plan to accommodate projects that have failed or are not considered feasible after an evaluation and review for their consistency with the benefit cost analysis, STAPLEE analysis, timeframe, community's priorities, and funding resources. Mitigation strategies that were not ranked as priorities during the 2014 update should be reviewed as well during the monitoring, evaluation, and update of this Plan to determine feasibility of future implementation. New mitigation actions or plans proposed upon adoption of this Plan should follow the benefit cost and STAPLEE analysis methods utilized in this Plan to ensure consistency with the adopted Plan and to help the Hazard Mitigation Team evaluate overall potential for success.

In addition to this annual meeting, the Hazard Mitigation Team will meet before, during, and after any hazard occurrence as part of the Town's debriefing exercise. The Hazard Mitigation Plan will be updated following this meeting to reflect changes in priorities and mitigation strategies that have resulted from the hazard event. It is especially important to incorporate updates within one year after a Presidential Disaster Declaration.

The Town of Merrimack will utilize its website, local cable channel, and existing social media outlets, including Facebook and Twitter to notify members of the public about the annual Hazard Mitigation Plan Update meeting and to involve them in the update process. Any public input that is received will be incorporated into the Plan update. In addition, following its annual meeting, the Hazard Mitigation Team will report the results of its update process to the Merrimack Town Council. The Town Council meetings are open to the public and are also broadcast on Merrimack public access cable.

CHAPTER 2. CHANGES FROM PREVIOUS PLAN

Section 2.1 ~ Changes in Development

There have been several significant changes in development in Merrimack since the 2010 Hazard Mitigation Plan that have decreased the Town's vulnerability to hazards. A repetitive loss structure on Beacon Drive was moved to reduce the risk of flooding. In addition, several structures on Horseshoe Pond were moved or raised to address flooding. Finally, a number of roads and bridges were raised to decrease their vulnerability to flooding.

Section 2.2 ~ Progress on Local Mitigation Efforts

In order to assess progress on local mitigation efforts, the Hazard Mitigation Team reviewed the actions originally presented in the Merrimack Hazard Mitigation Plan 2010 and determined if they had been completed, deleted, or deferred. Progress on each action and its current priority level were also evaluated to determine if it should continue to be included in the mitigation actions identified in this Plan update.

Table 1—Status of Previous Actions

2010 Mitigation Action	Description	Status	Explanation
Evacuation Plan for the Mastricola and High School Campus	In event of a disaster on Baboosic Lake Road and/or F.E. Everett Turnpike. Add as an addendum to *Emergency Management Plan*	Completed	This is a mitigation action (Emergency Services Protection). The Plan has been completed and practiced.
Acquire Mobile Weather Stations	Provide valuable (life-saving) data to Emergency Responders, the public and government	Deferred	This action has been deferred due to budget issues. Because this is a preparedness action and not a mitigation action, it will not be tracked in future natural hazard mitigation plans.
Mutual Aid Agreements on the Regional level to address Terrorism Issues.	This will involve establishing common frequencies among communications systems in surrounding communities	Completed	Police—agreements are complete with Hillsborough County, Londonderry and NH National Guard; not completely interoperable with Nashua and Manchester. Fire—agreements are in place with Souhegan Valley & Border Area Mutual Aid. Because this addresses manmade hazards and not natural hazards, it will not be tracked in future natural hazard mitigation plans.
Add Portable Generators at Town Wells	Generators, fixed or mobile are proven reliable backup power source and will insure adequate water pressure and volume for fire protection	Completed	Because this is a preparedness action and not a mitigation action, it will not be tracked in future natural hazard mitigation plans.
Construct a Northwest Fire Station	Off of Baboosic Lake Road and McQuestion Road	Deferred	This action has been deferred due to budget issues. Because this is a preparedness action and not a mitigation action, it will not be tracked in future

2010 Mitigation Action	Description	Status	Explanation
			natural hazard mitigation plans.
Safety Plan for BotL Gas Company	Meet with the property owners to set up a safety plan with a SCADA intrusion system. Regular inspections and warning signs should be components of this plan	Deferred	This action has been deferred because it is considered a low priority. Because this addresses manmade hazards and not natural hazards, it will not be tracked in future natural hazard mitigation plans.
Evacuation Plan for Entire Town	Develop, and have on file in Emergency Management, an emergency evacuation plan for each facility in Town. Add as an addendum to *Emergency Management Plan.*	Deleted	This action has been deleted because it is not considered a priority. It will not be tracked in future natural hazard mitigation plans.
DPW Plan to Identify & Repair Bridges & Culverts	Plan established by DPW to identify and repair failing culverts, bridges in disrepair, etc.	Completed	This is a mitigation action (Structural). Although it has been completed, a similar mitigation action has been identified in this Plan Update.
Better Communications System with DOD and Guilford Transportation	Develop a communication system with the Department of Defense and Guilford Transportation to determine what is being transported by train through the Town of Merrimack and when.	Deleted	This action has been deleted because it is not considered a priority. Because this addresses manmade hazards and not natural hazards, it will not be tracked in future natural hazard mitigation plans.
Expand Municipal Water System to Chelsea Development Site	The installation of water service is a requirement for approval. Design and approvals are in place.	Completed	Because this addresses manmade hazards and not natural hazards, it will not be tracked in future natural hazard mitigation plans.

Section 2.3 ~ Changes in Priorities

Many of the "mitigation" actions identified in Merrimack's 2010 Hazard Mitigation Plan were actually preparedness actions. While preparedness actions are important, the Merrimack Hazard Mitigation Plan Update 2014 will focus exclusively on mitigation actions. Therefore, only true mitigation actions from the 2010 Plan will be addressed here.

The STAPLEE scoring system in the 2010 Merrimack Hazard Mitigation Plan was different from the STAPLEE scoring system used in the 2014 update. This makes it difficult to analyze changes in mitigation action priority levels by comparing STAPLEE scores. As such, Table 2 also notes whether the action falls within the top 50% or bottom 50% of all mitigations actions identified in the plan.

The following mitigation action dropped in priority level from the 2010 Plan to the 2014 Plan: evacuation plan for the Mastricola and High School Campus.

The following mitigation action rose in priority level from the 2010 Plan to the 2014 Plan: DPW Plan to identify and repair bridges and culverts.

Table 2—Changes in Mitigation Priorities

2010 Mitigation Action	Current Status	Priority Level in 2010 Plan	Priority Level in 2014 Plan
Evacuation Plan for the Mastricola and High School Campus	Completed	STAPLEE Score = 21 Rank = 1 out of 12 Top 50% of all preparedness and mitigation actions.	This action has been completed and is no longer considered a priority. A similar action was not identified in the 2014 Plan update.
DPW Plan to identify and repair bridges and culverts	Completed	STAPLEE Score = 18 Rank = 9 out of 12 Bottom 50% of all preparedness and mitigation actions.	STAPLEE Score = 9 Rank = 2 out of 8 Top 50% of all preparedness and mitigation actions.

CHAPTER 3. HAZARD IDENTIFICATION AND RISK ASSESSMENT

Section 3.1 ~ Description of Natural Hazards

The Town of Merrimack is susceptible to a variety of natural hazards, which are outlined in Table 3. For each hazard type, the hazard location within the Town, extent, and impact are also noted. Extent refers to how bad the hazard can be; it is not the same as location. Examples of extent include potential wind

speed, depth of flooding, and existing scientific scales (ex. Fujita Tornado Damage Scale). Impact refers to damages or consequences resulting from the hazard.

Table 3—Natural Hazards in Jurisdiction

Hazard Type	Hazard Location within Jurisdiction	Hazard Extent	Impact
Drought	Entire jurisdiction.	NH DES Drought Management Plan: • Level 1—Alert • Level 2—Warning • Level 3—Emergency • Level 4—Disaster	Loss of crops. Inadequate quantity of drinking water. Loss of water for fire protection. Increased risk of fire. Loss of natural resources.
Earthquake	Entire jurisdiction.	Richter Scale: • <3.4—detected only by seismometers • >8—total damage, surface waves seen, objects thrown in air	Structural damage or collapse of buildings. Damage or loss of infrastructure, including roads, bridges, railroads, power and phone lines, municipal communications, 911 communications, radio system. Loss of water for fire protection. Increased risk of fire (gas break). Risk to life, medical surge.
Extreme Temperatures	Entire jurisdiction.	Extreme heat—period of 3 consecutive days when air temperature reaches 90°F or higher on each day. Extreme cold—extended exposure to typical NH winter	Overburdened power systems may experience failures due to extreme heat. Shortages of heating fuel in extreme cold due to high demand.

Hazard Type	Hazard Location within Jurisdiction	Hazard Extent	Impact
		weather without heat or shelter; period of 3 consecutive days when air temperature is 0°F or lower on each day.	Medical surge. Loss of municipal water supply for drinking water and fire protection due to freezing temperatures.
Flooding	Floodplains cover approximately 12.7% of Merrimack—9.1% of Merrimack is located in 1% Floodplain and 3.6% of Merrimack is located in the 0.2% Floodplain. The Island Drive area of Merrimack is particularly prone to flooding.	FEMA flood probabilities: • 1% possibility per year • 0.2% possibility per year State of NH Dam Hazard Potential Classification system (for flooding resulting from dam/levee failure): • Class S—significant hazard • Class H—high hazard • Class L—low hazard • Class NM—non-menace	Water damage to structures and their contents. Damage or loss of infrastructure, including roads, bridges, railroads, power and phone lines, municipal communications, 911 communications, radio system. Environmental hazards resulting from damage. Isolation of neighborhoods resulting from flooding.
Fluvial Erosion	Route 3, Baboosic Brook and McGaw Bridge, erosion around bridge. Bedford Road bridge, Wire Road bridge, flooding over approaches to bridge, erosion around road bed. Fluvial Erosion Hazard Zones are found primarily around Baboosic Brook, with Extreme sensitivity	Stream Sensitivity Rating: • Low • Moderate • High • Very High • Extreme	Physical loss of land. Damage or loss of infrastructure, including roads, bridges, railroads, power and phone lines, municipal communications, 911 communications, radio system. Water damage to structures and their contents. Environmental hazards resulting from damage.

Hazard Type	Hazard Location within Jurisdiction	Hazard Extent	Impact
	zones located east of Loop Road, and Very High sensitivity zones located Whispering Pines Lane and Daniel Webster Highway.		Isolation of neighborhoods resulting from damaged transportation infrastructure.
Hurricane/Severe Wind	Entire jurisdiction.	Saffir-Simpson Hurricane Wind Scale: • Category 1— sustained winds 74-95 mph • Category 2— sustained winds 96-110 mph • Category 3— sustained winds 111-129 mph • Category 4— sustained winds 130-156 mph • Category 5— sustained winds 157 mph or higher	Wind damage to structures and trees. Water damage to structures and their contents. Damage or loss of infrastructure, including roads, bridges, railroads, power and phone lines, municipal communications, 911 communications, radio system. Environmental hazards resulting from damage. Isolation of neighborhoods resulting from flooding. Water pressure, quality, and capacity issues impacting fire protection. Loss of natural resources.
Severe Thunderstorm/Lightning	Entire jurisdiction. Areas particularly prone to lightning strikes include parks, camps, and open fields in Merrimack as well as Harris Pond, Thomas More College, Manchester St, Police	Heavy rainfall, high winds, lightning, tornados, downbursts, fires.	Smoke and fire damage to structures and property. Disruption to power lines, municipal communications, and 911 communications. Damage to critical

Hazard Type	Hazard Location within Jurisdiction	Hazard Extent	Impact
	Department, Society Hill, and Maple Ridge.		electronic equipment. Injury or death to people involved in outdoor activity.
Severe Winter Weather	Entire jurisdiction.	Depth of snow in a given time frame (ex. 2 or more inches per hour over a 12 hour period). Blizzard—violent snowstorm with minimum winds of 35 mph and visibility less than ¼ mile for 3 hours. Ground snow load factor. Ice Storm—Sperry-Piltz Ice Accumulation Index: • 0—little impact • 5—catastrophic damage to exposed utility systems	Disruption to road network. Damage to trees municipal communications, and 911 communications. Structural damage to roofs/collapse. Increase in CO, other hazards.
Tornado/Downburst	Entire jurisdiction.	Fujita Tornado Damage Scale: • F0—winds <73 mph • F1—winds 73-112 mph • F2—winds 113-157 mph • F3—winds 158-206 mph • F4—winds 207-260 mph • F5—winds 261-318 mph	Wind damage to structures and trees. Damage or loss of infrastructure, including roads, bridges, railroads, power and phone lines, municipal communications, 911 communications, radio system. Environmental hazards resulting from damage. Medical surge. Loss of natural resources.

Hazard Type	Hazard Location within Jurisdiction	Hazard Extent	Impact
Wildfire	Western portions of Merrimack are most susceptible to wildfire along with areas around railroad tracks and power lines, Wildcat Falls Park, Horsehill Nature Preserve, and Grater Woods Nature Preserve.	Acres burned and/or property damaged.	Smoke and fire damage to structures in wild land/urban interface. Damage to habitat. Impacts to air quality. Impact to roadways. Loss of natural resources.

Section 3.2 ~ Description of Previous Hazards

The first step in determining the probability of future hazard events in the Town of Merrimack is to examine the location, extent, and impact of previous hazards. If a hazard event has not occurred within Merrimack but has occurred in the region it is also noted.

Table 4—Previous Occurrences of Hazards in Jurisdiction

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
Drought	1960-1969	Entire jurisdiction	Long term drought—9 years of less than normal precipitation	Farms had minimal grass for grazing animals and poor crops. Wells went dry for 2 consecutive years in mid-1960s.
Drought	1999	Entire jurisdiction	Level 2—Warning. Drought warning issued on June 29, 1999.	Damage to crops. Low water levels in dug wells.
Drought	March 2002	Entire jurisdiction	Level 3—Emergency. First time Level 3 Drought Impact Level had been declared.	Damage to crops. Low water levels in dug wells.
Earthquake	There have been no earthquakes centered in Merrimack to date.	Earthquakes noted below were centered in NH and had a magnitude of 3.0 or greater.		
Earthquake	March 18, 1926	Manchester, NH	No historic data on extent	Intensity V effects observed in

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
				Amherst, Lyndeborough, Manchester, Mason, and Wilton.
Earthquake	December 20, 1940	Lake Ossipee, NH	Magnitude 5.5 on Richter Scale	No damage in Merrimack
Earthquake	December 24, 1940	Lake Ossipee, NH	Magnitude 5.5 on Richter Scale	No damage in Merrimack
Earthquake	December 4, 1963	Laconia, NH (43.6 latitude, -71.5 longitude)	Magnitude 3.7 on Richter Scale	No damage in Merrimack
Earthquake	June 28, 1981	Sanbornton, NH (43.56 latitude, -71.56 longitude)	Magnitude 3.0 on Richter Scale	No damage in Merrimack
Earthquake	January 19, 1982	Sanbornton, NH (43.5 latitude, -71.6 longitude)	Magnitude 4.7 on Richter Scale	No damage in Merrimack
Earthquake	October 25, 1986	Northfield, NH (43.399 latitude, -71.59 longitude)	Magnitude 3.9 on Richter Scale	No damage in Merrimack
Earthquake	October 20, 1988	Milan, NH (44.539 latitude, -71.158 longitude)	Magnitude 3.9 on Richter Scale	No damage in Merrimack
Earthquake	November 22, 1988	Milan, NH (44.557 latitude, -71.183 longitude)	Magnitude 3.2 on Richter Scale	No damage in Merrimack
Earthquake	April 6, 1989	Berlin, NH (44.511 latitude, -71.144 longitude)	Magnitude 3.5 on Richter Scale	No damage in Merrimack
Earthquake	October 6, 1992	Canterbury, NH (43.324 latitude, -71.578 longitude)	Magnitude 3.4 on Richter Scale	No damage in Merrimack
Earthquake	June 16, 1995	Lyman, NH (44.286 latitude, -71.915 longitude)	Magnitude 3.8 on Richter Scale	No damage in Merrimack
Earthquake	August 21, 1996	Bartlett, NH (44.184 latitude, -71.352 longitude)	Magnitude 3.8 on Richter Scale	No damage in Merrimack
Earthquake	January 27, 2000	Raymond, NH (43.00 latitude, -71.18 longitude)	Magnitude 3.0 on Richter Scale	No damage in Merrimack
Earthquake	September 26, 2010	Boscawen, NH (43.2915 latitude, -71.6568 longitude)	Magnitude 3.4 on Richter Scale	No damage in Merrimack
Earthquake		Earthquakes noted below were centered outside of NH but were felt by NH municipalities.		
Earthquake	November 18, 1929	Grand Banks,	Magnitude 7.2 on	No damage in

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
		Newfoundland	Richter Scale	Merrimack
Earthquake	November 1, 1935	Timiskaming, Canada	Magnitude 6.25 on Richter Scale	No damage in Merrimack
Earthquake	June 15, 1973	Near Canadian/NH border	Magnitude 4.8 on Richter Scale	No damage in Merrimack
Earthquake	June 23, 2010	Buckingham, Quebec, Canada	Magnitude 5.0 on Richter Scale	No damage in Merrimack
Earthquake	August 23, 2011	Washington, DC	Magnitude 5.8 on Richter Scale	No damage in Merrimack
Earthquake	October 16, 2012	Hollis Center, ME	Magnitude 4.0 on Richter Scale	No damage in Merrimack
Extreme Temperature (Cold)	January 16-20, 2000	Entire jurisdiction	5 consecutive days of minimum temperatures at or below 0°F: • 1/16/00: -3°F • 1/17/00: -2°F • 1/18/00: -5°F • 1/19/00: -6°F • 1/20/00: -4°F	No known impact in Merrimack
Extreme Temperature (Cold)	January 28-30, 2000	Entire jurisdiction	3 consecutive days of minimum temperatures at or below 0°F: • 1/28/00: -6°F • 1/29/00: -2°F • 1/30/00: -4°F	No known impact in Merrimack
Extreme Temperature (Cold)	January 18-20, 2003	Entire jurisdiction	3 consecutive days of minimum temperatures at or below 0°F: • 1/18/00: -9°F • 1/19/00: -11°F • 1/20/00: -11°F	No known impact in Merrimack
Extreme Temperature (Cold)	January 28-31, 2003	Entire jurisdiction	4 consecutive days of minimum temperatures at or below 0°F: • 1/28/03: -9°F • 1/29/03: -5°F • 1/30/03: -0°F • 1/31/03: -0°F	No known impact in Merrimack
Extreme Temperature (Cold)	February 13-17, 2003	Entire jurisdiction	5 consecutive days of minimum temperatures at or below 0°F: • 2/13/03: -3°F • 2/14/03: -11°F	No known impact in Merrimack

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
			• 2/15/03: -10°F • 2/16/03: -7°F • 2/17/03: -2°F	
Extreme Temperature (Cold)	February 26-28, 2003	Entire jurisdiction	3 consecutive days of minimum temperatures at or below 0°F: • 2/26/03: -4°F • 2/27/03: -6°F • 2/28/03: -1°F	No known impact in Merrimack
Extreme Temperature (Cold)	January 9-12, 2004	Entire jurisdiction	4 consecutive days of minimum temperatures at or below 0°F: • 1/9/04: -7°F • 1/10/04: -8°F • 1/11/04: -8°F • 1/12/04: -7°F	No known impact in Merrimack
Extreme Temperature (Cold)	January 14-17, 2004	Entire jurisdiction	4 consecutive days of minimum temperatures at or below 0°F: • 1/14/04: -10°F • 1/15/04: -10°F • 1/16/04: -12°F • 1/17/04: -9°F	Wind chills of -30°F, 6 fatalities in NH
Extreme Temperature (Cold)	January 24-27, 2004	Entire jurisdiction	4 consecutive days of minimum temperatures at or below 0°F: • 1/24/04: -4°F • 1/25/04: -6°F • 1/26/04: -6°F • 1/27/04: -0°F	No known impact in Merrimack
Extreme Temperature (Cold)	January 18-25, 2005	Entire jurisdiction	8 consecutive days of minimum temperatures at or below 0°F: • 1/18/05: 0°F • 1/19/05: -8°F • 1/20/05: -3°F • 1/21/05: -5°F • 1/22/05: -12°F • 1/23/05: -9°F • 1/24/05: 0°F • 1/25/05: -1°F	No known impact in Merrimack
Extreme Temperature (Cold)	January 28-30, 2005	Entire jurisdiction	3 consecutive days of minimum temperatures at or	No known impact in Merrimack

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
			below 0°F: • 2/28/05: -1°F • 2/29/05: -7°F • 2/30/05: -5°F	
Extreme Temperature (Cold)	January 16-18, 2009	Entire jurisdiction	3 consecutive days of minimum temperatures at or below 0°F: • 1/16/09: -16°F • 1/17/09: -16°F • 1/18/09: -9°F	No known impact in Merrimack
Extreme Temperature (Cold)	January 25-27, 2009	Entire jurisdiction	3 consecutive days of minimum temperatures at or below 0°F: • 1/25/09: -7°F • 1/26/09: -7°F • 1/27/09: -5°F	No known impact in Merrimack
Extreme Temperature (Cold)	January 15-18, 2011	Entire jurisdiction	4 consecutive days of minimum temperatures at or below 0°F: • 1/15/11: -6°F • 1/16/11: -5°F • 1/17/11: 0°F • 1/18/11: -2°F	No known impact in Merrimack
Extreme Temperature (Cold)	January 23-27, 2011	Entire jurisdiction	5 consecutive days of minimum temperatures at or below 0°F: • 1/23/05: -5°F • 1/24/05: -10°F • 1/25/05: -9°F • 1/26/05: -3°F • 1/27/05: -2°F	No known impact in Merrimack
Extreme Temperature (Cold)	January 15-17, 2012	Entire jurisdiction	3 consecutive days of minimum temperatures at or below 0°F: • 1/15/12: -2°F • 1/16/12: -2°F • 1/17/12: 0°F	No known impact in Merrimack
Extreme Temperature (Heat)	May 3-5, 2001	Entire jurisdiction	3 consecutive days of temperatures above 90°F: • 5/3/01—93°F • 5/4/01—92°F • 5/5/01—92°F	No known impact in Merrimack
Extreme	June 15-17, 2001	Entire jurisdiction	3 consecutive days	No known impact in

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
Temperature (Heat)			of temperatures above 90°F: • 6/15/01—92°F • 6/16/01—95°F • 6/17/01—91°F	Merrimack
Extreme Temperature (Heat)	July 22-26, 2001	Entire jurisdiction	5 consecutive days of temperatures above 90°F: • 7/22/01—90°F • 7/23/01—90°F • 7/24/01—92°F • 7/25/01—95°F • 7/26/01—93°F	No known impact in Merrimack
Extreme Temperature (Heat)	August 7-10, 2001	Entire jurisdiction	4 consecutive days of temperatures above 90°F: • 8/7/01—94°F • 8/8/01—97°F • 8/9/01—96°F • 8/10/01—100°F	No known impact in Merrimack
Extreme Temperature (Heat)	July 2-5, 2002	Entire jurisdiction	4 consecutive days of temperatures above 90°F: • 7/2/02—90°F • 7/3/02—95°F • 7/4/02—98°F • 7/5/02—97°F	No known impact in Merrimack
Extreme Temperature (Heat)	July 30-August 2, 2002	Entire jurisdiction	4 consecutive days of temperatures above 90°F: • 7/30/02—90°F • 7/31/02—91°F • 8/1/02—91°F • 8/2/02—93°F	No known impact in Merrimack
Extreme Temperature (Heat)	August 13-20, 2002	Entire jurisdiction	8 consecutive days of temperatures above 90°F: • 8/13/02—94°F • 8/14/02—96°F • 8/15/02—98°F • 8/16/02—95°F • 8/17/02—94°F • 8/18/02—92°F • 8/19/02—94°F • 8/20/02—92°F	No known impact in Merrimack
Extreme Temperature (Heat)	June 25-28, 2003	Entire jurisdiction	4 consecutive days of temperatures above 90°F: • 6/25/03—90°F	No known impact in Merrimack

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
			• 6/26/03—93°F • 6/27/03—92°F • 6/28/03—92°F	
Extreme Temperature (Heat)	July 5-7, 2003	Entire jurisdiction	3 consecutive days of temperatures above 90°F: • 7/5/03—91°F • 7/6/03—90°F • 7/7/03—91°F	No known impact in Merrimack
Extreme Temperature (Heat)	July 17-19, 2006	Entire jurisdiction	3 consecutive days of temperatures above 90°F: • 7/17/06—90°F • 7/18/06—93°F • 7/19/06—94°F	No known impact in Merrimack
Extreme Temperature (Heat)	August 2-4, 2006	Entire jurisdiction	3 consecutive days of temperatures above 90°F: • 8/2/06—96°F • 8/3/06—97°F • 8/4/06—92°F	No known impact in Merrimack
Extreme Temperature (Heat)	August 16-20, 2006	Entire jurisdiction	5 consecutive days of temperatures above 90°F: • 8/16/09—90°F • 8/17/09—90°F • 8/19/09—91°F • 8/19/09—93°F • 8/20/09—90°F	No known impact in Merrimack
Extreme Temperature (Heat)	July 4-10, 2010	Entire jurisdiction	7 consecutive days of temperatures above 90°F: • 7/4/10—90°F • 7/5/10—90°F • 7/6/10—97°F • 7/7/10—98°F • 7/8/10—97°F • 7/9/10—92°F • 7/10/10—92°F	No known impact in Merrimack
Extreme Temperature (Heat)	July 17-20, 2010	Entire jurisdiction	4 consecutive days of temperatures above 90°F: • 7/17/10—93°F • 7/18/10—93°F • 7/19/10—93°F • 7/20/10—90°F	No known impact in Merrimack
Extreme Temperature (Heat)	August 30-Sept. 3, 2010	Entire jurisdiction	5 consecutive days of temperatures above 90°F:	No known impact in Merrimack

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
			• 8/30/10—92°F • 8/31/10—91°F • 9/1/10—94°F • 9/2/10—95°F • 9/3/10—96°F	
Extreme Temperature (Heat)	July 21-24, 2011	Entire jurisdiction	4 consecutive days of temperatures above 90°F: • 7/21/11—92°F • 7/22/11—96°F • 7/23/11—101°F • 7/24/11—96°F	No known impact in Merrimack
Extreme Temperature (Heat)	June 21-23, 2012	Entire jurisdiction	3 consecutive days of temperatures above 90°F: • 6/21/12—96°F • 6/22/12—94°F • 6/23/12—93°F	No known impact in Merrimack
Extreme Temperature (Heat)	July 13-16, 2012	Entire jurisdiction	4 consecutive days of temperatures above 90°F: • 7/13/12—92°F • 7/14/12—92°F • 7/15/12—93°F • 7/16/12—91°F	No known impact in Merrimack
Extreme Temperature (Heat)	August 3-6, 2012	Entire jurisdiction	4 consecutive days of temperatures above 90°F: • 8/3/12—91°F • 8/4/12—94°F • 8/5/12—95°F • 8/6/12—93°F	No known impact in Merrimack
Extreme Temperature (Heat)	June 1-3, 2013	Entire jurisdiction	3 consecutive days of temperatures above 90°F: • 6/1/13—93°F • 6/2/13—92°F • 6/3/13—91°F	No known impact in Merrimack
Extreme Temperature (Heat)	July 16-21, 2013	Entire jurisdiction	6 consecutive days of temperatures above 90°F: • 7/16/13—90°F • 7/17/13—91°F • 7/18/13—93°F • 7/19/13—93°F • 7/20/13—96°F • 7/21/13—91°F	No known impact in Merrimack
Flooding	October 23, 1785	Merrimack River	No historic data on	No historic data on

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
			extent	impact
Flooding	April 21-24, 1852	Merrimack River	Highest flood stage in 70 years. Flood waters 2 feet lower than 1785 flood.	No historic data on impact
Flooding	1927	Hillsborough County	No historic data on extent	Damage to road network.
Flooding	March 11-21, 1936	Hillsborough County	25-50 year recurrence interval	$133,000,000 in property damage and 77,000 homeless throughout New England. Primary impact to structures, infrastructure, and road network. Flooding caused by heavy snowfall totals, heavy rains, and warm weather.
Flooding	1940	Souhegan River, near Central Fire Station	No historic data on extent	Damage to road network.
Flooding	June 1942	Merrimack River	No historic data on extent	Damage to road network.
Flooding	June 1944	Merrimack River	No historic data on extent	Damage to road network.
Flooding	April 1960	Merrimack River	No historic data on extent	Flooding resulting from rapid snow melt and heavy rain. Damage to road network.
Flooding, ice jam	March 10, 1964	Souhegan River	Maximum gage height of 6.06 feet	No data on impact.
Flooding, ice jam	March 19, 1968	Souhegan River	Discharge of 3,800 cfs	No data on impact.
Flooding	July 11, 1973	Hillsborough County	No data on extent available	FEMA Disaster Declaration #399
Flooding, ice jam	March 1977	Souhegan River	No historic data on extent	5 homes flooded.
Flooding, ice jam	March 1977	Baboosic Brook	No historic data on extent	Impact to transportation infrastructure. $80,000 to replace bridge. Town tried unsuccessfully to remove ice with backhoe.
Flooding	July 29-August 10, 1986	Hillsborough County	No data on extent available	FEMA Disaster Declaration #771

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
Flooding	March 30-April 11, 1987	Hillsborough County	25-50+ year recurrence interval	$4,888,889 in damage in NH. FEMA Disaster Declaration #789. Primary impact to agricultural fields.
Flooding	August 7-11, 1990	Hillsborough County	No data on extent available	$2,297,777 in damage in NH. FEMA Disaster Declaration #876. Primary impact to infrastructure.
Flooding	October 20-23, 1996	Hillsborough County	No data on extent available	$2,341,273 in damage in NH. FEMA Disaster Declaration #1144. Primary impact to structures and infrastructure.
Flooding	July 2, 1998	Hillsborough County	No data on extent available	$3,400,000 in damage in NH, 6 counties impacted including Hillsborough. FEMA Disaster Declaration #1231. Primary impact to structures and infrastructure.
Flooding	May 2001	Pennichuck Brook	No data on extent available	NH 101A collapsed on the eastbound side. Traffic impacted for months.
Flooding	October 26, 2005	Hillsborough County	50-100 year recurrence interval	5 counties impacted in NH, including Hillsborough. FEMA Disaster Declaration #1610. Primary impact to structures and infrastructure.
Flooding	May 12-23, 2006	Hillsborough County	As much as 14 inches of rainfall in region. 100-500 year recurrence interval.	7 counties impacted in NH, including Hillsborough. FEMA Disaster Declaration #1643. Primary impact to infrastructure.
Flooding	April 15, 2007	Hillsborough County	100-500 year	$27,000,000 in

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
			recurrence interval	damages in NH; 2,005 home owners and renters applied for assistance in NH. FEMA Disaster Declaration #1695. Primary impact to structures and infrastructure.
Flooding	September 6-7, 2008	Hillsborough County	50-100 year recurrence interval	$6.90 per capita in damages in Hillsborough County. FEMA Disaster Declaration #1799 Primary impact to structures and infrastructure.
Flooding	March 14, 2010	Hillsborough County	50-100 year recurrence interval	$1,880,685 in FEMA public assistance in NH; $1.80 per capita in Hillsborough County. Flooding near Johnson Corner due to undersized culvert. FEMA Disaster Declaration #1913 Primary impact to roads and bridges.
Fluvial Erosion	May 13-14, 2006	Suncook River—Epsom, NH	Avulsion	River channel changed course following heavy rain event, shortening path by ½ mile. Excessive sedimentation downstream.
Fluvial Erosion	August 28, 2011	East Branch Pemigewasset River—Lincoln, NH	Stream bank erosion	Damage to bridge abutments at Loon Mountain Ski Resort during Tropical Storm Irene.
Fluvial Erosion	August 28, 2011	Peabody River—Gorham, NH	Berm breach and stream bank erosion	High flows eroded through a berm and eroded the banks in front of numerous properties during Tropical Storm

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
				Irene. Significant damage to White Birch Lane.
Fluvial Erosion	August 28, 2011	Saco River—Harts Location, Bartlett, Conway, NH	Stream bank erosion	Stream bank erosion adjacent to a campground in Harts Location. Erosion of a protective berm in Bartlett.
Fluvial Erosion	July 2-3, 2013	Merriam Brook—Surry, NH	Aggradation	Existing channel path filled in with sediment following heavy rain event, forcing flow to begin creating new path in backyards of two properties.
Hurricane	Great Hurricane of 1938	Hillsborough County	No data on extent available	$12,337,643 total damages (not adjusted for inflation), 13 deaths and 494 injuries in NH. Damage to road network and structures caused by flooding.
Hurricane	August 31, 1954 (Carol)	Hillsborough County	Saffir-Simpson Scale Category 3.	Extensive tree and crop damage.
Hurricane	September 12, 1960 (Donna)	Hillsborough County	Saffir-Simpson Scale Category 3	Water damage to structures due to flooding.
Hurricane	September 27, 1985 (Gloria)	Hillsborough County	Saffir-Simpson Scale Category 2	Damage to trees and power lines from high winds.
Hurricane	August 19, 1991 (Bob)	Hillsborough County	Saffir-Simpson Scale Category 1	FEMA Disaster Declaration #917. Damage to structures, trees, and power lines from high winds.
Hurricane	September 16-18, 1999 (Floyd)	Hillsborough County	Tropical Storm (winds 39-73 mph)	FEMA Disaster Declaration #1305. Primary impact to trees, infrastructure, and road network.
Hurricane	August 28, 2011 (Irene)	Hillsborough County	Tropical Storm (winds 39-73 mph).	Damage to trees and power lines from high winds. Flash

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
				floods.
Hurricane	October 26, 2012 (Sandy)	Hillsborough County	Tropical Storm (winds 39-73 mph).	Minimal damage.
Severe Thunderstorm	There has been no significant damage from severe thunderstorms in Merrimack to date.			
Severe Winter Weather	March 11-14, 1888	Entire jurisdiction	30-50 inches of snow	No historic data on impact
Severe Winter Weather	1922	Entire jurisdiction	No historic data on extent	Extreme snow drifts paralyzed road network.
Severe Winter Weather	February 14-15, 1940	Entire jurisdiction	Over 30 inches of snow	Snow and high winds paralyzed road network.
Severe Winter Weather	February 14-17, 1958	Entire jurisdiction	20-33 inches of snow	Primary impact to road network.
Severe Winter Weather	March 18-21, 1958	Entire jurisdiction	22-24 inches of snow	Primary impact to road network.
Severe Winter Weather	March 2-5, 1960	Entire jurisdiction	Up to 25 inches of snow	Primary impact to road network.
Severe Winter Weather	January 18-20, 1961	Entire jurisdiction	Up to 25 inches of snow	Blizzard conditions paralyze road network.
Severe Winter Weather	February 22-28, 1969	Entire jurisdiction	24-98 inches of snow in Central NH	Primary impact to road network. Slow moving storm.
Severe Winter Weather	December 25-28, 1969	Entire jurisdiction	12-18 inches of snow	Primary impact to road network.
Severe Winter Weather	January 19-21, 1978	Entire jurisdiction	Up to 16 inches of snow	Primary impact to road network.
Severe Winter Weather	February 5-7, 1978 (Blizzard of '78)	Entire jurisdiction	25-33 inches of snow	Snow paralyzed road network, trapped commuters in cars, and forced closure of businesses.
Severe Winter Weather	April 5-7, 1982	Entire jurisdiction	18-22 inches of snow	Primary impact to road network.
Severe Winter Weather	March, 1983	Entire jurisdiction	Over 18 inches of snow, 30-40 mph winds	Snow paralyzed road network and forced closure of businesses.
Severe Winter Weather	December 1996	Entire jurisdiction	14 inches of snow	Damage to power lines forces closure of businesses.
Severe Winter	January 7, 1998	Entire jurisdiction	Ice storm, no data	$12,446,202 in total

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
Weather			on extent available	damages, 1 death and 6 injuries in NH. $17,000,000 in damages to PSNH equipment. FEMA Disaster Declaration #1199. 20 major road closures; 67,586 without power; 2,310 without phone service; 1 communication tower failure.
Severe Winter Weather	December 11, 2008	Entire jurisdiction	Ice storm, no data on extent available	$10,383,602 in FEMA public assistance in NH; $6.35 per capita in Hillsborough County. FEMA Disaster Declaration #1812 Damage to power and phone lines and trees.
Severe Winter Weather	February 23, 2010	Entire jurisdiction	Snow followed by rainfall between 2-6 inches. Winds over 70 mph.	$6,268,179 in FEMA public assistance in NH; $3.68 per capita in Hillsborough County. FEMA Disaster Declaration #1892 Damage to power and phone lines, trees, and road network. Over 330,000 customers without power state-wide.
Severe Winter Weather	October 29-30, 2011	Entire jurisdiction	15-20 inches of snow.	$3,052,769 in FEMA public assistance in NH; $5.11 per capita in Hillsborough County. FEMA Disaster Declaration #4049 Damage to power and phone lines, trees, and road network.

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
Severe Winter Weather	February 8-10, 2013	Entire jurisdiction	Snowfall totals of 12-18 inches across region, up to 30 inches in parts of NH. Winds 10-20 mph with gusts up to 40 mph. Visibility less than ¼ mile.	FEMA Disaster Declaration #4105
Tornado	No tornado has originated in Merrimack to-date			
Tornado	July 2, 1961	Northern Hillsborough Co, originated near Weare, NH	Fujita Scale F2	0 fatalities, 0 injuries
Tornado	July 21, 1961	Central Hillsborough Co, originated near New Boston, NH	Fujita Scale F1	0 fatalities, 0 injuries
Tornado	May 9, 1963	Northeastern, Hillsborough Co, originated near Goffstown, NH	Fujita Scale F1	0 fatalities, 0 injuries
Tornado	May 20, 1963	Western Hillsborough Co, originated near Peterborough, NH	Fujita Scale F1	0 fatalities, 0 injuries
Tornado	June 9, 1963	Northeastern Hillsborough Co, originated near Manchester, NH	Fujita Scale F2	0 fatalities, 0 injuries
Tornado	August 28, 1965	Eastern Hillsborough Co, originated near Litchfield, NH	Fujita Scale F1	0 fatalities, 0 injuries
Tornado	July 19, 1966	Southern Hillsborough Co, originated near Amherst, NH	Fujita Scale F1	0 fatalities, 0 injuries
Tornado	July 17, 1968	Central Hillsborough Co, originated near Wilton, NH	Fujita Scale F2	0 fatalities, 0 injuries
Tornado	August 20, 1968	Northeastern Hillsborough Co, originated near Manchester, NH	Fujita Scale F1	0 fatalities, 0 injuries
Tornado	July 19, 1972	Southeastern Hillsborough Co, originated near Hudson, NH	Fujita Scale F1	0 fatalities, 0 injuries
Tornado	July 5, 1984	Western	Fujita Scale F1	0 fatalities, 0 injuries

Hazard Type	Date	Hazard Location within Jurisdiction	Hazard Extent	Impact
		Hillsborough Co, originated near Harrisville, NH		
Tornado	July 5, 1984	Southeastern Hillsborough Co, originated near Pelham, NH	Fujita Scale F1	0 fatalities, 0 injuries
Tornado	June 16, 1986	Western Hillsborough Co, originated near Swanzey, NH	Fujita Scale F1	0 fatalities, 0 injuries
Tornado	July 3, 1997	Central Hillsborough Co, originated near Greenfield, NH	Fujita Scale F2	0 fatalities, 0 injuries
Tornado	May 31, 1998	Western Hillsborough Co, orginated near Antrim, NH	Fujita Scale F2	0 fatalities, 0 injuries
Downburst	July 6, 1999	Merrimack, Grafton, and Hillsborough Co.	Macroburst	2 fatalities, 2 lost roofs, damage to trees and utility infrastructure
Wildfire	Exact date unknown	Power lines along Route 3 near Pointer Fish and Game Club, Merrimack to Bedford	Approximately 20 acres	8 day event, no damage to houses

Section 3.3 ~ Probability of Future Hazard Events

After documenting the occurrence of previous hazard events in the Town of Merrimack and the surrounding region, the Hazard Mitigation Team used this information to calculate the annual probability of these events occurring in the future. The first step was to determine how many times a particular hazard had occurred in a given number of years. The number of occurrences was then divided by the number of years to determine annual probability. For example, if history shows that a particular hazard typically occurs 1 time every 4 years, the annual probability is 25%. Annual probability was calculated twice for each hazard. First, annual probability was calculated since the first recorded historic occurrence of the event. Second, annual probability was calculated based on occurrences since 2000 to reflect potential recent changes in hazard event occurrence rates. The probability of future hazard events for each hazard type in the Town of Merrimack is outlined in Table 5.

Table 5—Probability of Future Hazard Events

Hazard Type	Probability of Future Event	Source
Drought	11 years of drought from 1960 through 2013.	NH Dept. of Environmental Services and public input

Hazard Type	Probability of Future Event	Source
	11 events in 54 years = .204 events per year **Annual Probability = 20.4%** 1 year of drought from 2000 through 2013. 1 event in 14 years = .071 **Annual Probability = 7.1%**	
Earthquake	History shows no known earthquakes centered in Merrimack. However, this hazard is still possible. 6 magnitude 5.0 or greater earthquakes felt in NH from 1929 through 2013. 6 events in 85 years = .071 events per year **Annual Probability = 7.1%** 2 magnitude 5.0 or greater earthquakes felt in NH from 2000 through 2013. 2 events in 14 years = .143 events per year **Annual Probability = 14.3%**	US Geological Survey; Northern California Earthquake Data Center, Advanced National Seismic System http://www.ncedc.org/anss/catalog-search.html
Extreme Temperatures	21 extreme heat events from 2000 through 2013. 21 event in 14 years = 1.5 event per year	National Climatic Data Center, National Oceanic and Atmospheric Administration http://www.ncdc.noaa.gov/cdo-web/search

Hazard Type	Probability of Future Event	Source
	Annual Probability = 100% 16 extreme cold events from 2000 through 2013. 16 event in 14 years = 1.14 event per year **Annual Probability = 100%**	
Flooding	35 flooding events in Hillsborough County from 1785 through 2013. 35 events in 229 years = .105 events per year **Annual Probability = 15.3%** 6 flooding events in Hillsborough County from 2000 through 2013. 6 events in 14 years = .429 events per year **Annual Probability = 42.9%**	FEMA, local knowledge, and public input
Fluvial Erosion	Because of limited data on previous fluvial erosion events, probability cannot be calculated statistically. Low probability is defined as 0-25% chance of occurrence annually. **Annual Probability = 0-25%**	NH Dept. of Environmental Services, local knowledge, and public input
Hurricane/Severe Wind	8 hurricanes/tropical storms from 1938 through 2013. 8 events in 76 years = .105	National Weather Service and public input

Hazard Type	Probability of Future Event	Source
	events per year **Annual Probability = 10.5%** 2 hurricanes/tropical storms from 2000 through 2013. 2 events in 14 years = .143 events per year **Annual Probability = 14.3%**	
Severe Thunderstorm/Lightning	Because of limited data on previous severe thunderstorm events, probability cannot be calculated statistically. History shows no occurrences of severe thunderstorms in Merrimack. However, this hazard is still possible and therefore, the probability is low. Low probability is defined as 0-25% chance of occurrence annually. **Annual Probability = 0-25%**	FEMA Mitigation Planning Workshop (Unit 3), local knowledge, and public input
Severe Winter Weather	19 severe winter weather events from 1888 through 2013. 19 events in 126 years = .151 events per year **Annual Probability = 15.1%**	FEMA, local knowledge, and public input

Hazard Type	Probability of Future Event	Source
	4 severe winter weather events from 2000 through 2013. 4 events in 14 years = .286 events per year **Annual Probability = 28.6%**	
Tornado/Downburst	16 tornados and 1 downburst in Hillsborough Co. from 1961 through 2013. 17 events in 53 years = .321 events per year **Annual Probability = 32.1%** 0 tornados and 0 downbursts in Hillsborough Co. from 2000 through 2013. 0 events in 14 years = 0 events per year **Annual Probability = 0-25%**	Tornado History Project (Joshua Lietz, Storm Prediction Center, National Climatic Data Center) and public input http://www.tornadohistoryproject.com
Wildfire	Because of limited data on previous wildfire events, probability cannot be calculated statistically. Low probability is defined as 0-25% chance of occurrence annually. **Annual Probability = 0-25%**	FEMA Mitigation Planning Workshop (Unit 3), local knowledge, and public input