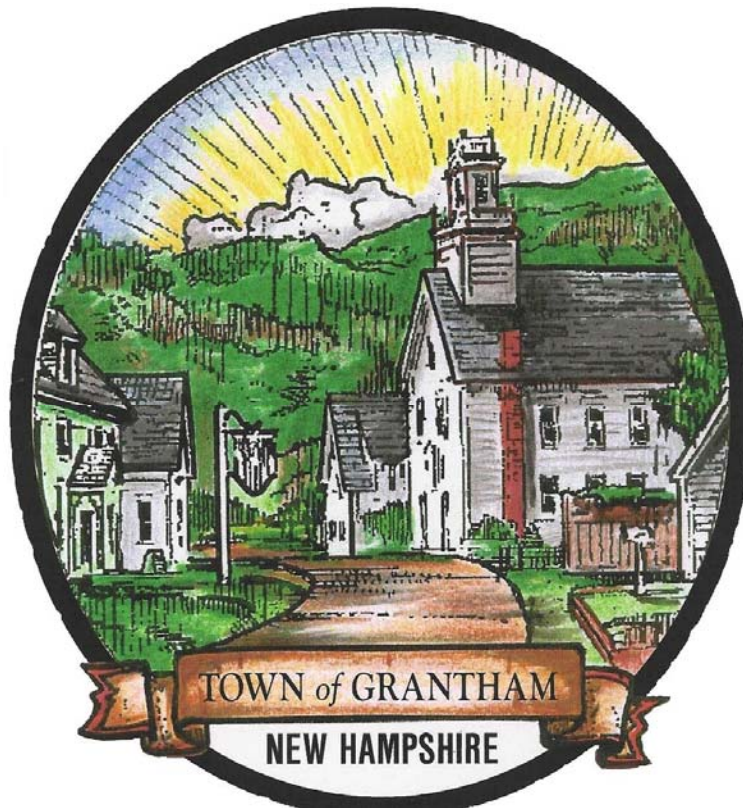


# **TOWN OF GRANTHAM HAZARD MITIGATION PLAN**



**FEMA Approved July 2008**

**Prepared by the:  
Town of Grantham Hazard Mitigation Committee**

**&**

**Upper Valley Lake Sunapee Regional Planning Commission**



## Executive Summary

The *Grantham Hazard Mitigation Plan* serves as a means to reduce future losses from natural or human-made hazard events before they occur. The Town of Grantham Hazard Mitigation Committee developed the *Plan*.

The natural addressed in this plan are as follows:

### Hazards

- Flooding
- Dam Failure
- Hurricanes/High Wind Storms
- Tornados/Downbursts
- Severe Winter Weather
- Wildfire
- Earthquakes
- Drought
- Hazardous Materials

The Grantham Hazard Mitigation Committee identified “Critical Facilities” and “Facilities/Populations to Protect” as follows and as identified in Section V:

### Critical Facilities

- Grantham Fire Department
- Town Hall
- Grantham Highway Garage
- Eastman Maintenance
- Grantham Methodist Church
- Dunbar Free Library
- Grantham Village School
- Transfer Station
- Eastman Community Association Building
- The Center at Eastman
- Historical Society Building
- South Cove Activity Center
- The Well Field

### Facilities & Populations to Protect

- 27 Residences along Stocker Pond Road
- 33 Residences along Miller Pond Road
- 339 Eastman Condominiums
- 14 Structures along Route 10 South
- 13 Structures along Springfield Road

The Grantham Hazard Mitigation Committee identified existing hazard mitigation strategies as follows and as identified in Section VII:

### Existing Hazard Mitigation Strategies

- Reverse 911 Notification System
- Eastman Dam Emergency Action Plan
- Eastman Health & Safety Committee
- Class VI Road Ordinance
- Zoning Ordinance & Floodplain Regulations
- Conservation Commission
- Subdivision Regulations/Steep Slopes Ordinance
- Building Codes
- Culvert Maintenance by Highway Department
- NH Shoreland Protection Act
- NH Wetland Permit Requirements

The Grantham Hazard Mitigation Committee developed a prioritized implementation schedule for newly identified hazard mitigation strategies as follows and as shown in Sections VIII & IX:

### New Hazard Mitigation Strategies

- Health & Safety Memo in Eastman Newsletter
- Alternative Route Information
- Town-Wide Hazard Prevention Publication
- Educate Citizens about Reverse 911
- Plan for Door-to-Door Notification
- Culvert Inventory
- Update Emergency Operations Plan
- Install second bridge at school



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## I. INTRODUCTION

### **Background**

The Federal Emergency Management Agency has mandated that all communities within the State of New Hampshire establish local hazard mitigation plans as a means to reduce future losses from natural or man-made hazard events before they occur. The New Hampshire Bureau of Emergency Management has outlined a process whereby communities throughout the State may be eligible for hazard mitigation grants and disaster assistance upon completion of a local hazard mitigation plan. The New Hampshire Bureau of Emergency Management has provided funding to the Upper Valley Lake Sunapee Regional Planning Commission to prepare local hazard mitigation plans with several of its communities, including the Town of Grantham, NH. A handbook entitled *Hazard Mitigation Planning for New Hampshire Communities* was produced by the Southwest Region Planning Commission and distributed by the New Hampshire Bureau of Emergency Management to assist communities in developing local plans. The Upper Valley Lake Sunapee Regional Planning Commission, local officials and volunteers from the Town of Grantham began preparing a local hazard mitigation plan in August 2006. The *Grantham Hazard Mitigation Plan* will serve as a strategic planning tool for use by the Town of Grantham in its efforts to reduce future losses from natural and/or man-made hazard events before they occur.

### **Purpose**

The *Grantham Hazard Mitigation Plan* is a planning tool for use by the Town of Grantham in its efforts to reduce future losses from natural and/or man-made hazards. This plan does not constitute a section of the Town Master Plan, nor is it adopted as part of the Zoning Ordinance.

### **Authority**

The Grantham Hazard Mitigation Committee prepared the *Grantham Hazard Mitigation Plan* with the assistance of the Upper Valley Lake Sunapee Regional Planning Commission (UVLSRPC) under contract with the New Hampshire Bureau of Emergency Management (NHBEM) operating under the guidance of the Federal Emergency Management Agency (FEMA). After a public meeting held in the Grantham Town Hall, the Grantham Board of Selectmen adopted the *Plan* on August 13, 2008.

### **History**

On October 30, 2000 President Clinton signed into law the Disaster Mitigation Act of 2000 (DMA 2000). The purpose of the DMA 2000 is as follows:

- To establish a national disaster mitigation program that will reduce loss of life and property, human suffering, economic disruption and disaster assistance costs; and

- To provide a source of pre-disaster mitigation funding that will assist States and local governments in accomplishing that purpose.

The DMA 2000 amends the Robert T. Stafford Disaster Relief and Emergency Assistance Act by adding a new section: 322 – Mitigation Planning. This section places new emphasis on local mitigation planning by requiring local governments to prepare and adopt jurisdiction wide hazard mitigation plans as a condition for receiving Hazard Mitigation Grant Program (HMPG) project grants. Local governments must update hazard mitigation plans within a five year cycle to continue program eligibility.

### Scope of Plan

The *Grantham Hazard Mitigation Plan* addresses hazards identified by the Grantham Hazard Mitigation Committee. The hazards were reviewed under the following categories as outlined in the State of New Hampshire Hazard Mitigation Plan:

#### Hazards

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>• Flooding</li> <li>• Dam Failure</li> <li>• Hurricanes/High Wind Storms</li> <li>• Tornados/Downbursts</li> <li>• Severe Winter Weather</li> </ul> | <ul style="list-style-type: none"> <li>• Wildfire</li> <li>• Earthquakes</li> <li>• Drought</li> <li>• Hazardous Materials</li> </ul> |
|--|---|

### Methodology

Using the *Hazard Mitigation Planning for New Hampshire Communities* handbook, as developed by the Southwest Region Planning Commission, the Grantham Hazard Mitigation Committee and the UVLSRPC developed the content of the *Grantham Hazard Mitigation Plan* by following the ten-step process set forth in the handbook. The Committee held a total of five posted meetings beginning on January 11<sup>th</sup>, 2007 and ending on March 6<sup>th</sup>, 2007. All meetings were posted at the Town Office and open to the general public. The Grantham Board of Selectmen adopted the *Plan* on August 13, 2008.

By nature, natural hazards affect areas not defined by political boundaries. Additionally, response to these disasters often may rely on neighboring communities for assistance such as the mutual aid services. Because of this it is important to notify and work with adjacent communities. Notification of this plan and its meetings were publicly noticed and posted, although direct invitations were not made to neighboring municipalities of Enfield, Springfield, Croydon and Plainfield. Future iterations and updates to this plan will incorporate invitations to those communities to comment and participate in the planning process.

Support for mitigation strategies is important in order to carry out implementation. Although this Hazard Mitigation Plan for the Town of Grantham was unable to interest additional parties, every effort will be made in the future to incorporate representation in future revisions of this plan. In order to ensure in the future that opportunity to participate in the planning process is given to other interested parties, the Town will send invitations to local businesses, educational institutions and non-profit organizations. Revisions of this plan shall incorporate press releases



that will notice citizens, businesses and organizations of the progress of the plan while also soliciting input that could strengthen the value of the plan. This process will enable more successful implementation actions.

Upon notification from FEMA that this plan is been conditionally approved, the Town of Grantham will hold a public hearing. At this public hearing, public comment and input regarding the plan shall be taken. Once public input has been heard, the Town shall adopt the plan with any improvements or recommended changes that are appropriate.

The following hazard mitigation planning meetings were held to develop this plan:

- January 11, 2007
- January 26, 2007
- February 9, 2007
- February 27, 2007
- March 6, 2007

During the hazard mitigation planning meetings the Grantham Hazard Mitigation Committee adhered to the following planning steps:

**Step 1: Map the Hazards**

Committee members identified areas where damage from natural disasters had previously occurred, areas of potential damage and man-made facilities and other features that were at risk for loss of life, property damage or other risk factors (*e.g.*, contamination of water sources). A GIS generated base map was used to locate areas of past and potential hazards.

**Step 2: Determine Potential Damage**

Committee members identified facilities that were considered to be of value to the Town for emergency management purposes; for provision of utilities and services; and for historic, cultural and social value. A GIS generated map was prepared to show critical facilities identified by the Grantham Hazard Mitigation Committee. This is presented as Appendix H.

**Step 3: Identify Plans/Policies Already in Place**

Using the information and activities in the *Hazard Mitigation Planning for New Hampshire Communities* handbook, the Committee identified existing mitigation strategies already in place in the Town related to flood, wind, fire, severe winter weather, and earthquakes.

**Step 4: Identify Gaps in the Current Protection/Mitigation**

Existing mitigation strategies were reviewed for coverage, effectiveness, and need for improvement.

**Step 5: Determine Actions to be Taken**

During an open brainstorming session, the Hazard Mitigation Committee developed a list of possible new hazard mitigation actions and strategies for the Town of Grantham. Ideas proposed included policies, planning efforts, structural projects, purchasing emergency services equipment and outreach/education.

**Step 6: Evaluate Feasible Options**

The Hazard Mitigation Committee evaluated the potential mitigation strategies based on criteria derived from the evaluation chart found on page 27 of the *Hazard Mitigation Planning for New Hampshire Communities* handbook.

**Step 7: Coordinate with other Agencies/Entities**

The UVLSRPC staff reviewed the Grantham Master Plan to determine if any conflicts existed or if there were any potential areas for cooperation. Representatives from different town departments participated in the hazard mitigation planning sessions and worked to avoid the duplication of previous plans and to share information.

**Step 8: Determine Priorities**

The Committee reviewed the preliminary prioritization list to determine a final prioritization list for both new hazard mitigation efforts and existing protection improvements identified in previous steps.

**Step 9: Develop an Implementation Strategy**

With guidance from the *Hazard Mitigation Planning for New Hampshire Communities* handbook, the Committee created an implementation schedule which included person(s) responsible for implementation, a schedule for completion, and a funding source for each of the identified hazard mitigation actions.

**Step 10: Adopt and Monitor the Plan**

The UVLSRPC staff compiled the information gathered in steps one through nine in a draft document. The State of New Hampshire Natural Hazards Mitigation Plan served as a resource for *Grantham Hazard Mitigation Plan*.

## **Hazard Mitigation Goals**

The Grantham Hazard Mitigation Committee reviewed the hazard mitigation goals set forth in the State of New Hampshire Natural Hazards Mitigation Plan and revised them as follows:

1. To improve upon the protection of the general population, the citizens of Grantham and guests, from all natural and man-made hazards.
2. To reduce the potential impact of natural and man-made disasters on Grantham's Critical Facilities.
3. To reduce the potential impact of natural and man-made disasters on Grantham's infrastructure.
4. To improve emergency preparedness.
5. To improve Grantham's disaster response and recovery capabilities.
6. To reduce the potential impact of natural and man-made disasters on private property in Grantham.
7. To reduce the potential impact of natural and man-made disasters on Grantham's economy.
8. To reduce the potential impact of natural and man-made disasters on Grantham's natural environment.
9. To reduce Grantham's liability with respect to natural and man-made hazards.
10. To reduce the potential impact of natural and man-made disasters on Grantham's historic resources as well as other tangible and intangible characteristics which add to the quality of life of the citizens and guests of Grantham.
11. To identify and implement cost effective hazard mitigation measures to accomplish Grantham's goals and objectives and to raise awareness and acceptance of hazard mitigation in general.

## **Acknowledgements**

The following people participated in the development of this plan:

- Tina Stearns, Town Administrator
- Connie Jones, Selectman
- Roger Woodworth, Building Inspector
- F. Robert Orgood, Emergency Management Director
- Merle Schotanus, Conservation Commission Alternate
- Richard Hocker, Conservation Commission Chair
- John Moses, Grantham Village School Superintendent
- Joseph Figley, FAST Squad Assistant Coordinator
- Jeff Hastings, Assistant Road Agent
- Ken Ryder, Eastman Community Association General Manager

## II. COMMUNITY PROFILE

### Location

The Town of Grantham, NH is located in the northern region of Sullivan County along its border with Grafton County. Within the boundaries of the Town of Grantham are the smaller areas of North Grantham and Eastman Village. Interstate 89 connects Grantham to the City of Lebanon in the north and to the Town of New London to the south. Route 10 provides access to the southern towns of Sullivan County.



### Climate and Hydrography

The climate of the Town of Grantham is temperate and is characterized by moderate annual fluctuation. The fluctuations occur in both temperature and precipitation causing the strong variation in Grantham's seasons.

“All of Grantham's major watercourses feed into the watershed of the Sugar River and, in fact serve as the source for the Sugar River's north branch.”<sup>1</sup> The water system consists of, “about 45 miles of rivers and brooks, including the North Branch of the Sugar River.”<sup>2</sup>

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<sup>1</sup> Grantham Master Plan

<sup>2</sup> Ibid

“Grantham contains a significant amount of wetlands consisting of upland forested swamps and drainageways, some scrub-shrub swamps, and lowland shallow and deep water emergent marshes. These are not classified as “prime wetlands”, however, and therefore are not protected by law.”<sup>3</sup> These areas “provide for detention of floodwaters...”<sup>4</sup>

## **Floodplains**

“Significant floodplain areas include:

- North Branch of the Sugar River corridor;
- Portions of Stocker Pond;
- Eastman Brook corridor;
- Portions of Skinner Brook;
- Sawyer Brook;
- The lower portion of Butternut Brook.

Not all of these significant flood-prone areas contain the gravel and sand deposits normally associated with floodplains. In many instances, wetlands lie within the floodway and serve as important sponges for retaining peak storm water runoff. Of particular note, the Sugar River floodplain from Croydon to the Town center overlies the potential high-yield aquifer identified by the U.S. Geological Survey. Consequently, this floodplain corridor appears to also serve as a recharge area for the aquifer complex.

Given the critical role that floodplains serve, development should be controlled on floodplain soils.”<sup>5</sup>

## **Potential Development**

The Town of Grantham experienced substantial population growth from 1990 to 2000. Growth lessened in following years, but remained high relative to other towns in Sullivan County through 2005 according to the Towns Master Plan (2005). The number of housing units has risen to accommodate this growth and there has been substantial conversion of Eastman community homes from seasonal homes to year-round homes. Growth has lessened even more in the last several years. It is not anticipated that any new development will occur in known hazard areas.<sup>6</sup>

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<sup>3</sup> Ibid

<sup>4</sup> Ibid

<sup>5</sup> Ibid

<sup>6</sup> 05/21/08 discussion with Town Administrator

### III. HAZARD IDENTIFICATION

The Grantham Hazard Mitigation Committee reviewed the list of hazards provided in the State of New Hampshire Hazard Mitigation Plan concentrating on past hazards occurring in Sullivan County. After compiling the list of past and potential hazards the Committee conducted a Risk Assessment provided in a section IV.

#### **Introduction**

The Grantham Hazard Mitigation Committee reviewed natural and human-made hazards to determine which hazards are relevant in Grantham. Past experiences were noted and several sources were reviewed including websites listing hazard events. Grantham is prone to a variety of hazards. These include: flooding, dam breach, hurricane/high wind events, tornados and downbursts, severe winter weather, wildfire, earthquakes, drought, and hazardous materials spills. Hazards that were eliminated from assessment are those that have not had a direct impact on the Town of Grantham and are not anticipated to have an impact as determined by the Hazard Mitigation Planning Committee. Eliminated hazards include land subsidence, expansive soils, landslides, radon, and snow avalanches due to past experiences and soils and topography not conducive to these hazards.

#### **Descriptions of Hazards**

##### **Flooding**

Flooding is the temporary overflow of water onto lands that are not normally covered by water. Flooding results from the overflow of major rivers and tributaries, storm surges, and inadequate local drainage. Floods can cause loss of life, property damage, crop/livestock damage, and water supply contamination, and can disrupt travel routes on roads and bridges.

Floods in the Grantham area are most likely to occur in the spring due to the increase in rainfall and snowmelt; however, floods can occur at any time of the year. A sudden winter thaw or a major summer downpour can cause flooding.

##### *100-Year Floods*

The term “100-year flood” does not mean that flooding will occur once every 100 years, but is a statement of probability to describe how one flood compares to others that are likely to occur. What it actually means is that there is a one percent chance of a flood in any given year. The 100-year flood areas for Grantham are shown on a map in Appendix E.

##### *River Ice Jams*

“Ice forming in riverbeds and against structures presents significant hazardous conditions [;] ... storm waters encounter these ice formations which may create temporary dams. These dams may create flooding conditions where none previously existed (i.e., as a consequence of

elevation in relation to normal floodplains). Additionally, there is the impact of the ice itself on structures such as highway and railroad bridges. Large masses of ice may push on structures laterally and/or may lift structures not designed for such impacts.”<sup>7</sup>

*Rapid Snow Pack Melt.*

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

*Bank Erosion and Failure*

As development increases, changes occur that increase the rate and volume of runoff, and accelerate the natural geologic erosion process. Erosion typically occurs at the outside of river bends and sediment deposits in low velocity areas at the insides of bends. Resistance to erosion is dependent on the riverbank’s protective cover, such as vegetation or rock riprap, or its soils and stability.

*Location and Extent of Past Flooding*

**III-1: Flooding – Disaster Declarations and Ice Jams**

Hazard	Date	Location	Extent
Flood	Nov 3-4, 1927	Southern NH	Damage to Road Network. Caused many roads to wash out.
Flood	Mar 11-21, 1936	NH State	Damage to Road Network. Flooding caused by simultaneous heavy snowfall totals, heavy rains and warm weather. Run-off from melting snow with rain overflowed the rivers
Flood	April 1969	Merrimack	Excessive snow melt
Flood	August 7-11, 1990	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack & Sullivan Counties, NH	FEMA Disaster Declaration # 876. Flooding caused by a series of storm events with moderate to heavy rains. \$2,297,777 in damage.
Flood	October 29, 1996	Grafton, Hillsborough, Merrimack, Rockingham, Strafford & Sullivan Counties, NH	FEMA Disaster Declaration # 1144- DR. Flooding caused by heavy rains. \$2,341,273 in damage.
Flood	July 2, 1998	Southern NH	FEMA Disaster Declaration # 1231. Severe storms and flooding
Flood	October 26th 2005	Cheshire, Grafton, Merrimack, Sullivan, and Hillsborough Counties, NH	FEMA Disaster Declaration # 1610. Severe storms and flooding.
Flood	October-November 2005	Grafton, Hillsborough, Merrimack, Rockingham, Strafford & Sullivan counties	FEMA Disaster Declaration # DR-1144-NH
Flood	May 25th, 2006	Belknap, Carroll, Hillsborough, Merrimack, Rockingham, and Strafford Counties, NH	FEMA Disaster Declaration # 1643. Severe storms and flooding.
Flood	April 16, 2007	All counties, NH	FEMA Disaster Declaration # 1695. Severe storms and flooding.

<sup>7</sup> NH State Hazard Mitigation Plan, page 16

Hazard	Date	Location	Extent
Flooding	Yearly w/ rain	Elkins Lake area	The committee noted flooding on an annual basis
Flooding	Yearly	Forest Acres Road	Annual flooding
Flooding	Yearly	Bog Road	Primarily road washouts on an annual basis
Flooding	Yearly	Stoneybrook Road	Annual flooding, primarily road washouts and some basement flooding
<b>ICE JAMS</b>			
An ice jam was reported by the committee in the early to mid 1960s at the bridge by Learning Drive along the north branch of the Sugar River. A search on the Cold Regions Research and Environmental Laboratory's (CRREL) Ice Jam Database reveals that there was a second ice jam in Grantham along the Sugar River on the March 11, 1992.			

**Potential Future Events**

- The Hazard Mitigation Committee identified flooding as a typical occurrence along the north branch of the Sugar River. The State of New Hampshire Natural Hazard Mitigation Plan 2004 related to Sullivan County notes, ‘Erosion accelerated by the destabilizing effects on riverbanks is a significant issue all along...the State’s Rivers. Additionally, River Ice may directly impact upon docks, wharfs, boathouses and nearby roads, bridges, culverts and other infrastructure.’
- Flooding has caused a road wash out on Miller Pond Road which exists between a ledge and Skinner Brook and the Committee believes this will continue.
- There is a stream flowing out of Eastman Pond through a culvert under I-89 that empties into Stalker Pond. Often, there is more water than the culvert can handle causing flooding in the area- this occurrence is expected to continue.
- The Committee believes that Miller Pond, Anderson Pond and Butternut Pond are at risk for potential flooding that could impact the entire development of Eastman located in Grantham.

**Dam Breach/Failure**

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

***Location and Extent of Past Events***

The Committee did not note any past events that resulted from dam breach or failure.

***Potential Future Events***

The possibility for dam breach and/or failure exists at the Eastman Dam. The Hazard Mitigation Committee revealed that there is no control pipe and that the dam holds back approximately 325 acres of water. A breach or failure of this dam would allow for flooding in the center of Grantham. Almost all critical facilities would be vulnerable.

The following table lists the dams in Grantham and the risk as evaluated by the New Hampshire Department of Environmental Services (NHDES).



**III-2: Dams**

Class	Name	Stream	Status	Type
-	Recreation Pond Dam	Skinner Brook	ruins	earth
NM	Miller Pond	Trib. Skinner Brook	active	stone/earth
-	Mill Pond Dam	Skinner Brook	ruins	stone/earth
NM	Stoney Brook Pond Dam	Stoney Brook	active	concrete
NM	Lindell Pond Dam	Unnamed Stream	active	concrete
NM	Martin Dam	Trib Sawyer Brook	active	earth
H	Eastman Lake Dam	Eastman Brook	active	earth
-	9 <sup>th</sup> Fairway Pond Dam	Trib Eastman Brook	exempt	earth
-	Heinlein Fire Pond Dam	Natural Swale	exempt	earth
-	Stocker Brook Dam	Stocker Brook	ruins	stone/earth
-	Croydon Branch Sugar River	North Branch Sugar River	ruins	stone/earth
NM	Fire Pond	Trib Branch Sawyer Brook	active	earth
L	Butternut Pond Dam	Butternut Brook	active	stone/earth
NM	Golf Coarse Pond	Trib Eastman Brook	active	earth
NM	Grantham Indoor Fire Pond	Unnamed Stream	active	earth
NM	Gulas Pond	Sawyer Brook	active	earth

The class of dams is defined by the NHDES as follows, “Every dam is 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 (NM), low hazard (L), significant hazard and high hazard (H). A detailed breakdown of the classifications is as follows.

The extent of dam failure is provided in the inundation map produced from information obtained from the NH Department of Environmental Services Dam Bureau for the Eastman Lake Dam and shown as Appendix F.

**Hurricanes/High Wind Storms**

A hurricane is an intense tropical weather system with a well-defined circulation and maximum sustained winds of 74 mph (64 knots) or higher. Hurricane winds blow in a large spiral around a relative calm center known as the "eye." The "eye" is generally 20 to 30 miles wide, and the storm may extend outward 400 miles. As a hurricane nears land, it can bring torrential rains, high winds, and storm surges. A single hurricane can last for more than 2 weeks over open waters and can run a path across the entire length of the eastern seaboard. August and September are peak months during the hurricane season that lasts from June 1 through November 30. Damage resulting from winds of this force can be substantial, especially considering the duration of the event, which may last for many hours.<sup>8</sup>

Hurricane and high wind events can cause devastating damage to structures, and loss of life. Grantham has experienced high winds from some hurricane events but the more significant risk is flooding from the associated rainfall from hurricanes.

<sup>8</sup> Ibid. p. 56; FEMA website

A thunderstorm is a rain shower during which you hear thunder. Since thunder comes from lightning, all thunderstorms have lightning. A thunderstorm is classified as "severe" when it contains one or more of the following: hail three-quarter inch or greater, winds gusting in excess of 50 knots (57.5 mph), tornado. Hail is a form of precipitation that occurs when updrafts in thunderstorms carry raindrops upward into extremely cold areas of the atmosphere where they freeze into ice. When the hail particle becomes heavy enough to resist the updraft, it falls to the ground. The resulting wind and hail can cause death, injury, and property damage.

An average thunderstorm is 15 miles in diameter and lasts an average of 30 minutes. Winter thunderstorms are rare because the air is more stable, strong updrafts cannot form because the surface temperatures during the winter are colder.

Lightning is a giant spark of electricity that occurs within the atmosphere or between the atmosphere and the ground. As lightning passes through the air, it heats the air to a temperature of about 50,000 degrees Fahrenheit, considerably hotter than the surface of the sun. Fires are a likely result of lightning strikes, and lightning strikes can cause death, injury, and property damage. It is impossible to predict where lightning will strike. There have probably been lightning strikes in Grantham, but there is no record of damage.

**Location and Extent of Past Occurrences**

Since 1635, fifteen hurricanes have reached New Hampshire that have impacted the area.

**III-3: Hurricanes and High Wind Storms**

Hazard	Date	Location	Description of Areas Impacted
Hurricane	August, 1635	n/a	
Hurricane	October 18-19, 1778	n/a	Winds 40-75 mph
Hurricane	October 9, 1804	n/a	
Gale	September 23, 1815	n/a	Winds > 50mph
Hurricane	September 8, 1869	n/a	
Hurricane	September 21, 1938	Southern New England	Flooding caused damage to road network and structures. 13 deaths, 494 injured throughout NH. Disruption of electric and telephone services for weeks. 2 Billion feet of marketable lumber blown down. Total storm losses of \$12,337,643 (1938 dollars). 186 mph maximum winds.
Hurricane (Carol)	August 31, 1954	Southern New England	Category 3, winds 111-130 mph. Extensive tree and crop damage in NH, localized flooding
Hurricane (Edna)	September 11, 1954	Southern New England	Category 3 in Massachusetts. This Hurricane moved off shore but still cost 21 lives and \$40.5 million in damages throughout New England. Following so close to Carol it made recovery difficult for some areas. Heavy rain in NH
Hurricane (Donna)	September 12, 1960	Southern and Central NH	Category 3 (Category 1 in NH). Heavy flooding in some parts of the State.

Hazard	Date	Location	Description of Areas Impacted
Tropical Storm (Doria)	August 28, 1971	New Hampshire	Center passed over NH resulting in heavy rain and damaging winds
Hurricane (Belle)	August 10, 1976	Southern New England	Primarily rain with resulting flooding in New Hampshire. Category 1
Hurricane (Gloria)	September, 1985	Southern New England	Category 2, winds 96-110 mph. Electric structures damaged; tree damages. This Hurricane fell apart upon striking Long Island with heavy rains, localized flooding, and minor wind damage in NH
Hurricane (Bob)	August 19, 1991	Southern New England	Structural and electrical damage in region from fallen trees. 3 persons were killed and \$2.5 million in damages were suffered along coastal New Hampshire. Federal Disaster FEMA-917-DR
Hurricane (Edouard)	September 1, 1996	Southern New England	Winds in NH up to 38 mph and 1 inch of rain along the coast. Roads and electrical lines damaged
Tropical Storm (Floyd)	September 16-18, 1999	Southern New England	FEMA DR-1305-NH. Heavy Rains

**III-4: Lightning Events in Sullivan County**

Hazard	Date	Location	Description of Areas Impacted	Hazard
Lightning	July 21, 1994	Sullivan County	1 person injured	--
Lightning	May 31, 2002	Town of Sunapee	Storage barns struck & destroyed	\$20,000
Lightning	June 5, 2002	Town of Washington	Tower of Town Hall struck; damage to tower and equipment	\$11,000
Lightning	August 18, 2002	Town of Sunapee	Three people injured	--
Lightning	July 8, 2004	Town of Sunapee	Computer and radio equipment damaged at Town Office	\$3,000

**Potential Future Events**

All areas of the Town of Grantham are vulnerable in the event of a hurricane. The State Hazard Plan lists Sullivan County as a medium risk for future hurricanes based on past experience. Hurricanes in Grantham are more likely to cause flooding from associated rain than disturbance and destruction from wind speeds. The extent of hurricanes in Grantham would most likely not be geographically bound and would affect the entire community.

All areas of Grantham are at risk for property damage and loss of life due to lightning. The worst damage lightning is likely to cause is minimal, due to limited property damage and contained geographic area inherent in the nature of a lightning strike. There is potential for interruption of essential services if communications equipment or infrastructure is damaged.

“Lightning kills an average of 87 people per year in the United States, and New Hampshire has the 16th highest casualty rate in the nation.”<sup>9</sup> In Sullivan County, five lightning strikes have

<sup>9</sup> State of NH Hazard Mitigation Plan, page 63

been reported from 1950 and 2007 to the National Climatic Data Center, including two lightning strikes that damaged equipment in town-owned buildings. The Grantham Hazard Mitigation Committee did not note any lightning strikes within the Town.

Sullivan County has a medium risk of lightning strikes, according to the State Hazard Plan. It is impossible to predict future events for lightning, but they will inevitably happen at some point. The cost of these events can be high.

### **Tornados and Downbursts**

“A tornado is a violent windstorm characterized by a twisting, funnel shaped cloud. These events are spawned by thunderstorms and, occasionally by hurricanes, and may occur singularly or in multiples. They develop when cool air overrides a layer of warm air, causing the warm air to rise rapidly. Most vortices remain suspended in the atmosphere. Should they touch down, they become a force of destruction.”<sup>10</sup> The Fujita Scale is the standard scale for rating the severity of a tornado as measured by the damage it causes. Most tornadoes are in the F0 to F2 Class. Building to modern wind standards provides significant property protection from these hazard events. New Hampshire is located within Zone 2 for Design Wind Speed for Community Shelters, which suggests that buildings should be built to withstand 160 mph winds.

“A downburst is a severe localized wind blasting down from a thunderstorm. These ‘straight line’ winds are distinguishable from tornadic activity by the pattern of destruction and debris. Depending on the size and location of these events, the destruction to property may be devastating. Downbursts fall into two categories. Microbursts cover an area less than 2.5 miles in diameter, and macrobursts cover an area at least 2.5 miles in diameter.”<sup>11</sup>

#### ***Location and Extent of Past Occurrences***

Between 1950 and 1995, tornadoes were documented in Sullivan County on October 24, 1955, July 09, 1962 (2 tornadoes on this date), and July 18, 1963 (per [www.tornadoproject.com](http://www.tornadoproject.com).) “There were no injuries or fatalities in any of the occurrences. All events were classified as weak tornadoes, according to the Fujita scale (the official classification system for tornadoes.)”

According to the Tornado Project Online, “weak tornadoes can cause the following damage: some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages sign boards; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.”

Per the State Hazard Mitigation Plan, it is estimated that ‘the county has experienced 4 known F2 events ...in the past.’ An F2 is a significant tornado that can cause considerable damage including ‘roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated’ per [www.tornadoproject.com](http://www.tornadoproject.com).

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<sup>10</sup> Ibid. p. 54

<sup>11</sup> Ibid. p. 59

The National Climatic Data Center lists five tornado events in Sullivan County between the years 1950 and March 2007. The Goshen Hazard Mitigation Committee could not recall any specific tornado events within the Town.

**III-5: Tornadoes**

Hazard	Date	Location	Fujita Scale	Property Damage
Tornado	October 24, 1955	Sullivan County	F0 scale	\$25,000
Tornado	July 9, 1962	Sullivan County	F0 scale	\$25,000
Tornado	July 9, 1962	Sullivan County	F2 scale	\$3,000
Tornado	July 18, 1963	Sullivan County	F1 scale	\$25,000
Tornado	August 13, 1999	East Plainfield, Sullivan County	F1 scale	\$100,000

***Potential Future Events***

The State Hazard Plan lists Sullivan County as an area of medium risk for tornados and downbursts. Future tornadoes may affect the entire town or be location specific and pose a risk of property damage and risk of injury. The path and extent of future tornados is difficult to predict.

**Severe Winter Weather**

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

*Heavy Snow Storms*

“A heavy snowstorm is generally considered to be one which deposits four or more inches of snow in a twelve-hour period... A blizzard is a winter storm characterized by high winds, low temperatures, and driving snow- according to the official definition given in 1958 by the U.S. Weather Bureau, the winds must exceed 35 miles per hour and the temperatures must drop to 20°F (-7°C) or lower. Therefore, intense Nor’easters, which occur in the winter months, are often referred to as blizzards. The definition includes the conditions under which dry snow, which has previously fallen, is whipped into the air and creates a diminution of visual range. Such conditions, when extreme enough, are called ‘white outs’.”<sup>12</sup>

*Ice Storms*

“When a mass of warm moist air collides with a mass of cold arctic air, the less dense warm air will rise and the moisture may precipitate out in the form of rain. When this rain falls through the colder more dense air and comes in contact with cold surfaces, the latent heat of fusion is removed by convective and/or evaporative cooling. Ice forms on these cold surfaces and may continue to form until the ice is quite deep, as much as several inches. This condition may strain branches of trees, power lines and even transmission towers to the breaking point and often creates treacherous conditions for highway travel and aviation.”<sup>13</sup> Debris impacted roads make emergency access, repair and cleanup extremely difficult.

<sup>12</sup> Ibid. pp. 69-70

<sup>13</sup> Ibid. p. 80

*“Nor’easters”*

“In the winter months, [Towns within] the State may experience the additional coincidence of blizzard conditions with many of these events as well as the added impact of the masses of snow and/or ice upon infrastructure thus, impacting upon transportation and the delivery of goods and services for extended periods of time, as well as various related impacts upon the economy. The entire area of the State may be impacted by these events... Heavy snow and/or rainfall may be experienced in different areas of the State and the heavy rains may contribute to flood conditions. Nor’easter events which occur toward the end of a winter season may exacerbate the spring flooding conditions by depositing significant snow pack at a time of the season when spring rains are poised to initiate rapid snow pack melting.”<sup>14</sup>

***Location and Extent of Past Events****1998*

A greater region of New Hampshire, including Grantham, was impacted by an ice storm in this year. Many were left without power as ice accumulated on tree branches and power lines.

*2003-2004*

There were several severe winter storms occurring back to back during the winter in these two years. The entire Town of Grantham was affected.

The forest density in the more remote parts of Grantham is vulnerable during an ice storm. The broken trees can become a source of fuel for wildfire.

The I-89 corridor which runs through Grantham becomes extremely hazardous in the event of an ice storm. The accidents that occur along the corridor put a strain on emergency services during a winter weather event.

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<sup>14</sup> Ibid. p. 70

**III-6: Winter Weather Events**

<b>Hazard</b>	<b>Date</b>	<b>Location</b>	<b>Description of Areas Impacted</b>
Ice Storm	December 17-20, 1929	New Hampshire	Unprecedented disruption and damage to telephone telegraph and power system. Comparable to 1998 Ice Storm (see below)
Ice Storm	Dec. 29-30, 1942	NH	Glaze storm; severe intensity
Snow Storm	December 10-13, 1960	New Hampshire	Up to 17 inches of snow in southern NH
Snow Storm	January 18-20, 1961	New Hampshire	Up to 25 inches of snow in southern NH
Snow Storm	February 2-5, 1961	New Hampshire	Up to 18 inches of snow in southern NH
Snow Storm	January 11-16, 1964	New Hampshire	Up to 12 inches of snow in southern NH
Blizzard	January 29-31, 1966	New Hampshire	Third and most severe storm of 3 that occurred over a 10-day period. Up to 10 inches of snow across central NH
Snow Storm	December 26-28, 1969	New Hampshire	Up to 41 inches of snow in west central NH
Snow Storm	February 18-20, 1972	New Hampshire	Up to 19 inches of snow in southern NH
Snow Storm	January 19-21, 1978	New Hampshire	Up to 16 inches of snow in southern NH
Blizzard	February 5-7, 1978	New Hampshire	New England-wide. Up to 25 inches of snow in central NH
Snow Storm	April 5-7, 1982	New Hampshire	Up to 18 inches of snow in southern NH
Extreme Cold	November-December, 1988	New Hampshire	Temperature was below 0 degrees F for a month
Ice Storm	March 3-6, 1991	New Hampshire	Numerous outages from ice-laden power lines in southern NH
Ice Storm	January 15, 1998	New Hampshire	Federal disaster declaration DR-1199-NH, 20 major road closures, 67,586 without electricity, 2,310 without phone service, \$17+ million in damages to Public Service of NH alone
Snow Storm	December 6-7, 2004	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, Sullivan Counties	Federal emergency declaration, EM-3193
Snow Storm	January 22-23, 2005	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, Rockingham, Strafford, Sullivan Counties	Federal emergency declaration, EM-3207
Snow Storm	February 10-11, 2005	Carroll, Cheshire, Coos, Grafton, Sullivan Counties	Federal emergency declaration, EM-3208
Snow Storm	March 11-12, 2005	Carroll, Cheshire, Hillsborough, Rockingham, Sullivan	Federal emergency declaration, EM-3211

***Potential Future Events***

The State Hazard Plan lists Sullivan County including Grantham as an area of high risk for severe winter storms. Future storms may affect the entire town or be localized and could include significant risk of property loss or injury. It is most likely that a storm would affect the entire community.

**Wildfire**

Wildfire is defined as any unwanted and unplanned fire burning in the forest, shrub or grass. Wildfires are frequently referred to as forest fires, shrub fires or grass fires, depending on their location. They often occur during drought and when woody debris on the forest floor is readily available to fuel the fire. The threat of wildfires is greatest where vegetation patterns have been altered by past unsafe land-use practices, fire suppression and fire exclusion. Vegetation buildup can lead to more severe wildfires.

There are many types and causes of fires. Wildfires, arson, accidental fires and others all pose a unique danger to communities and individuals. "Since 1985, approximately 9,000 homes have been lost to urban/wild land interface fires across the United States."<sup>15</sup> The majority of wildfires usually occur in April and May, when home owners are cleaning up from the winter months, and when the majority of vegetation is devoid of any appreciable moisture making them highly flammable. Trees broken during winter storms can also be a source of fuel for wildfires.

***Location and Extent of Past Events******October through December 1953***

This was the year of the Grantham Wildfire. The fire followed the ridge top of Grantham Mountain and lasted for 3 months.

***1989-1990***

The Hazard Mitigation Committee reported that during this time the Town experienced the Sturgis Fire.

***Potential Future Events***

There is very dense forest located in more remote areas of Grantham. These areas are potentially vulnerable to wildfire.

There also exists the potential for structure fire in the Eastman area of Grantham. The Eastman condominiums are made from all wood construction located very close together and are not easily accessed by emergency services.

The attached map of the wildland-urban interface provides an overview of the large amount of interface area that is vulnerable to wildfire. The State Hazard Mitigation Plan lists a high risk of wildfire in the county including Grantham. The location of the wild fire will affect the ability to contain the hazard and limit property damage and risk of injury. See Appendix G for the wildland/urban interface map showing the areas at most risk.

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<sup>15</sup> Northeast States Emergency Consortium ([www.nesec.org](http://www.nesec.org))



## **Earthquakes**

New England is considered a moderate risk earthquake zone. “An earthquake is a rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth’s surface. Earthquakes can cause buildings and bridges to collapse, disrupt gas, electric and phone lines, and cause landslides, flash floods and fires.”<sup>16</sup> The magnitude and intensity of an earthquake is determined by the use of scales such as the Richter scale and the Mercalli scale.

### ***Location and Extent of Past Occurrences***

Per the USGS website, the history of earthquakes in New Hampshire which may affect Grantham is as follows:

‘In addition to tremors originating within the State, New Hampshire has also been affected by some of the stronger earthquakes centered in the St Lawrence Valley seismic zone and in the northeastern Massachusetts seismic zone:

- On February 5, 1663, a major earthquake centered in the St. Lawrence River region was felt over all the settled areas of eastern Canada and northeastern United States. Because of the sparse population at this early time in Colonial history, accounts of the earthquake are far from definite. However, the shock was felt sharply in New England. At Massachusetts Bay, houses were shaken, pewter fell from shelves, and chimneys were broken or thrown down. The affected area undoubtedly includes New Hampshire.
- A damaging shock at Newbury, Massachusetts, in 1727 probably affected towns in New Hampshire.
- A September 16, 1732, earthquake centered in the St. Lawrence Valley was felt at Piscataqua. The shock was centered near Montreal, where several hundred houses were damaged.
- A major shock on November 18, 1755, centered east of Cape Ann, Massachusetts, caused extensive damage at Boston. The felt area included most of New Hampshire.
- On November 9, 1810, Exeter, New Hampshire, was strongly shaken by an intensity VI earthquake. The shock was accompanied by a very unusual noise like a great explosion directly beneath the area. Windows were broken in Portsmouth and a vessel in the harbor seemed to strike bottom. The shock was also felt in Maine at Kennebunk and Portland.
- The area around Concord experienced a number of shocks between 1872 and 1891. Two moderate earthquakes, the first on November 18, 1872, and the second on December 19, 1882, were felt at Concord. The first shock, described as lasting only 10 seconds, was felt in adjacent towns and at Laconia, 50 kilometers to the north. The 1882 tremor was strongest at Concord, although buildings reportedly shook at Dover and Pittsfield. The town of Contoocook, near Concord, reported an earthquake of moderate intensity on January 18, 1884. On November 23, 1884, two more earthquakes, the first a light shock, followed 15 minutes later by a heavy one, were felt at Concord. Nearby, at Henniker, the foundation of a boiler

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<sup>16</sup> Ibid.

was displaced. The second shock was felt over an area of about 20,750 square kilometers including eastern Massachusetts, Connecticut, and eastern New York. Concord again experienced a mild tremor on May 1, 1891. The earthquake was reported felt at Cambridge and Melrose, Massachusetts.

- Northern New Hampshire and nearby parts of Maine and Vermont experienced a moderate earthquake on April 25, 1928. The shock was felt over a line extending 145 kilometers from Lewiston, Maine, to St. Johnsbury, Vermont. Berlin and Gorham, New Hampshire, were apparently closest to the epicenter. The shock was described as "violent" in some places, although little damage was done.
- All of New Hampshire felt minor effects from a magnitude 7.2 earthquake on November 18, 1929, centered on the Grand Banks of Newfoundland. Another strong, distant earthquake affected the State on November 1, 1935, when a magnitude 6.25 shock occurred near Timiskaming, Canada. Damage was relatively slight in the epicentral region, largely because of sparse population. The November 1 earthquake was felt over an area nearly 2,600,000 square kilometers in the United States and Canada. Intensity V effects were reported from Keene, West Manchester, and Woodville; many other places within the State reported this shock.
- Two earthquakes, 4 days apart, centered near Lake Ossipee on December 20 and 24, 1940, caused damage over a broad area. Since the shocks were both of approximately the same intensity, the damage and felt reports were combined. Damage resulting from the second tremor was greater because of the weakening effects of the earlier shock. A maximum intensity of VII was noted at Tamworth and Wonalancet, where chimneys were thrown down, some walls were cracked, plaster fell, and a few pipes were broken. Much stucco was knocked loose from outside walls. Some furniture was also broken and there was considerable damage to china and glassware. There was evidence of ground cracks in the region near the two towns. The earthquakes were felt as far as 550 kilometers from the epicentral area and affected a total land area in the United States of approximately 390,000 square kilometers. This included Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont and also parts of New Jersey, New York, and Pennsylvania. A large number of aftershocks were reported in the epicentral area. One observer counted 129 aftershocks through January 31, 1941.'

The Committee could not recall any specific damages that resulted from these that took place in Grantham. The Committee did not have record of the extent to which these past events may have affected the community.

### ***Potential Future Events***

Per the New Hampshire Hazard Mitigation Plan, all of New Hampshire, including Grantham, lies in a zone of moderate seismic vulnerability generally. Future earthquakes would most likely affect the entire town and could include property damage and risk of injury.

**Drought**

A drought is defined as a long period of abnormally low precipitation. The effects of drought are indicated through measurements of soil moisture, groundwater levels and stream flow; however, not all of these indicators will be low during a drought.

***Location and Extent of Past Occurrences***

Droughts in the region have had no geographic extent. Any drought in the past has affected the entire town to varying degree. Water bans are often instituted when summer residents substantially increase the population in the town.

**III-7: Drought Events**

Dates	Area	Description
1929-1936	Statewide	Regional. Recurrence Interval 10 to > 25 years
1939-1944	Statewide	Severe in southeast and moderate elsewhere. Recurrence Interval 10 to > 25 years
1947-1950	Statewide	Moderate. Recurrence Interval 10 to > 25 years
1960-1969	Statewide	Regional longest recorded continuous spell of less than normal precipitation. Encompassed most of the Northeastern US. Recurrence Interval > 25 years
2001-2002	Statewide	Third worst drought on record, exceeded only by the drought of 1956-1966 and 1941-1942.

***Potential Future Events***

Based on the cyclical nature and past history of drought in the State of New Hampshire it is most probable that Grantham will see drought again in the future. According to the State Hazard Plan, Sullivan County ‘was impacted by the Drought event of the 1960’s, as was the rest of the State. The county host’s significant agricultural and livestock assets that are negatively impacted by such events...the editor has located no specific data as to losses from Drought events for this county.’ The Town Committee noted no significant drought damage in the past or future risk. It is reasonable to assume that future droughts that affect the region will not be isolated to any geographic extent and could pose some risk of property damage and risk of injury.

**Hazardous Materials**

The greatest potential for a hazardous material spill in Grantham occurs along the I-89 corridor, running through Grantham. Grantham’s school sits below I-89 and is vulnerable in the event of a hazardous materials spill. In the event that a hazardous material spill should occur on I-89 there is a major strain placed on emergency response resources.

## IV. HAZARD RISK ASSESSMENT

The Town of Grantham Hazard Mitigation Committee reviewed each potential hazard and rated both the hazard’s probability of occurrence and the vulnerability of the town to the hazard. The result was an overall risk rating. The two hazard types that pose the greatest risk to the Town of Grantham are flooding and severe winter weather.

### Assessing Probability, Vulnerability and Risk

The Committee members completed a Risk Assessment all of the types hazards identified in Chapter III. Appendix D provides a detailed methodology for the Risk Assessment. The process involved assigning Unlikely, Possible, Likely values (numerically 1, 2 or 3) to each hazard type for its potential of occurring based on past historic information. (An n/a score was given if there was insufficient evidence to make a decision). To assess vulnerability, a 1, 2, or 3 value was assigned to each hazard type. Risk was calculated by multiplying probability by the vulnerability. Risk was assigned as shown below: Low = 0-1.9; Low/Medium=2-3.9; Medium=4-5.9; Medium/High=6-7.9; and High=8-9.

#### IV-1: Risk Assessment

Hazards	Probability based on Committee Review	Probability based on State Hazard Plan	Average of Probabilities	Committee Vulnerability	Vulnerability based on State Hazard Plan	Average of Vulnerabilities	Risk Rating	Risk
Flooding	2	3	3	2	1	1.5	4.5	M
Dam Failure	2	1	1.5	2	1	1.5	2.25	L
Hurricanes	3	2	2.5	3	1	2	5	M
Tornadoes	3	3	3	3	1	2	6	M/H
Severe Winter Weather	3	3	3	3	1	2	6	M/H
Lightning	3	2	2.5	3	1	2	5	M
Wildfire	3	3	3	3	1	2	6	M/H
Earthquake	2	2.5	2.25	2	1	1.5	3.4	L
Drought	2	2	2	3	1	2	4	M
HazMat	2	n/a	2	3	1	2	4	M

## V. CRITICAL FACILITIES

The Critical Facilities list, identified by the Grantham Hazard Mitigation Committee, is divided into three categories. The *first* category contains facilities needed for emergency response in the event of a disaster. The *second* category contains non-emergency response facilities that are not required in an event, but that are considered essential for the everyday operation of the Town of Grantham. The *third* category contains facilities/populations that the Committee wishes to protect in the event of a disaster. A map showing Grantham’s critical facilities is provided as Appendix H.

The critical facilities were evaluated for their vulnerability to various hazards. Not included are events which could be town-wide and which could potentially affect every structure in town or events which could impact random areas of town. These hazards include hurricanes and high wind storms, tornados and downbursts, lightning, severe winter weather and ice storms, earthquakes, and drought (impact on water supplies and crops).

### V-1: Emergency Response Facilities, Services & Structures

Critical Facilities	Hazard Vulnerability	Replacement Value
Grantham Fire Department	Flooding; Wildfire	\$575,000
Town Hall	Flooding; Wildfire	\$1,700,000
Grantham Highway Garage	Flooding; Wildfire	\$225,000
Eastman Maintenance	Flooding	\$150,000

### V-2: Non-Emergency Response Facilities & Services

Critical Facilities	Hazard Vulnerability	Replacement Value
Grantham Methodist Church	Flooding; Dam Failure	\$275,100
Dunbar Free Library	Flooding	\$377,000
Grantham Village School	Flooding, Hazardous Materials	\$3,253,800
Transfer Station	Flooding	\$150,000
Eastman Community Association Office Building	Flooding, Fire	\$280,000
The Center at Eastman	Flooding, Fire	\$1,500,000
Historical Society Building	Flooding	\$150,000
South Cove Activity Center	Flooding, Fire	\$500,000
The Well Field – Village District Pumping Stations and Water Treatment Plant	Flooding, Hazardous Materials	\$300,000

**V-3: Facilities and Populations to Protect**

Critical Facilities	Hazard Vulnerability	Replacement Value
27 Residences along Stocker Pond Road	Flooding	\$3,513,500.00
33 Residences along Miller Pond Road	Flooding	\$4,639,400.00
206 Condominiums in Eastman West Cove A-D	Flooding, Fire	\$51,978,700.00
4 Residences along Lumber Lane	Fire	\$162,600.00
11 Eastman Condominiums along Black Duck Spur	Flooding, Fire	\$2,644,900.00
13 Eastman Condominiums along Pintail Knob	Flooding, Fire	\$2,852,600.00
49 Eastman Condominiums along Pleasant Drive	Flooding, Fire	\$11,032,500.00
15 Eastman Condominiums and 11 Residences along Barn Owl Overlook	Flooding, Fire	\$6,766,100.00
6 Eastman Condominiums along Lakeview Place	Flooding, Fire	\$1,778,800.00
17 Eastman Condominiums along Niblick Lane	Flooding, Fire	\$4,626,200.00
18 Eastman Condominiums along Pioneer Point	Flooding, Fire	\$5,744,800.00
14 Structures along Route 10 South	Flooding, Fire	\$1,333,300.00
13 Structures along Springfield Road (Woodland Heights)	Flooding, Fire	\$2,257,000.00
Public infrastructure including roads and bridges	Flooding	Unknown

Bridges are important to the Town’s infrastructure. They need to be maintained or replaced when necessary to avoid potential damage to property or life due to bridge failure. Bridges are often located along emergency routes, and bridge failures could be devastating during a hazard or other event requiring evacuation or emergency access. Grantham has three red-listed bridges on town roads. This is from a State Bridge Condition Category which means “priority for repair.” Age is the primary reason for the inadequacy of these bridges. Most of the bridges in Grantham are State-owned and are considered adequate. A substantial portion of the roads in Grantham are private due to the Eastman community. However, only one of the bridges on the private roads is red-listed, and it leads to one residence.

**V-4: Red-Listed Town Bridges**

Bridge #	Bridge Name	Feature Crossed	Location	Year Built or Reconstructed
083/108	Olde Farms Road	Sawyer Brook	.021 mi from Dunbar Hill Rd	1965
105/128	Miller Pond Road	Skinner Brook	Town road	1964
107/113	Olde Farms Road	Skinner Brook	0.06 mi Rte 10	1979

## VI. DETERMINING HOW MUCH WILL BE AFFECTED

### Identifying Vulnerable Facilities

It is important to determine which critical facilities and other structures are the most vulnerable to hazards and to estimate potential losses. The first step is to identify the facilities most likely to be damaged in a hazard event. To do this, the locations of critical facilities were compared to the location of past and potential hazard events. Facilities and structures located in federally and locally determined flood areas, wildfire prone areas, etc. were identified and included in the analysis. Replacement values were obtained from town tax assessment records.

#### VI-1: Vulnerable Facilities

Hazard Area/ Potential Hazards	Critical Facilities	Other Buildings	Total Building Replacement Value
Grantham Village Area/Flooding, Wildfire	Grantham Fire Department Town Hall Grantham Highway Garage Dunbar Free Library Transfer Station Historical Society Building		\$3,277,000
I-89 Corridor/Flooding, Wildfire	Grantham Village School		3,253,800
E/S Grantham/ Flooding, Hazardous Materials	The Well Field – Village District Pumping Stations and Water Treatment Plant		300,000
W/S Route 10 South/ Flooding, Dam Failure	Grantham Methodist Church		275,100
Eastman Village Area/ Flooding, Wildfire	Eastman Maintenance Eastman Community Association Office Building The Center at Eastman South Cove Activity Center	335 Condos 15 Residences	2,430,000 - non-residential; 87,587,200 – Residential  Total – 90,017,200
Stocker Pond Road/Flooding		27 Residences	3,513,500
Miller Pond Road/Flooding		33 Residences	4,639,400
Route 10 South/Flooding, Wildfire		14 Structures	1,333,300
Springfield Road (Woodland Heights)/Flooding, Wildfire		13 Structures	2,257,000
<b>Total Value All Buildings</b>			<b>\$108,866,300</b>

## Potential Loss Estimates

This section identifies areas in town that are most vulnerable to hazard events and estimates potential losses from these events. It is difficult to ascertain the amount of damage caused by a natural hazard because the damage will depend on the hazard's extent and severity, making each hazard event quite unique. In addition, human loss of life was not included in the potential loss estimates, but could be expected to occur.

### Flooding

The Grantham Hazard Mitigation Committee has identified an area of potential flooding along Miller Pond Road caused by the road being situated between a ledge and Skinner Brook. A potential damage estimate in the event that the 33 structures along Miller Pond Road were lost is \$3,466,900.00. Additionally, the Grantham Hazard Mitigation Committee has identified most of the Eastman development at potential risk for flooding from Miller Pond, Anderson Pond and Butternut Pond. The entire assessed value of the Eastman development that is vulnerable is approximately \$87,587,200.00. The stream flowing between Eastman Pond and Stocker Pond must pass through a culvert to bypass I-89. Often, there is more water than the culvert can handle. This also causes flooding in the Eastman area. The Committee estimated that there is a potential cost of facilities and buildings of \$118,341,000 due to flooding in Grantham.

The potential loss was calculated by multiplying the estimated value of the structure by the percent of the floodwaters. For example, FEMA estimates that in the event of a 100-year, 4-foot flood, structures in the 100-year floodplain would suffer 28% damage

#### *High Risk*

Considers eight foot flooding in 100 and 500-year floodplain areas. All structures receiving 49% damage. Cost for repairing or replacing bridges, railroads, power lines, telephone lines, natural gas pipelines, water and wastewater treatment facilities, contents of structures and loss of cropland values are not included.

$$\$118,341,000 \times 49\% = \$58,087,090$$

#### *Medium Risk*

Considers 4-foot flooding in 100-year floodplain areas. All structures receive 28% damage.

$$\$118,341,000 \times 28\% = \$33,135,480$$

#### *Low Risk*

Considers 1-foot flooding in 100-year floodplain areas. All structures receive 15% damage.

$$\$118,341,000 \times 15\% = \$17,751,150$$

*The potential loss estimates for flood in Grantham for the identified facilities and buildings would be between \$58,087,090 and \$17,751,150.*



### **Dam Failure**

According to the Eastman Lake Dam Inundation Map (see Appendices G & I), the Grantham Methodist Church could be impacted. The value of the church is estimated to be \$275,100.

*If we assume the medium risk factor of 28% as used for flooding, the damage could be around \$77,028.*

### **Hurricane/High Wind Storms**

Given that the extent of hurricanes could encompass the entire town of Grantham the total value of identified facilities and buildings was assessed at \$118,503,600. A major hurricane can cause significant damage to a community. Since Grantham is inland from the coast, less damage would be expected to occur here than elsewhere in New Hampshire. A community-wide approximation of damage of 1% to 5% could be anticipated in the event of a large scale event. Lightning can occur with many events such as thunderstorms. The event is random and it is impossible to predict costs associated with future events.

*The potential loss estimate for hurricanes in Grantham for the identified facilities and buildings would be between \$1,185,036 and \$5,925,185.*

### **Tornado/Downburst**

Tornadoes, downbursts and microbursts are relatively uncommon natural hazards in New Hampshire. On average, about six tornado events strike each year. The total cost of tornadoes between 1950 and 1995 was \$9,071,389<sup>17</sup>. Most tornadoes are in the F0 to F2 Class. Building to modern wind standards provides significant property protection from these hazard events. It is difficult to assess the monetary impact a tornado may have on a community as the effect may vary from minor roof damage to a single structure, to destruction of an entire neighborhood. The range of damage is difficult to project as tornadoes can be erratic and localized.

*The potential loss estimate for tornadoes in Grantham for the identified facilities and buildings would be between \$1,185,036 and \$2,370,072 based on past history.*

### **Severe Winter Weather/Ice Storms**

New England usually experiences at least one or two severe snow storms per year. The storms impact the region with varying degrees of severity. Typical effects of severe winter weather are power outages and damages to infrastructure.

Ice storms often cause widespread power outages by breaking power lines.

*The potential loss estimate for severe winter storms in Grantham for the identified facilities and buildings would be between \$1,185,036 and \$5,925,185 base on past history.*

### **Wildfire**

Wildfire is most likely to occur during drought years and the exact location of the occurrence is difficult to predict. However, areas and structures that are surrounded by dry vegetation that has

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<sup>17</sup> The Disaster Center

not been suitably cleared are at high risk. The Wildland/Urban Interface map provides an overview of where wildfire is most likely to occur. The Committee calculated that the total valuation of potential property loss for areas affected by wildfire would be \$107,418,800

Following the accepted formula for flooding the following assumptions regarding wildfire could be made.

High Risk - \$107,418,800 X 49% = \$52,635,212

Moderate Risk - \$107,418,800 X 28% = \$30,077,264

Low Risk - \$107,418,800 X 15% = \$16,112,720

*The total potential loss due to wildfire in Grantham could be between \$52,635,212 and \$16,112,720.*

### **Earthquake**

Earthquakes can cause buildings and bridges to collapse; disrupt gas, electric and phone lines; precipitate landslides; and cause flash flooding events. Buildings in Grantham that are not built to a high seismic design level would be vulnerable in the event of an earthquake. Additionally, Grantham's dams could be breached or fail. There is no record of damages from earthquakes in Grantham on which to base a potential loss estimate. Assuming a moderate earthquake in Grantham where structures are not built to a high seismic design level, presuming mostly wood framed construction, it could be estimated that about 1% to 5% of the assessed structural valuation could be lost, including damage to homes.

*The potential loss estimate for earthquakes in Grantham for the identified facilities and buildings would be between \$1,185,036 and \$5,925,185.*

### **Drought**

A long-term drought can impact municipal and individual water sources as well as agricultural crops. No loss estimate has been made. Costs could include transporting water from other sources.

### **Hazardous Materials**

The cost of a hazardous material spill would depend upon the extent of the spill, the location of the spill in relation to population, structures, infrastructure, and natural resources, as well as the type of hazardous material. The cost of any clean-up would be imposed upon the owner of the material. However, other less tangible costs such as loss of water quality might be borne by the community. No cost estimate has been provided for this possible hazard. There are no significant hazardous waste generators in Grantham. There are "small quantity generators." Any spills would probably be a result of accidents from these small quantity generators, heating fuel delivery, or transport of hazardous materials through the town on Route 10 or Interstate-89.

## **VII. EXISTING MITIGATION STRATEGIES**

### **Inventory of Existing Mitigation Strategies**

The Grantham Hazard Mitigation Committee identified policies and practices that already exist to protect the Town from past and/or potential hazards. The existing mitigation strategies were evaluated for gaps in the protection that the strategies may provide. This information will be used to determine future mitigation strategies to protect the Town from natural and some man-made hazards. Following is a chart of existing mitigation strategies in the Town of Grantham.

### **Summary of Recommended Improvements**

The Grantham Hazard Mitigation Team recommended improvements to existing programs and potential mitigation measures as follows:

- The Committee recommended more education and outreach by doing the following: publishing a health and safety memo in the Eastman Newsletter, publishing alternative route information in the event that I-89 is closed, and creating a town wide publication with information on safety concerns should a hazard occur.
- The Committee recommended that they notify citizens of the reverse 911 system to ensure awareness of a possibly important recorded telephone message.
- The Committee recommended that in a worse case scenario (i.e., loss of electric and telephone) that they prepare for door-to-door notification.
- The Committee recommended that a culvert inventory be performed to identify the location, size, age, condition and life span of each culvert in Grantham.
- The Committee recommended and is planning an update to the EOP to be completed in the fall of 2007.
- The Committee recommended that the Conservation Commission start a program for hazardous tree identification. Hazardous trees cannot be removed from scenic roads without a public hearing and the Committee thought it was important to identify the areas that pose a threat to public safety.



**VII-1: Existing Mitigation Strategies**

<b>Type of Existing Protection/Hazard</b>	<b>Description</b>	<b>Area of Town Covered</b>	<b>Effectiveness and/or Enforcement</b>	<b>Gaps in Existing Protection/Recommended Improvements</b>
Reverse 911 Notification System/ All Hazards	The notification system has been set up and running since December 2006. The Hanover Dispatch is notified of the emergency and in turn makes calls to the residents of Grantham.	The whole town is protected by this system.	The Fire Department is in charge of deciding when to notify citizens in the event of an emergency.	The Committee suggested that the reverse 911 system is explained to citizens of Grantham in a newsletter so that they don't hang up on the recorded message warning them of an emergency.
The Eastman Dam Emergency Action Plan/ Dam Failure Hazard	Areas threatened by dam breach or failure are protected by this plan.	Areas threatened by a breach of failure of the Eastman Dam are protected by the Dam Emergency Action Plan.	The General Manger of Eastman is in charge of the effectiveness and enforcement of the Dam Emergency Action Plan.	The Committee did not identify any gaps in this protection nor did they suggest any recommended improvements.
Eastman Health and Safety Committee/ All Hazards	This committee helps to educate citizens about their health and safety.	The Eastman development is educated through the efforts of the Health and Safety committee.		The Committee recommended that the Health and Safety Committee could publish a health and safety memo for inclusion in the Eastman Newsletter. There was a second recommendation to use the Health and Safety Committee to disseminate information about alternative routes.
Class VI Road Ordinance/ All Hazards		All Grantham's citizens who may attempt travel on unsafe class VI roads are protected.	The Road Agent oversees the posting of signage along roads and the Board of Selectmen oversee the Ordinance that regulates travel during mud season.	The Committee identified no gaps in this current protection.
Zoning Ordinance including Floodplain Regulations/ Flooding	The Zoning Ordinance is a tool for use in determining what is built; where it is built; and provides guidelines for density, frontage and other lot standards. The floodplain regulations follow the State of New Hampshire standards.	The entire town is protected from development occurring in unsafe areas.	The Planning Board enforces the Zoning Ordinance when they are presented with a development application.	The Committee did not identify any gaps in this protection nor did they recommend any improvements.

Type of Existing Protection/Hazard	Description	Area of Town Covered	Effectiveness and/or Enforcement	Gaps in Existing Protection/Recommended Improvements
Conservation Commission	The Conservation Commission exists to ensure the proper utilization and protection of Grantham's natural resources.	The entire town is protected.	The Chairman of the Conservation Commission is in charge of overseeing their work.	The Committee did not identify any gaps in this protection nor did they recommend any improvements.
Subdivision Regulations including a Steep Slopes Ordinance	The Subdivision Regulations provides standards to ensure safe parcels are created from the subdividing of land. The Steep Slopes Ordinance prohibits developments on land that is not suitable.	The entire town is protected.	The Planning Board enforces the Subdivision Regulations.	The Committee did not identify any gaps in this protection nor did they recommend any improvements.
Building Codes	The Town of Grantham has adopted the state guidelines for building codes (ICC). These codes ensure structures are safe.	The entire town is protected.	The Building Code Enforcement Officer enforces Grantham's Building Codes.	The Committee did not identify any gaps in this protection nor did they recommend any improvements.
The Highway Department maintains culverts/ Flooding	The culverts are inspected, cleaned and replaced as necessary. Currently, the Highway Department is working to replace steel culverts with poly culverts throughout Grantham.	The entire town is protected.	The Road Agent is in charge of this maintenance.	The Grantham Hazard Mitigation Committee recommended a culvert inventory to identify location, size, age, condition and life span of each culvert.
Shoreland Protection Act/ Flooding	The Town of Grantham follows the state regulations.	All areas along riverbanks and water bodies are protected.	The Conservation Commission enforces the Act.	There were no recommendations for improvements.
Wetland Permit Requirements/ Flooding	Wetlands are required to be delineated and documented. A permit is required from the state to cross wetlands.	All areas in and around wetlands are protected.	The Planning Board enforces the permitting of wetlands and ensure applicants have state approval to cross wetlands.	There were no recommendations for improvements to this strategy.
Emergency Operations Plan (EOP)/ All Hazards	Details an organized response protocol in the event of an emergency in Grantham.	The entire town is protected.	The Emergency Management Director is in charge of the EOP.	The Town of Grantham is expecting to update the EOP in the next year. The update is expected to be completed in the fall of 2007.

## VIII. NEWLY IDENTIFIED MITIGATION STRATEGIES

### Potential Mitigation Strategies

#### *Strategies Mitigating Multiple Hazards*

- The Committee would like to start an education and outreach campaign to inform citizens about public safety. It was suggested that this be accomplished in the following way:
  - The Health and Safety Committee of the Eastman development will publish a health and safety memo for inclusion in the Eastman Newsletter,
  - The Town of Grantham will publish, or make available on their website, alternate route information to provide citizens access to hospitals and other services in the event that I-89 is impassible. Information about hazard mitigation will be posted to the website.
  - The Committee will publish a hazard newsletter for distribution to citizens at Town Meeting, and
- The Committee would like to publish an alternate route evacuation plan map.
- The Town will repair and replace the three “red-listed” bridges in Town to protect its road system for emergency evacuation and access.
- The Committee suggested that it is time to update the Emergency Operations Plan to provide better response and coordination in the event of a hazard.
- The Committee would like to start a hazardous tree identification program that would be the responsibility of the Conservation Commission. The concentration would be on the scenic roads in Grantham for which a public hearing is required to do any tree trimming even if the trees are a hazard to travelers or power lines.
- The Committee suggested the creation of a plan that would direct emergency services in the event of a worst case scenario hazard, (i.e., loss of electric and phone), to notify the citizens of Grantham by going door-to-door.
- The school will install a second vehicular bridge for emergency access and evacuation; the current entrance to the school is in a flood hazard area and the dam inundation area.

#### *Strategies Mitigating Flood Hazards*

- A culvert inventory could be performed to identify the location, size, age, condition and life span of all culverts in Grantham. This mitigation effort would allow the Road Agent opportunity for better maintenance and replacement of Town culverts, preventing flooding and road damage. For example, a larger culvert may be needed to prevent flooding over the road where a rainstorm would increase the stream flow exceeding the existing culvert capacity.

### Summary of Critical Evaluation

The Grantham Hazard Mitigation Team reviewed each of the newly identified mitigation strategies using the following factors:

- Does it reduce disaster damage?
- Does it contribute to community objectives?
- Can it be quickly implemented?

- Is it socially acceptable?
- Is it technically feasible?
- Is it administratively possible?
- Is the action legal?
- Does the action offer reasonable benefit compared to cost of implementation?

The Grantham Hazard Mitigation Team assigned the following scores to each strategy for its effectiveness related to the critical evaluation questions listed above. For each critical evaluation question the Committee assigned a 1, 2, or 3 to the strategy being scored. Three indicated that the strategy ranked high in regard to the evaluation question, and one indicated that the strategy ranked low in regard to the evaluation question. The sum of the scores for each evaluation question equals the overall score for a particular strategy. The highest score suggests the highest priority. The highest possible total score is 24.

**VIII-1: Critical Evaluation**

<b>Project/Hazard</b>	<b>Score</b>	<b>Additional Cost/Benefit Consideration</b>	<b>Mitigate Existing or New Built Environment, or Both?</b>
Install second bridge at school	24	Emergency access	Both
Publish a Health and Safety Memo in the Eastman Newsletter/All Hazards	24	A committee is in place to start this effort. Little cost to Eastman and the great benefit	Both
Publish alternative route information to provide access to hospitals and services in the event the I-89 is closed/All Hazards	17	This could be provided in a newsletter with little cost to the town.	Both
Create a town wide publication to educate citizens about hazard prevention. This publication could be posted to the Town Website and distributed at Town Meeting/All Hazards	24	This would require little money from the town and would greatly benefit its citizens.	Both
Start a campaign to inform citizens of Grantham’s reverse 911 system. Citizens need to know that such a system exists and to be ready to receive a recorded message in the event of an emergency/All Hazards	20	The cost of this effort would be great and the benefit would be impossible to measure unless tested in the event of an emergency.	NA
Plan for door-to-door notification in the event of a worse case scenario emergency, (i.e., loss of electric and phone)/All Hazards	17	This would be very difficult to accomplish. There would be benefit in the event of an emergency.	NA
Perform a culvert inventory to identify the location, size, age, condition and life span of each culvert in Grantham/Flooding & Erosion	21	The town would greatly benefit from a culvert inventory and replacement as needed to reduce flooding and washout.	Both
Repair/replace three “red-listed” bridges/Flooding & Erosion	21	Adequate bridges are needed for emergency evacuation and access	Both
Update the Emergency Operations Plan/All Hazards	20	There is already money available for this effort and the town will benefit from the update.	NA
Start a hazardous tree identification program to be run by the Conservation Commission. Attention should be paid to trees posing a threat on scenic roads/Wind Event Hazards	18	The benefit of this effort outweighs the costs.	Both



## IX. PRIORITIZED IMPLEMENTATION SCHEDULE

The Grantham Hazard Mitigation Committee created the following action plan for implementation of priority mitigation strategies:

### IX-1: Prioritized Implementation Schedule

Mitigation Action	Who (Leadership)	When (Deadline)	Cost/Funding Source
Install second bridge at school	School Board	To be determined	Grants & Taxes
Publish a Health and Safety Memo in the Eastman Newsletter.	Eastman Health and Safety Committee	Begin in Summer 2007	Volunteer time
Publish alternative route information to provide access to hospitals and services in the event the I-89 is closed.	Town Administrator and Emergency Management Director	Fall 2007	Staff time and Town funds
Create a town wide publication to educate citizens about hazard prevention. This publication could be posted to the Town Website and distributed at Town Meeting.	Town Administrator	Town Meeting 2008	Staff time and Town funds
Start a campaign to inform citizens of Grantham's reverse 911 system. Citizens need to know that such a system exists and to be ready to receive a recorded message in the event of an emergency.	Emergency Management Director and Town Emergency Services	2009	Staff time and Town funds
Plan for door-to-door notification in the event of a worse case scenario emergency, (i.e., loss of electric and phone).	Emergency Management Director and Town Emergency Services	2009	Staff time and Town funds
Perform a culvert inventory to identify the location, size, age, condition and life span of each culvert in Grantham. Replace culverts as needed.	Road Agent	Begin in the Summer of 2007 (this may take a few years)	Grant funding
Update the Emergency Operations Plan.	Emergency Management Director	To be completed in the Falloff 2007	Grant money is available
Start a hazardous tree identification program to be run by the Conservation Commission. Attention should be paid to trees posing a threat on scenic roads.	Conservation Commission	Town Meeting 2008	Volunteer time
Repair/replace bridge #083/108	Road Agent	2010	NH DOT Bureau of Planning & Community Assistance; Other grants; Taxes
Repair/replace bridge #105/128		2012	
Repair/replace bridge #107/113		2014	

## **X. ADOPTION AND IMPLEMENTATION OF THE PLAN**

A good plan needs to provide for periodic monitoring and evaluation of its successes and challenges, and to allow for updates of the Plan where necessary. In order to track progress and update the Mitigation Strategies identified in the Plan, the Town of Grantham will review the Hazard Mitigation Plan *annually, or after a hazard event*. The Plan will be updated on a five-year cycle. The Grantham Emergency Management Director will initiate this review, or update and should consult with the Hazard Mitigation Committee. Changes will be made to the plan to accommodate for projects that have failed, or that are not considered feasible after a review for their consistency with the evaluation criteria, the timeframe, the community's priorities, and funding resources. Priorities that were not ranked highest, but that were identified as potential mitigation strategies, will be reviewed as well during the monitoring and update of this plan, to determine feasibility for future implementation. During the five-year update, there will be a public hearing to receive public comment, and the Board of Selectmen will adopt the final Plan.

### *Implementation Through Existing Programs*

The Plan will be adopted locally as a stand-alone document. The Board of Selectmen will review and include any proposed projects outlined in this plan. Appropriate mitigation actions will be incorporated in future Capital Improvement Program that the town conducts. During periods of review or update the Hazard Mitigation Committee will consult the Grantham Master Plan to ensure that the Hazard Mitigation Plan doesn't conflict with the Master Plan.

### *Continued Public Involvement*

The public will continue to be involved in the hazard mitigation planning process. In future years, a public meeting will be held (separate from the adoption meeting) to inform and educate members of the public. Prior to the meeting, a press release will be distributed, and information will be posted in the Town.

By nature, natural hazards affect areas not defined by political boundaries. Additionally, response to these disasters often may rely on neighboring communities for assistance such as the mutual aid services. Because of this it is important to notify and work with adjacent communities. Notification of this plan and its meetings were publicly noticed and posted, although direct invitations were not made to neighboring municipalities of Enfield, Springfield, Croydon and Plainfield. Future iterations and updates to this plan will incorporate invitations to those communities to comment and participate in the planning process.

Support for mitigation strategies is important in order to carry out implementation. Although this Hazard Mitigation Plan for the Town of Grantham was unable to interest additional parties, every effort will be made in the future to incorporate representation in future revisions of this plan. In order to ensure in the future that opportunity to participate in the planning process is given to other interested parties, the Town will send invitations to local businesses, educational institutions and non-profit organizations. Revisions of this plan shall incorporate press releases that will notice citizens, businesses and organizations of the progress of the plan while also

soliciting input that could strengthen the value of the plan. This process will enable more successful implementation actions.

Upon notification from FEMA that this plan is been conditionally approved, the Town of Grantham will hold a public meeting. At this public meeting, public comment and input regarding the plan shall be taken. Once public input has been heard, the Town shall adopt the plan with any improvements or recommended changes that are appropriate.

Copies of the Grantham Hazard Mitigation Plan will be sent to the following parties for review:

- Jeremy LaPlante, Field Representative, NH BEM
- Board of Selectmen
- Conservation Commission
- Planning Board
- Police Department
- Fire Department
- Highway Department

## **APPENDICES**

**Appendix A: Technical Resources**

**Appendix B: Hazard Mitigation Assistance Grants**

**Appendix C: Meeting Documentation**

**Appendix D: Risk Assessment Methodology**

**Appendix E: 100-Year Floodplains Map**

**Appendix F: Eastman Dam Inundation Map**

**Appendix G: Wildland/Urban Interface Map**

**Appendix H: Critical Facilities Map**

## APPENDIX A

### TECHNICAL RESOURCES

#### 1) Agencies

<b>New Hampshire Bureau of Emergency Management</b> .....	271-2231
Hazard Mitigation Section .....	271-2231
<b>Federal Emergency Management Agency</b> .....	(617) 223-4175
<b>NH Regional Planning Commissions:</b>	
Upper Valley Lake Sunapee Regional Planning Commission .....	448-1680
<b>NH Executive Department:</b>	
Governor’s Office of Energy and Community Services .....	271-2611
New Hampshire Office of State Planning .....	271-2155
<b>NH Department of Cultural Affairs:</b> .....	271-2540
Division of Historical Resources .....	271-3483
<b>NH Department of Environmental Services:</b> .....	271-3503
Air Resources .....	271-1370
Waste Management .....	271-2900
Water Resources .....	271-3406
Water Supply and Pollution Control .....	271-3504
Rivers Management and Protection Program .....	271-1152
<b>NH Office of State Planning and Energy Programs</b> .....	271-2155
<b>NH Municipal Association</b> .....	224-7447
<b>NH Fish and Game Department</b> .....	271-3421
<b>NH Department of Resources and Economic Development:</b> .....	271-2411
Natural Heritage Inventory .....	271-3623
Division of Forests and Lands .....	271-2214
Division of Parks and Recreation .....	271-3255
<b>NH Department of Transportation</b> .....	271-3734
<b>Northeast States Emergency Consortium, Inc. (NESEC)</b> .....	(781) 224-9876
<b>US Department of Commerce:</b>	
National Oceanic and Atmospheric Administration:	
National Weather Service; Gray, Maine .....	207-688-3216

**US Department of the Interior:**

US Fish and Wildlife Service ..... 225-1411  
US Geological Survey ..... 225-4681  
US Army Corps of Engineers.....(978) 318-8087

**US Department of Agriculture:**

Natural Resource Conservation Service ..... 868-7581

**2) Mitigation Funding Resources**

404 Hazard Mitigation Grant Program (HMGP) ..... NH Office of Emergency Management  
406 Public Assistance and Hazard Mitigation NH Office of Emergency Management  
Community Development Block Grant (CDBG)..... NH OEM, NH OSP, also refer to RPC  
Dam Safety Program ..... NH Department of Environmental Services  
Disaster Preparedness Improvement Grant (DPIG) ..... NH Office of Emergency Management  
Emergency Generators Program by NESEC<sup>‡</sup> ..... NH Office of Emergency Management  
Emergency Watershed Protection (EWP) ProgramUSDA, Natural Resources Conservation Service  
Flood Mitigation Assistance Program (FMAP) ..... NH Office of Emergency Management  
Flood Plain Management Services (FPMS) ..... US Army Corps of Engineers  
Mitigation Assistance Planning (MAP) ..... NH Office of Emergency Management  
Mutual Aid for Public Works ..... NH Municipal Association  
National Flood Insurance Program (NFIP) <sup>†</sup> ..... NH Office of State Planning  
Power of Prevention Grant by NESEC<sup>‡</sup> ..... NH Office of Emergency Management  
Project Impact..... NH Office of Emergency Management  
Roadway Repair & Maintenance Program(s) ..... NH Department of Transportation  
Section 14 Emergency Stream Bank Erosion & Shoreline Protection  
US Army Corps of Engineers  
Section 103 Beach Erosion.....US Army Corps of Engineers

Section 205 Flood Damage Reduction .....	US Army Corps of Engineers
Section 208 Snagging and Clearing .....	US Army Corps of Engineers
Shoreline Protection Program .....	NH Department of Environmental Services
Various Forest and Lands Program(s)	NH Department of Resources and Economic Development
Wetlands Programs.....	NH Department of Environmental Services

‡NESEC – Northeast States Emergency Consortium, Inc. is a 501(c)(3), not-for-profit natural disaster, multi-hazard mitigation and emergency management organization located in Wakefield, Massachusetts. Please, contact NH BEM for more information.

† Note regarding **National Flood Insurance Program (NFIP)** and **Community Rating System (CRS)**:

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

### 3) Websites

Sponsor	Internet Address	Summary of Contents
Natural Hazards Research Center, U. of Colorado	<a href="http://www.colorado.edu/litbase/hazards/">http://www.colorado.edu/litbase/hazards/</a>	Searchable database of references and links to many disaster-related websites.
Atlantic Hurricane Tracking Data by Year	<a href="http://wxp.eas.purdue.edu/hurricane">http://wxp.eas.purdue.edu/hurricane</a>	Hurricane track maps for each year, 1886 – 1996
National Emergency Management Association	<a href="http://nemaweb.org">http://nemaweb.org</a>	Association of state emergency management directors; list of mitigation projects.
NASA – Goddard Space Flight Center “Disaster Finder:	<a href="http://www.gsfc.nasa.gov/ndrd/disaster/">http://www.gsfc.nasa.gov/ndrd/disaster/</a>	Searchable database of sites that encompass a wide range of natural disasters.
NASA Natural Disaster Reference Database	<a href="http://ltpwww.gsfc.nasa.gov/ndrd/main/html">http://ltpwww.gsfc.nasa.gov/ndrd/main/html</a>	Searchable database of worldwide natural disasters.
U.S. State & Local Gateway	<a href="http://www.statelocal.gov/">http://www.statelocal.gov/</a>	General information through the federal-state partnership.
National Weather Service	<a href="http://nws.noaa.gov/">http://nws.noaa.gov/</a>	Central page for National Weather Warnings, updated every 60 seconds.

<b>Sponsor</b>	<b>Internet Address</b>	<b>Summary of Contents</b>
USGS Real Time Hydrologic Data	<a href="http://h20.usgs.gov/public/realtime.html">http://h20.usgs.gov/public/realtime.html</a>	Provisional hydrological data
Dartmouth Flood Observatory	<a href="http://www.dartmouth.edu/artsci/geog/floods/">http://www.dartmouth.edu/artsci/geog/floods/</a>	Observations of flooding situations.
FEMA, National Flood Insurance Program, Community Status Book	<a href="http://www.fema.gov/fema/csb.htm">http://www.fema.gov/fema/csb.htm</a>	Searchable site for access of Community Status Books
Florida State University Atlantic Hurricane Site	<a href="http://www.met.fsu.edu/explores/tropical.html">http://www.met.fsu.edu/explores/tropical.html</a>	Tracking and NWS warnings for Atlantic Hurricanes and other links
National Lightning Safety Institute	<a href="http://lightningsafety.com/">http://lightningsafety.com/</a>	Information and listing of appropriate publications regarding lightning safety.
NASA Optical Transient Detector	<a href="http://www.ghcc.msfc.nasa.gov/otd.html">http://www.ghcc.msfc.nasa.gov/otd.html</a>	Space-based sensor of lightning strikes
LLNL Geologic & Atmospheric Hazards	<a href="http://wwwep.es.llnl.gov/wwwep/ghp.html">http://wwwep.es.llnl.gov/wwwep/ghp.html</a>	General hazard information developed for the Dept. of Energy.
The Tornado Project Online	<a href="http://www.tornadoproject.com/">http://www.tornadoproject.com/</a>	Information on tornadoes, including details of recent impacts.
National Severe Storms Laboratory	<a href="http://www.nssl.uoknor.edu/">http://www.nssl.uoknor.edu/</a>	Information about and tracking of severe storms.
Independent Insurance Agents of America IIAA Natural Disaster Risk Map	<a href="http://www.iaaa.iix.com/ndcmap.htm">http://www.iaaa.iix.com/ndcmap.htm</a>	A multi-disaster risk map.
Earth Satellite Corporation	<a href="http://www.earthsat.com/">http://www.earthsat.com/</a>	Flood risk maps searchable by state.
USDA Forest Service Web	<a href="http://www.fs.fed.us/land">http://www.fs.fed.us/land</a>	Information on forest fires and land management.
Northeast Emergency Consortium	<a href="http://www.serve.com/NESEC">http://www.serve.com/NESEC</a>	Information on disasters and preparedness.



## **APPENDIX B: HAZARD MITIGATION ASSISTANCE GRANTS**

Hazard Mitigation Assistance (HMA) grant programs of the Department of Homeland Security (DHS) Federal Emergency Management Agency (FEMA), presents a critical opportunity to protect individuals and property from natural hazards while simultaneously reducing reliance on Federal disaster funds. The HMA programs provide pre-disaster mitigation grants annually to local communities. The statutory origins of the programs differ, but all share the common goal of reducing the loss of life and property due to natural hazards. Eligible applicants include State-level agencies including State institutions; Federally recognized Indian Tribal governments; Public or Tribal colleges or universities (PDM only); and Local jurisdictions that are participating in the National Flood Insurance Program (NFIP).

The HMA grant assistance includes four programs:

1. *The Pre-Disaster Mitigation (PDM) program:* This provides funds for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. PDM grants are awarded on a competitive basis.
2. *The Flood Mitigation Assistance (FMA) program:* This provides funds so that cost-effective measures can be taken to reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insured under the NFIP. The long-term goal of FMA is to reduce or eliminate claims under the NFIP through mitigation activities.
3. *The Repetitive Flood Claims (RFC) program:* This program provides funding to reduce or eliminate the long-term risk of flood damage to structures insured by NFIP that have had one or more claim payments for flood damages. The long-term goal of the RFC program is to reduce or eliminate claims under the NFIP through mitigation activities that are in the best interest of the NFIP.
4. *The Severe Repetitive Loss (SRL) program:* This program provides funding to reduce or eliminate the long-term risk of flood damage to severe repetitive loss residential structures insured under the NFIP.

Potential eligible projects are shown in the following table by grant program. For further information on these programs visit the following FEMA websites:

PDM – [www.fema.gov/government/grant/pdm/](http://www.fema.gov/government/grant/pdm/)

FMA – [www.fema.gov/government/grant/fma](http://www.fema.gov/government/grant/fma)

RFC – [www.fema.gov/government/grant/rfc](http://www.fema.gov/government/grant/rfc)

SRL – [www.fema.gov/government/grant/srl](http://www.fema.gov/government/grant/srl)

<b>Mitigation Project:</b>	<b>PDM</b>	<b>FMA</b>	<b>RFC</b>	<b>SRL</b>
<b>1. Property Acquisition and Demolition or Relocation Project</b>				
Property Elevation	X	X	X	X
<b>2. Construction Type Projects</b>				
Property Elevation	X	X	X	X
Mitigation Reconstruction <sup>1</sup>				X
Localized Minor Flood Reduction Projects	X	X	X	X
Dry Floodproofing of Residential Property <sup>2</sup>		X		X
Dry Floodproofing of Non-residential Structures		X	X	
Stormwater Management	X	X		
Infrastructure Protection Measure	X			
Vegetative Management/Soil Stabilization	X			
Retrofitting Existing Buildings and Facilities (Wind/Earthquake)	X			
Safe room construction	X			
<b>3. Non-construction Type Projects</b>				
All Hazard/Flood Mitigation Planning	X	X		
<p>1. The SLR Program allows Mitigation Reconstruction projects located outside the regulatory floodway or Zone V as identified on the effective Flood Insurance Rate Map (FIRM), or the mapped limit of the 1.5-foot breaking wave zone. Mitigation Reconstruction is only permitted if traditional elevation cannot be implemented.</p> <p>2. The residential structure must meet the definition of “Historic Structure” in 44 CFR§59.1.</p>				

Source: “Hazard Mitigation Assistance Program Guidance,” FEMA, June 19, 2008

## APPENDIX C

### MEETING DOCUMENTATION

**Agenda - Thursday, January 11, 2006: 1:00 – 3:00 p.m.**

**Grantham, NH Town Offices**

- 1:00 Review work plan and establish meeting schedule
- 1:30 Map past and potential hazards
- 2:30 Identify hazard areas and vulnerable structures/populations
- 3:00 Adjourn

**Agenda - Friday, January 26, 2007; 9:00 a.m. – 11:00 a.m.**

**Grantham, NH Town Offices**

- 9:00 Identify critical facilities
- 10:00 Map critical facilities
- 10:30 Brainstorm existing mitigation strategies
- 11:00 Adjourn

**Agenda - Friday, February 9, 2007; 9:00 – 11:00 a.m.**

**Grantham Town Offices**

- 9:00 Identify current mitigation policies/programs in place
- 10:30 Identify gaps in the current protection
- 11:00 Adjourn

**Agenda - Tuesday, February 27, 2007; 9:00 – 11:00 a.m.**

**Grantham Town Offices**

- 9:00 Identify current mitigation policies/programs in place
- 10:30 Identify gaps in the current protection
- 11:00 Adjourn

**Agenda - Tuesday, March 6, 2007; 9:00 a.m. – 11:00 a.m.**

**Grantham Town Hall**

- 9:00 Brainstorm potential mitigation strategies
- 10:00 Establish prioritized implementation schedule
- 10:30 Discuss public process and adoption
- 11:00 Adjourn

**Agenda – May 3, 2007**

**Grantham Town Hall**

- Review and revise draft plan



## Appendix D:

### Risk Assessment

**Probability-** The Committee members completed a risk assessment of all types of hazards identified in Chapter III. The process involved assigned Unlikely (1), Possible (2), Likely (3) to each hazard type for its potential of occurring based on the committee’s knowledge of past historic information. The ratings were based on the probability that the occurrence may happen within the next ten years (3), between 10-25 years (2), or after 25-years (1). (An n/a score was given if there was insufficient evidence to make a decision). To ensure some balance with a more scientific measurement, the plan also identifies the probability of occurrence from the State Hazard Plan as shown below.

State Hazard Plan – “By weighting both the building value and population, each county is assigned a Vulnerability Level. In addition you will find [the vulnerability table below] which identifies the hazard risk (probability of occurring)... By evaluating the two tables you can compare each county’s vulnerability with it’s’ risk to the 12 different hazards that occur in New Hampshire.”

<i>Hazard Risk for Sullivan County</i>											
<i>Flood</i>	<i>Dam Failure</i>	<i>Drought</i>	<i>Wildfire</i>	<i>Earth quake</i>	<i>Land slide</i>	<i>Radon</i>	<i>Tornado</i>	<i>Hurricane</i>	<i>Lightning</i>	<i>Sever Winter</i>	<i>Avalanche</i>
<i>H</i>	<i>L</i>	<i>M</i>	<i>H</i>	<i>M+</i>	<i>M</i>	<i>M</i>	<i>H</i>	<i>M</i>	<i>M</i>	<i>H</i>	<i>L</i>

<i>Hazard Risk Vulnerability by County</i>										
<i>Hillsborough</i>	<i>Merrimack</i>	<i>Rockingham</i>	<i>Grafton</i>	<i>Stratford</i>	<i>Coos</i>	<i>Belknap</i>	<i>Cheshire</i>	<i>Sullivan</i>	<i>Carroll</i>	
<i>H</i>	<i>H</i>	<i>H</i>	<i>M</i>	<i>M</i>	<i>L</i>	<i>L</i>	<i>L</i>	<i>L</i>	<i>L</i>	

**Vulnerability-** The Committee members completed a risk assessment of all type of hazards identified in Section III. The process also involved assigning vulnerability based on the Committee’s opinion of the extent of damage the hazard may cause based on past occurrences and current assessments of the Town. Great amount of damage and cost (3), moderate amount of damage and cost (2), and limited damage or costs (1).

The probabilities and vulnerabilities were then averaged with those that were determined by the State Hazard Plan.

The averages of each vulnerability and probability were multiplied to arrive at the overall risk the hazard has on the community.

**Risk** - An adjective description (High, Medium, or Low) of the overall threat posed by a hazard over the next 25 years.

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

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

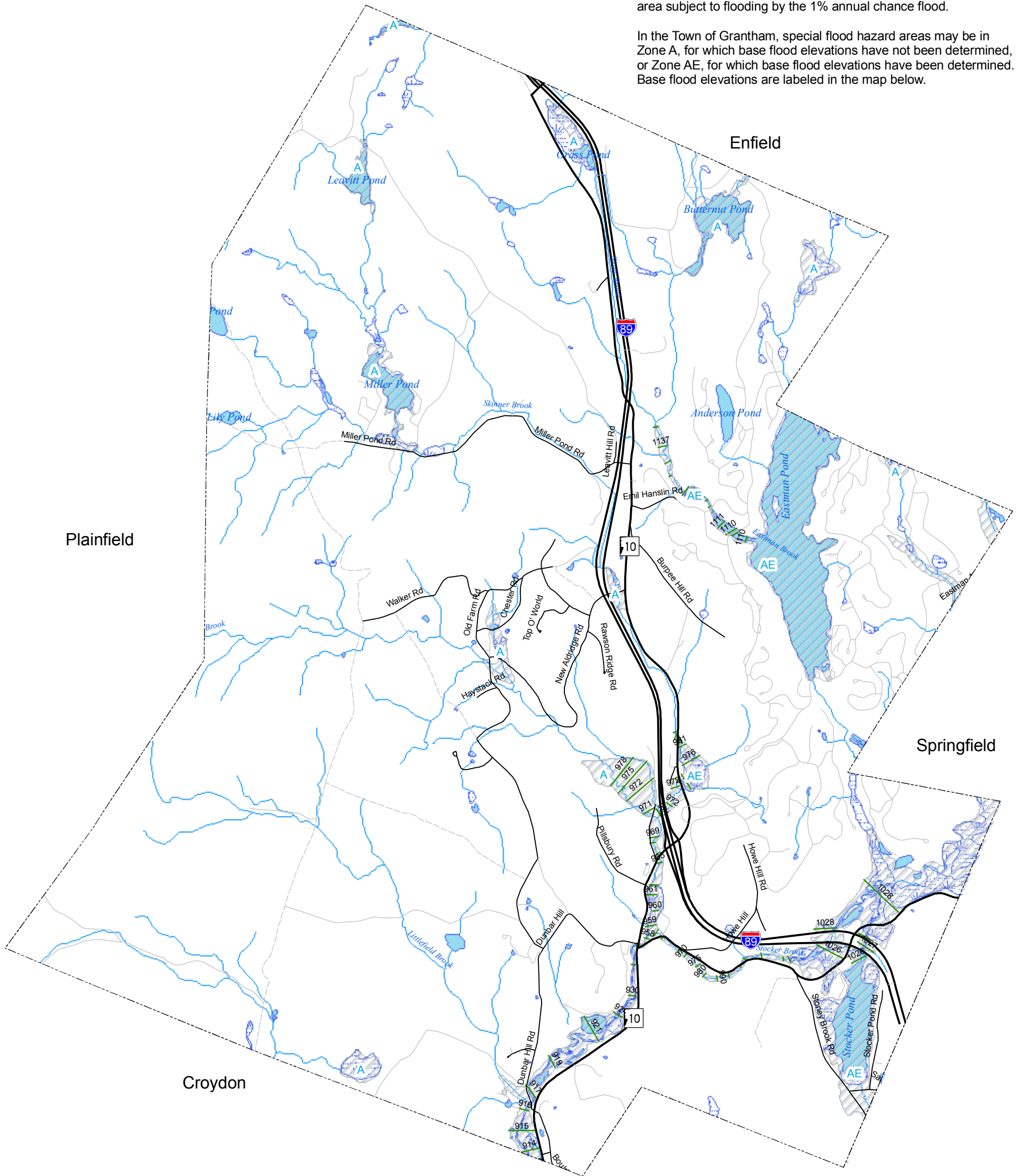
**LOW:** There is little potential for a disaster during the next 25 years. The threat is such as to warrant no special effort to prepare for, respond to, recover from, or mitigate against this hazard. This hazard need not be specifically addressed in the town's emergency management training and exercise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

**Appendix E**  
**100-Year Floodplains Map**

# Town of Grantham, NH 100-Year Floodplains

The 100-year flood (or 1% annual chance flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood.

In the Town of Grantham, special flood hazard areas may be in Zone A, for which base flood elevations have not been determined, or Zone AE, for which base flood elevations have been determined. Base flood elevations are labeled in the map below.

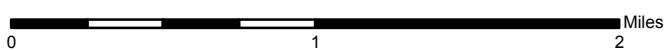
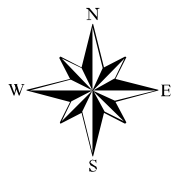


Source Data:  
100-year floodplains and base flood elevations from FEMA Digital Flood Insurance Rate Map database, distributed by NH GRANIT.

Base map features from NH GRANIT, digitized by Complex Systems Research Center, UNH.

Disclaimer:  
Digital data in NH GRANIT represent the efforts of the contributing agencies to record information from the cited source materials. Complex Systems Research Center (CSRC), under contract to the Office of Energy and Planning (OEP), and in consultation with cooperating agencies, maintains a continuing program to identify and correct errors in these data. OEP, CSRC, and the cooperating agencies make no claim as to the validity or reliability or to any implied uses of these data.

Legend	
Town Line	Special Flood Hazard Area
<b>Road Network</b>	
State	Lake/Pond
Local	Reservoir
Private	Swamp/Marsh
Not Maintained	Stream/River



1:40,000



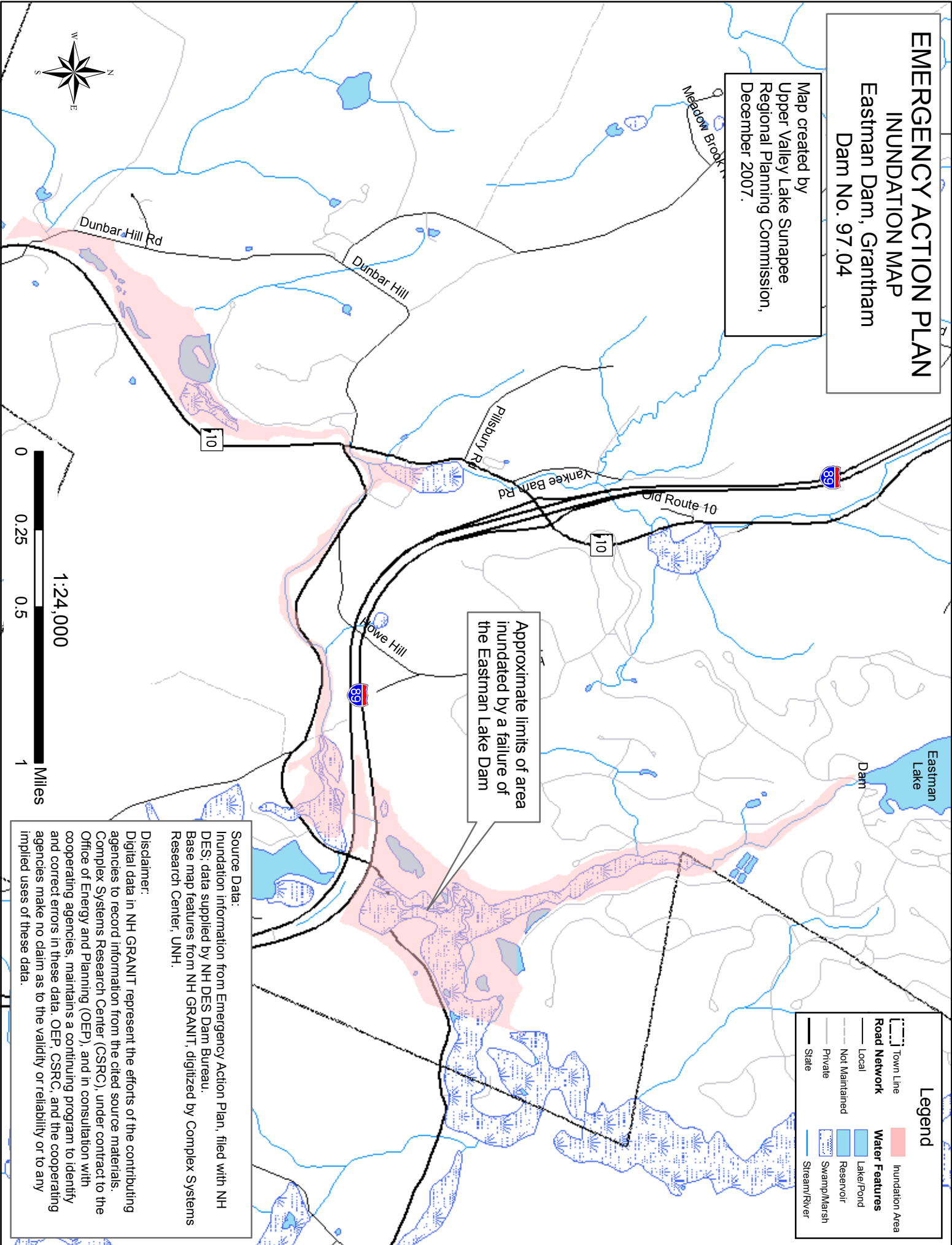
Map created by  
Upper Valley Lake Sunapee Regional Planning Commission,  
November 2007.



**Appendix F**  
**Eastman Dam Inundation Map**

# EMERGENCY ACTION PLAN INUNDATION MAP Eastman Dam, Grantham Dam No. 97.04

Map created by  
Upper Valley Lake Sunapee  
Regional Planning Commission,  
December 2007.



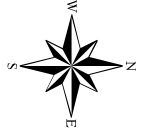
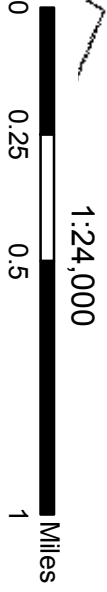
Approximate limits of area  
inundated by a failure of  
the Eastman Lake Dam

### Legend

	Town Line		Inundation Area
	Road Network		Water Features
	Local		Lake/Pond
	Not Maintained		Reservoir
	Private		Swamp/Marsh
	State		Stream/River

**Source Data:**  
Inundation information from Emergency Action Plan, filed with NH DES; data supplied by NH DES Dam Bureau.  
Base map features from NH GRANIT, digitized by Complex Systems Research Center, UNH.








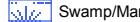
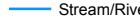


**Disclaimer:**  
Digital data in NH GRANIT represent the efforts of the contributing agencies to record information from the cited source materials. Complex Systems Research Center (CSRC), under contract to the Office of Energy and Planning (OEP), and in consultation with cooperating agencies, maintains a continuing program to identify and correct errors in these data. OEP, CSRC, and the cooperating agencies make no claim as to the validity or reliability or to any implied uses of these data.

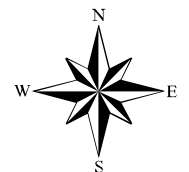
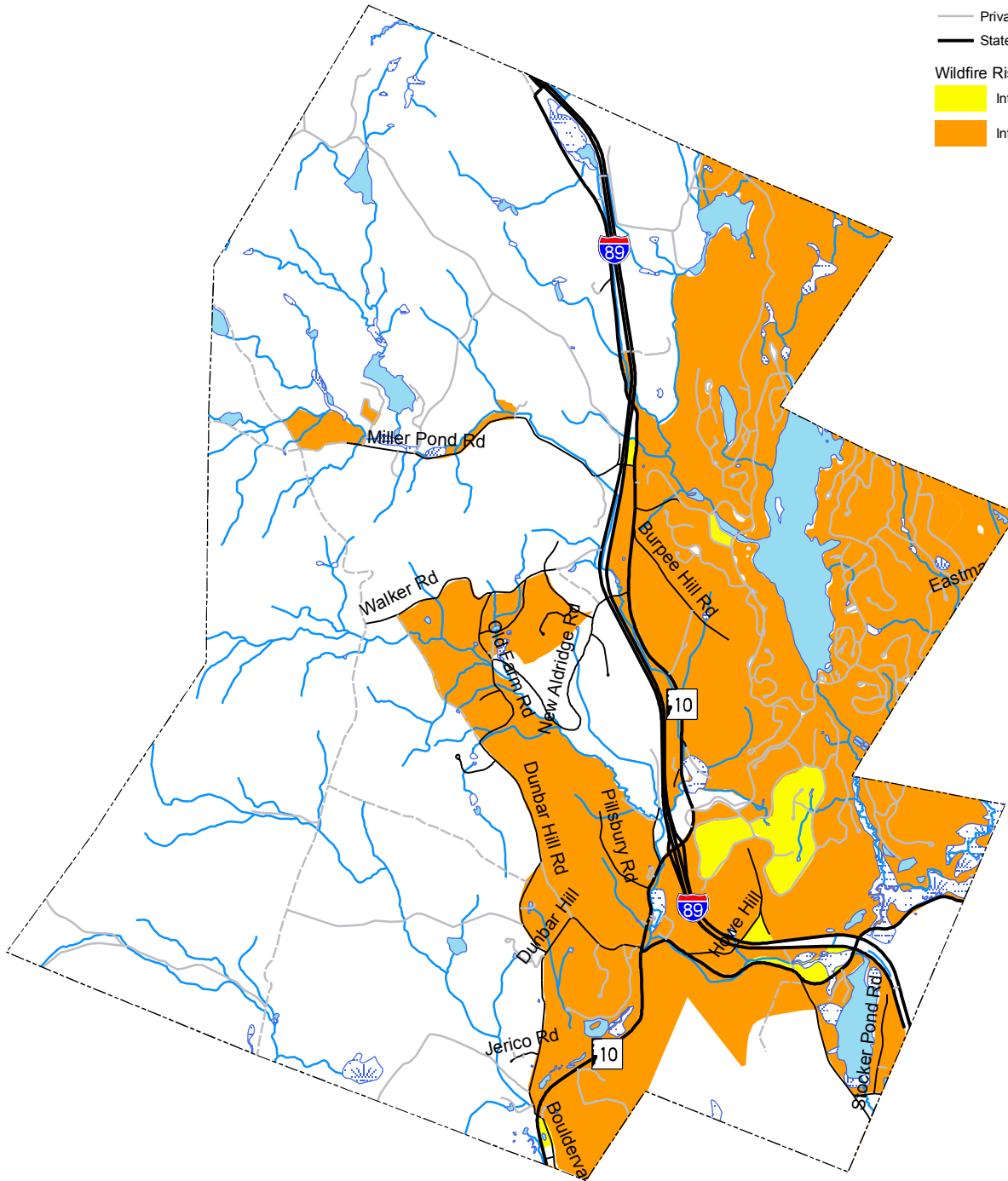


**Appendix G**  
**Wildland/Urban Interface Map**

# Town of Grantham NH Wildland - Urban Interface Map

## Legend

-  Town Line
- Road Network**
  -  Local
  -  Not Maintained
  -  Private
  -  State
- Water Features**
  -  Lake/Pond
  -  Reservoir
  -  Swamp/Marsh
  -  Stream/River
- Wildfire Risk Area**
  -  Interface
  -  Intermix

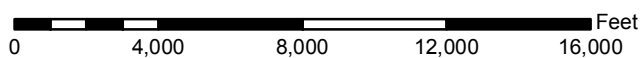


Source Data:  
Radeloff, V. C., R. B. Hammer, S. I Stewart, J. S. Fried, S. S. Holcomb,  
and J. F. McKeefry. 2005. The Wildland Urban Interface in the United States.  
Ecological Applications 15:799-805.

Base map features from NH GRANIT, digitized by Complex Systems  
Research Center, UNH.

Disclaimer:  
Digital data in NH GRANIT represent the efforts of the contributing  
agencies to record information from the cited source materials.  
Complex Systems Research Center (CSRC), under contract to the  
Office of Energy and Planning (OEP), and in consultation with  
cooperating agencies, maintains a continuing program to identify  
and correct errors in these data. OEP, CSRC, and the cooperating  
agencies make no claim as to the validity or reliability or to any  
implied uses of these data.

1:64,000













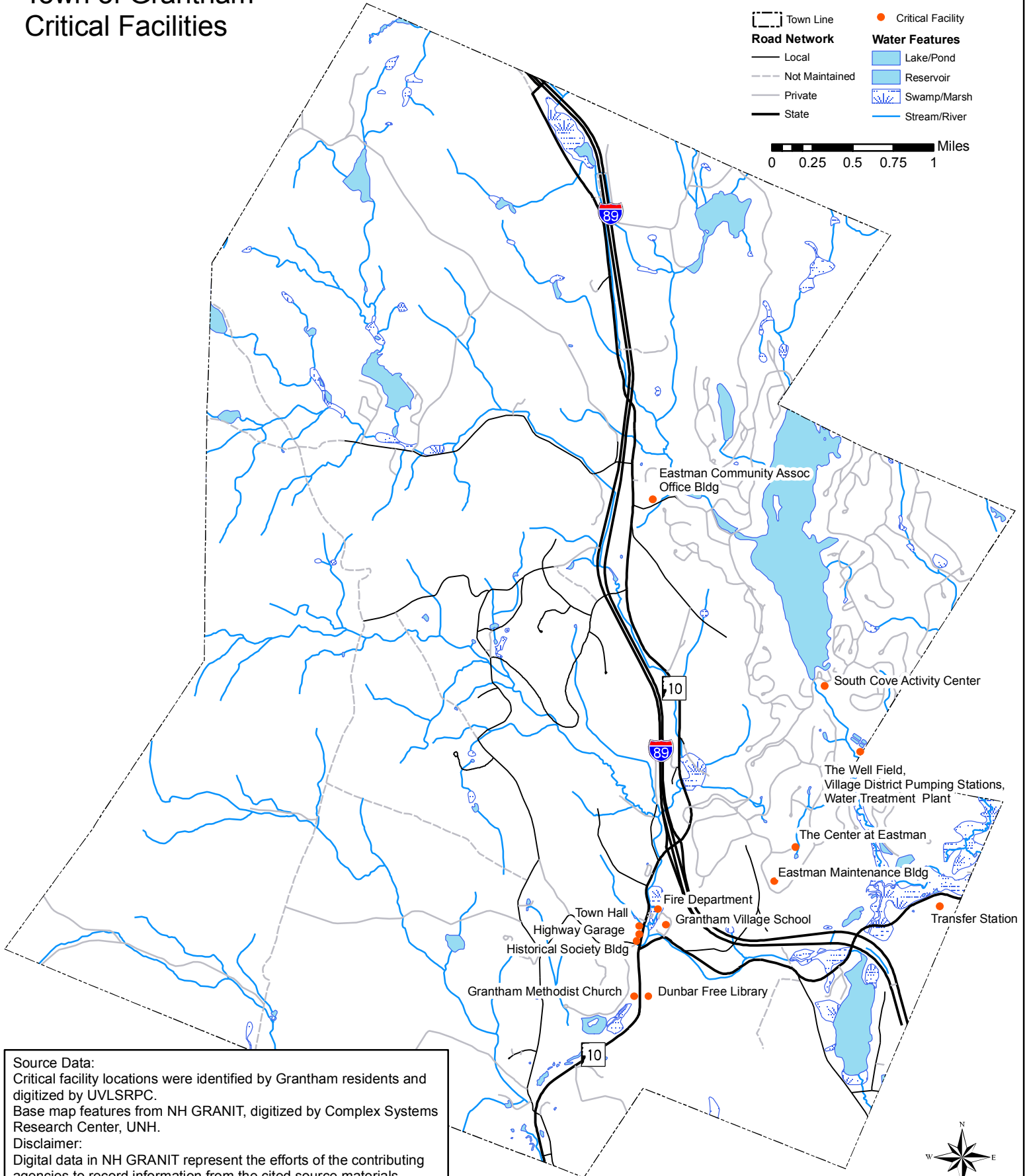
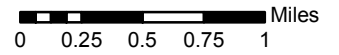
Map created by  
Upper Valley Lake Sunapee Regional Planning Commission,  
November 2007.

**Appendix H**  
**Critical Facilities Map**

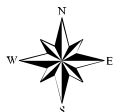
# Town of Grantham Critical Facilities

## Legend

- |  |   |
|--|---|
|  Town Line      |  Critical Facility |
| <b>Road Network</b>  |   |
|  Local          |  Lake/Pond         |
|  Not Maintained |  Reservoir         |
|  Private        |  Swamp/Marsh       |
|  State          |  Stream/River      |



Source Data:  
Critical facility locations were identified by Grantham residents and digitized by UVLSRPC.  
Base map features from NH GRANIT, digitized by Complex Systems Research Center, UNH.  
Disclaimer:  
Digital data in NH GRANIT represent the efforts of the contributing agencies to record information from the cited source materials. Complex Systems Research Center (CSRC), under contract to the Office of Energy and Planning (OEP), and in consultation with cooperating agencies, maintains a continuing program to identify and correct errors in these data. OEP, CSRC, and the cooperating agencies make no claim as to the validity or reliability or to any implied uses of these data.



Map created by  
Upper Valley Lake Sunapee Regional Planning Commission,  
December 2007.