The Town of Granville

Hazard Mitigation Plan

Adopted by the Granville Select Board on _____

Prepared by:

Granville Hazard Mitigation Planning Committee

and

The Pioneer Valley Planning Commission

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Acknowledgements

The Granville Select Board extends special thanks to the Granville Natural Hazard Mitigation Planning Committee as follows:

Kathryn Martin, Town Administrator
Kevin Stromgren, EMD
Scott Loomis, Fire Chief
Doug Roberts, Highway Superintendent
Scott Flebotte, Police Chief

The Granville Select Board offers thanks to the Massachusetts Emergency Management Agency (MEMA) for developing the Commonwealth of Massachusetts Natural Hazards Mitigation Plan (www.state.ma.us/dem/programs/mitigate/index.htm) which served as a model for this plan. In addition, special thanks are extended to the staff of the Pioneer Valley Planning Commission for professional services, process facilitation and preparation of this document.

The Pioneer Valley Planning Commission

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1: PLANNING PROCESS

Introduction

The Federal Emergency Management Agency (FEMA) and the Massachusetts Emergency Management Agency (MEMA) define Hazard Mitigation as any sustained action taken to reduce or eliminate long-term risk to people and property from natural hazards such as flooding, storms, high winds, hurricanes, wildfires, earthquakes, etc. Mitigation efforts undertaken by communities will help to minimize damages to buildings and infrastructure, such as water supplies, sewers, and utility transmission lines, as well as natural, cultural and historic resources.

Planning efforts, like the one undertaken by the Town of Granville and the Pioneer Valley Planning Commission, make mitigation a proactive process. Pre-disaster planning emphasizes actions that can be taken before a natural disaster occurs. Future property damage and loss of life can be reduced or prevented by a mitigation program that addresses the unique geography, demography, economy, and land use of a community within the context of each of the specific potential natural hazards that may threaten a community.

Preparing a hazard mitigation plan before a disaster, can save the community money and facilitate post-disaster funding. Costly repairs or replacement of buildings and infrastructure, as well as the high cost of providing emergency services and rescue/recovery operations, can be avoided or significantly lessened if a community implements the mitigation measures detailed in the plan. FEMA requires that a community adopt a pre-disaster mitigation plan as a condition for mitigation funding. For example, the Hazard Mitigation Grant Program (HMGP), the Flood Mitigation Assistance Program (FMA), and the Pre-Disaster Mitigation Program are programs with this requirement.

Hazard Mitigation Committee

Planning for natural hazard mitigation in Granville involved a five member committee:

Kathryn Martin, Town Administrator
Kevin Stromgren, EMD
Scott Loomis, Fire Chief
Doug Roberts, Highway Superintendent
Scott Flebotte, Police Chief

The natural hazard mitigation planning process for the Town included the following tasks:

- Reviewing and incorporating existing plans and other information.
- Identifying the natural hazards that may impact the community.
- Conducting a Vulnerability/Risk Assessment to identify the infrastructure at the highest risk for being damaged by the identified natural hazards, particularly flooding.
- Identifying and assessing the policies, programs, and regulations the community is currently implementing to protect against future disaster damages.
- Identifying deficiencies in the current strategies and establishing goals for updating, revising or adopting new strategies.
- Adopting and implementing the final Hazard Mitigation Plan.

The key product of this process is the development of an Action Plan with a Prioritized Implementation Schedule.

Committee Meetings

Meetings of the planning committee were all held on the dates listed below. Agendas for these meetings are included in Appendix _B_.

Feb 13, 2015
Work group meeting included hazard mitigation planning overview, identify and organizing of the planning team, and beginning of critical facilities identification.

Feb 27, 2015
Work group revisited critical facilities and evacuation routes potentially affected, discussed history of natural hazard events, reviewed vulnerability assessment methodology, profile hazards, and discussed development trends relative to natural hazard areas.

March 2, 2015

Work group reviewed revised vulnerability assessment, reviewed map of location of critical facilities and natural hazards, prioritized the identified mitigation strategies, defined plan implementation process and discussed public outreach process.

Participation by Public & Entities in Surrounding Communities

On Feb 25, 2015 the Pioneer Valley Planning Commission sent a press release to all area media outlets to inform private citizens that the planning process for Granville's Hazard Mitigation Plan had commenced and that all residents of Granville were invited to attend plan development sessions. Residents were also made aware of the planning process by an article in the Regional Reporter, the newsletter of the Pioneer Valley Planning Commission. The Regional Reporter is e-mailed to multiple municipal officials in the 43 cities and towns that comprise the Pioneer Valley region of western Massachusetts, and also reaches Granville residents.

On _____ the Pioneer Valley Planning Commission sent a press release to all area media outlets to inform the public that a draft of Granville's Hazard Mitigation Plan had had been placed on PVPC's website, as well as the website for the Town of Granville. The release also indicated that hard copies were available at PVPC's offices and that all residents, businesses and other concerned parties of Granville and adjacent communities were encouraged to comment on the plan. Citizens from adjacent municipalities were also encouraged to comment on Granville's plan.

Two public planning sessions were held as part of the development of Granville's plan – one at the beginning of the planning process, and one after the draft plan had been completed. At both meetings, residents were provided with an overview of the Hazard Mitigation Planning process. At the second meeting, the public was also presented with the key findings and mitigation strategies identified by the Hazard Mitigation Committee and the first public meeting. Notice of both public meetings was posted at Granville's Town Hall, as well as the Town's website, in compliance with the Commonwealth of Massachusetts' open meeting law.

Press releases and public meeting agendas can be found in Appendix **B**.

Select Board Meeting

In 2013, the Select Board agreed to begin the process of developing a Hazard Mitigation Plan. Once the plan was provisionally approved by FEMA, the Select Board held a public hearing on the plan and then adopted it.

2: LOCAL PROFILE

Community Setting

Geography

Granville borders the communities of Blandford, Russell, Westfield, Southwick, Granby, Connecticut, Hartland, Connecticut, and Tolland. The town is approximately 18 miles to the west of Springfield and 107 miles southwest of Boston.

History

Granville was first settled in 1736 and was officially incorporated in 1754, after the end of the Indian wars in 1750. Early settlers could get at 100-acre (0.40 km^2) lot for free, providing they built a house and "put four acres in English hay". Perhaps the most famous resident of that era was Oliver Phelps, whose purchase of 6 million acres (24,000 km^2) in western New York remains the largest real estate purchase in US history (Phelps and Gorham Purchase). The population expanded quickly, peaking at 2100 in 1810, when it rivaled Springfield. However, perhaps due to the rocky soil in New England, the settlers eventually migrated west, some establishing the town of Granville, Ohio.

Many historic homes dot Route 57, the main road through town. The village center, the old center, and West Granville center, are all districts recognized by The National Register of Historic Places. Historic buildings include Granville's Old Meeting House (superb acoustics), the Stevenson house to the west of the old meeting house, the West Granville Academy, and the West Granville Church.

Government

The Town of Granville was incorporated as a town in 1754. The Town is governed by an Open Town Meeting form of government in which any registered voter may participate. Acting as the legislative branch of local government, the Town Meeting enacts bylaws, appropriates the operating budget, and makes other important decisions about the Town's resources and services. An elected three-member Board of Selectmen act as the Town's chief executive officers. A variety of appointed volunteer committees are responsible for budget preparation, policy development, town bylaws, and state codes and regulations, and advisor responsibilities.

Population Characteristics

According to the American Community Survey 2008-2012, there are currently 1,481 Granville residents in 580 housing units. The median family income is $65,455 with 6.2% of residents living in poverty. Over half of the town is over the age of 45. Over 99 percent of residents are white.

Economy

According to the American Community Survey 2008 – 2012, the majority of Granville's workforce works at jobs outside the town, traveling an average of 30.2 minutes to work each day. Total employment within town is approximately 161 persons. According to the Massachusetts Department of Employment and Training, the town is currently home to 35 businesses. The approximate labor force is 814, a number that has declined from about 927 in 2007. The unemployment rate is 7.3 percent, an increase from the years 2000-2007, when it was consistently below 3.3 percent.

Climate

Granville is located in western Hampden County, where annual rainfall averages 44 inches and is distributed throughout the year. Precipitation is usually adequate for all types of crops in New England; however, brief droughts occasionally occur in sandy soils with lower water capacity. In addition to rain, snowfall averages 40 inches per season. Prevailing winds from the south (and from the north/northwest to a lesser extent) reach their highest average speed during the month of April.

Since 1948, incidents of extreme rainfall events (large amounts of rain in a short period of time) in the U.S. have increased 30%. However, New England states have experienced a far greater increase than the national average. In Massachusetts, the increase is 81%; upstream on the Connecticut River, New Hampshire is up 115% and Vermont is up 84%. (Source: Environment America Research & Policy Center, 2012). Extreme rainfall is a cause of flooding, which is a major concern of this plan. In the last five years, there has also been an increased occurrence of tornadoes and large storms that generate strong wind gusts.

Infrastructure

Transportation

The principal highway through Granville is State Route 57, which runs east-west through town and connects with State Route 189 and U.S. Route 202.There are no airports, rail stations, or public transit in Granville.

Water Service:

Granville has a small privately owned water company that supplies 32 customers in the center portion of the Town. Those served by the water company are located from 641 Main Road to 734 Main Road, In addition there are customers located from 32 Blandford road to 154 Blandford Road and one customer at 21 Pond View. The well and pump house system is located at 89 Blandford Road. The water Company service is critical to Granville's Emergency Response capability as it provides water to 707 Main Road and services the Town Hall and Emergency Shelter, the Police Department, Center Fire Station and the Emergency operations Center.

There is no municipal sewer service

Natural Resources

Water Resources

Granville is the watershed for three reservoirs: Barkhamsted, the main source for the Hartford metropolitan district; Cobble Mountain, the main source for the City of Springfield; and Westfield, the main source for the City of Westfield, Massachusetts. Much of the land in town is owned by the various water districts.

Forests and Fields

The Granville State Forest, located in Granville and Tolland, is over 2,400 acres and provides recreation for hunters and campers. The Town of Granville is composed mainly of forested area, at 88 percent of the total land area.

Development

Zoning

Zoning is the primary land use tool that the town may use to manage development and direct growth to suitable and desired areas while also protecting critical resources and ensuring that development is in keeping with the town's character.

Granville's Zoning Ordinances establishes one base zoning district, which is the Agricultural-Residential District. The town also has a floodplain overlay district, the purpose of which includes ensuring public safety through reducing the threats to life and personal injury and reducing damage to public and private property resulting from flood waters.

The boundaries of Granville's floodplain overlay district are all special flood hazard areas designated as Zone A on the Town of Granville Flood Hazard Boundary Map, FHBM, issued by FEMA. Zone A is the 100-year flood zone, or the area determined to have a 1% chance of flooding in any given year. All new development in the district must minimize flood damage and not result in any increase in flood levels within the community.

The zone prohibits the following uses:

1. Industrial uses

2. Junkyards, solid waste landfills, auto salvage and recycling facilities, and dumps

3. Business and industrial uses, not agricultural, involving manufacture, use, processing, storage or disposal of hazardous materials or wastes as a principal activity, including but not limited to metal plating, chemical manufacturing, wood preserving, furniture stripping, dry cleaning and auto body repair

4. The outdoor storage of salt, other de-icing chemicals, pesticides or herbicides, flammable, explosive or toxic materials

5. Excavation or disposal of soil or mineral substances, except as necessary for construction of foundations, utilities or roads

In addition, the floodplain overlay district has several uses that are allowed by special permit including single family residences, utility lines and facilities, and residential accessory uses.

Current Development Trends

Granville is a mainly rural community that has only a small percentage of its land area developed. The town's density is low, at approximately 33 per square mile. There are currently 580 housing units in Granville. According to US Census Building Permit Data, there have been 29 construction permits issued in town between 2008 and 2012, all for single family units. Between 1950 and 2000, the population of Granville increased by between 10 and 20 percent. Population growth has leveled off recently, with an increase of 3 percent between 2000 and 2010, according to the US Census.

Compliance with National Flood Insurance Program

Granville is a participating member of the National Flood Insurance Program, and had the following NFIP policy and claim statistics as of October of 2013:

- Flood Insurance Rate Maps (FIRMs) are used for flood insurance purposes and are on file with the Granville Planning Board.

- FEMA designated Flood Zones are also available via Overlay Maps available on the Town of Granville website.

- FIRMs have been effective since August 30, 1974 with the current map in effect since July 16, 2013.

- Granville has 4 in-force policies in effect for a total of $559,500 worth of insurance.

- There has been 1 NFIP claims for which $3,202 has been paid.

- As of 2013, there have been no Repetitive Loss Properties in Granville.

- The Town will maintain compliance with the NFIP throughout the next 5-year Hazard Mitigation Planning cycle by monitoring its Flood Plain Overlay District and ensuring that the district accurately reflects the 100-year flood plain and FEMA Flood Insurance Rate Map (FIRM).

3: HAZARD IDENTIFICATION AND RISK ASSESSMENT

The following section includes a summary of disasters that have affected or could affect Granville. Historical research, conversations with local officials and emergency management personnel, available hazard mapping and other weather-related databases were used to develop this list. Identified hazards are the following:

- Floods
- Severe snowstorms / ice storms
- Hurricanes
- Severe thunderstorms / wind / tornadoes
- Wildfires / brushfires
- Earthquakes
- Dam failure
- Drought

Natural Hazard Analysis Methodology

This chapter examines all hazards identified by the Massachusetts State Hazard Mitigation Plan. The analysis is organized into the following sections: Hazard Description, Location, Extent, Previous Occurrences, Probability of Future Events, Impact, and Vulnerability. A description of each of these analysis categories is provided below.

Hazard Description

The natural hazards identified for Granville are: floods, severe snowstorms/ice storms, hurricanes, severe thunderstorms / wind / tornadoes, wildfire/brushfire, earthquakes, dam failure, and drought. Many of these hazards result in similar impacts to a community. For example, hurricanes, tornadoes and severe snowstorms may cause wind-related damage.

Location

Location refers to the geographic areas within the planning area that are affected by the hazard. Some hazards affect the entire planning area universally, while others apply to a specific portion, such as a floodplain or area that is susceptible to wild fires. Classifications are based on the area that would potentially be affected by the hazard, on the following scale:

Location of Occurrence, Percentage of Town Impacted by Given Natural Hazard	
Location of Occurrence	**Percentage of Town Impacted**
Large	More than 50% of the town affected
Medium	10 to 50% of the town affected
Small	Less than 10% of the town affected

Extent

Extent describes the strength or magnitude of a hazard. Where appropriate, extent is described using an established scientific scale or measurement system. Other descriptions of extent include water depth, wind speed, and duration.

Previous Occurrences

Previous hazard events that have occurred are described. Depending on the nature of the hazard, events listed may have occurred on a local, state-wide, or regional level.

Probability of Future Events

The likelihood of a future event for each natural hazard was classified according to the following scale:

Frequency of Occurrence and Annual Probability of Given Natural Hazard	
Frequency of Occurrence	**Probability of Future Events**
Very High	70-100% probability in the next year
High	40-70% probability in the next year
Moderate	10-40% probability in the next year
Low	1-10% probability in the next year
Very Low	Less than 1% probability in the next year

Impact

Impact refers to the effect that a hazard may have on the people and property in the community, based on the assessment of extent described above. Impacts are classified according to the following scale:

Extent of Impacts, Magnitude of Multiple Impacts of Given Natural Hazard	
Extent of Impacts	**Magnitude of Multiple Impacts**
Catastrophic	Multiple deaths and injuries possible. More than 50% of property in affected area damaged or destroyed. Complete shutdown of facilities for 30 days or more.
Critical	Multiple injuries possible. More than 25% of property in affected area damaged or destroyed. Complete shutdown of facilities for more than 1 week.
Limited	Minor injuries only. More than 10% of property in affected area damaged or destroyed. Complete shutdown of facilities for more than 1 day.
Minor	Very few injuries, if any. Only minor property damage and minimal disruption on quality of life. Temporary shutdown of facilities.

Vulnerability

Based on the above metrics, a hazard index rating was determined for each hazard. The hazard index ratings are based on a scale of 1 (highest risk) through 5 (lowest risk). The ranking is qualitative and is based, in part, on local knowledge of past experiences with each type of hazard. The size and impacts of a natural hazard can be unpredictable. However; many of the mitigation strategies currently in place and many of those proposed for implementation can be applied to the expected natural hazards, regardless of their unpredictability.

Hazard Identification and Analysis Worksheet for Granville				
Type of Hazard	**Location of Occurrence**	**Probability of Future Events**	**Impact**	**Vulnerability**
Floods	small	High	minor	1
Severe Snowstorms/Ice Storms	medium	Very high	limited	2
Hurricanes	medium	Low	critical	3
Severe Thunderstorms / Wind / Tornadoes	medium	Very high	limited	2
Wildfire / Brushfire	small	Low	minor	4
Earthquakes	large	Very low	catastrophic	5
Dam Failures	small	Low	limited	4
Drought	small	Low	limited	5

Source: Adapted from FEMA Local Hazard Mitigation Planning Handbook (March 2013) Worksheet 5.1; Town of Holden Beach North Carolina Community-Based Hazard Mitigation Plan, July 15, 2003 and the Massachusetts Emergency Management Agency (MEMA).

Floods

Hazard Description

There are three major types of storms that can generate flooding in Granville:

- Continental storms are typically low-pressure systems that can be either slow or fast moving. These storms originate from the west and occur throughout the year.

- Coastal storms, also known as nor'easters, usually occur in late summer or early fall and originate from the south. The most severe coastal storms, hurricanes, occasionally reach Massachusetts and generate very large amounts of rainfall.

- Thunderstorms form on warm, humid summer days and cause locally significant rainfall, usually over the course of several hours. These storms can form quickly and are more difficult to predict than continental and coastal storms.

A floodplain is the relatively flat, lowland area adjacent to a river, lake or stream. Floodplains serve an important function, acting like large "sponges" to absorb and slowly release floodwaters back to surface waters and groundwater. Over time, sediments that are deposited in floodplains develop into fertile, productive farmland like that found in the Connecticut River valley. In the past, floodplain areas were also often seen as prime locations for development. Industries were located on the banks of rivers for access to hydropower. Residential and commercial development occurred in floodplains because of their scenic qualities and proximity to the water. Although periodic flooding of a floodplain area is a natural occurrence, past and current development and alteration of these areas will result in flooding that is a costly and frequent hazard.

Location

There are approximately _1075_ acres of land within the FEMA mapped 100-year floodplain and _0_ acres of land within the 500-year floodplain within the Town of Granville. The 100-year flood zone covers mostly the following areas in Granville:

1. Area's associated with Cobble Mountain Reservoir
2. Area's associated with Borden Brook Reservoir
3. Area's associated with Granville Reservoir
4. Area's associated with Parsons Pond
5. Area's associated with Degano Pond
6. Ripley Brook
7. Half Pond Brook
8. Pond Brook
9. Valley Brook
10. Halfway Brook
11. Tillotson Brook

12. Japhet Brook
13. Dickinson Brook
14. Seymour Brook

In addition, various parts of Granville have issues with localized flooding, described below:

- Route 57-the main route through town, at Shaughnessey swamp and Old Westfield Road
- Granby Road and Intersection of Water Street

When there are major storms or hurricanes, these areas flood a couple of times each year

Jurisdictional, Perennial, and Intermittent stream crossings cross Granville's road network in numerous locations. Granville, located on the eastern side of the Berkshires, is a natural gravity flow watershed for the urban center in the Pioneer Valley and Hartford. Very few of these stream crossings were installed utilizing standard engineering practices. Many crossing structures were installed with inadequate understanding of drainage engineering or were emergency repairs from severe flooding events like the flood of 1955. Pond Brook, Potash Brook, and Dickinson Brook are some examples of major stream crossings that are in a state of failure, and were installed after catastrophic failure in 1955. The dependent variables of the current state of the infrastructure are complicated, because it is essential that key decisions makers come to a consensus on a repair strategy. Understanding of the following dependent factors is critical.

One - Many of the current structures were installed in 1955 as emergency repairs.

Two - 65 years of service is longer than the engineered lifespan for buried infrastructure.

Three - Traffic counts (ADT) and commercial vehicle gross weights have increased exponentially. And use patterns have changed; the southern Berkshires are dependent on commuting routes to the urban centers.

Four – Repairs to corridor since the installation have only addressed the travel surface.

Five – State bridge inspection does not include large culverts and headwalls.

Six –Environmental compliance, stream crossing standards, critical habitats, and permitting have driven the project costs of repairing and replacing culverts past the ability of a Hilltown budgets. In most cases, permitting to replace jurisdictional crossing and design costs are more than 50% of the total completed project costs. The permitting and design function uses a significant portion of State allocated chapter funds, resulting in long delays in project completion.

Seven- It is critical to understand that the major stream crossings in Granville are currently in a state of failure, that they are currently unsafe, and that a significant storm event will result in the isolation of large sections of the Southern Berkshires because of extreme wash outs at those locations. The next storm event that approaches the magnitude of the 1955 flood will result in washouts on Route 57 that could take 100 million dollars to repair and two years to complete. With some exceptions, the drainage on Route 57 was installed in 1948 and repaired as needed in 1955.

Eight- Duration and intensity projections for critical rain events have relied on flawed data for 45 years. The results of incorporating this flawed model, for drainage design purposes, are that even relatively new drainage structures are undersized for extreme events which maybe more frequent and more intense due to climate change. Moreover, damaged and deteriorated crossings are critically vulnerable to extreme weather events, therefore it cannot be overstated that Potash Brook and Pond Brook are likely to fail.

Extent

Floods can be classified as one of two types: flash floods and general floods.

- **Flash floods** are the product of heavy, localized precipitation in a short time period over a given location. Flash flooding events typically occur within minutes or hours after a period of heavy precipitation, after a dam or levee failure, or from a sudden release of water from an ice jam. Most often, flash flooding is the result of a slow-moving thunderstorm or the heavy rains from a hurricane. In rural areas, flash flooding often occurs when small streams spill over their banks. However, in urbanized areas, flash flooding is often the result of clogged storm drains (leaves and other debris) and the higher amount of impervious surface area (roadways, parking lots, roof tops).

- **General floods** may last for several days or weeks and are caused by precipitation over a longer time period in a particular river basin. Excessive precipitation within a watershed of a stream or river can result in flooding particularly when development in the floodplain has obstructed the natural flow of the water and/or decreased the natural ability of the groundcover to absorb and retain surface water runoff (e.g., the loss of wetlands and the higher amounts of impervious surface area in urban areas).

The average annual precipitation for Granville and surrounding areas in western Massachusetts is 46 inches.

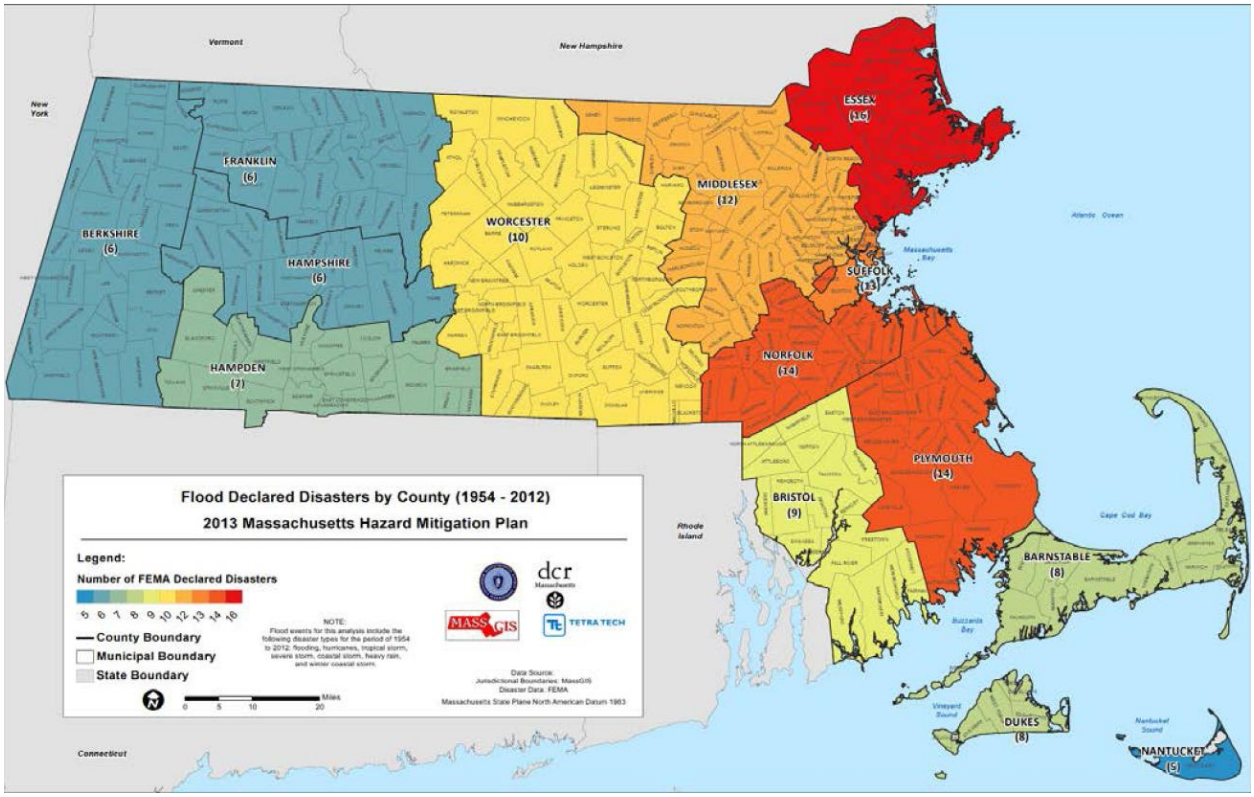
Previous Occurrences

The major floods recorded in Granville have been the result of rainfall alone or rainfall combined with snowmelt. A history of floods is shown in the table below, along with their length, depth, and location:

Historic Floods in Granville			
Date	**Duration (days)**	**Depth**	**Location**
1955	5 days	Various	Town Wide
1991	2 days	Various	RT57 Old Westfield Rd.

In addition, since 1954, there have been 7 FEMA flood declared disasters in Hampden County, as shown in the map below.

FEMA Flood Declared Disasters by County, 1954-2012



Source: Massachusetts Hazard Mitigation Plan

Probability of Future Events

The area within the 100-year flood plain has a 1 percent chance of flooding in any given year.

Based on previous occurrences, the chances of localized, flash flooding are approximately 20% a year.

Climate scientists predict that in the next few decades, climate change will increase the frequency and intensity of all storms that can cause flooding. Currently, floods are the most costly natural hazard in the United States, and climate change will only increase this damage. More information about the effect of Climate Change can be found in the Pioneer Valley Planning Commission's Climate Action Plan, available at www.sustainableknowledgecorridor.org.

The Massachusetts State Climate Change Adaptation Report has additional information about the impact of climate change and can be accessed at www.mass.gov/eea/air-water-climate-change/climate-change/climate-change-adaptation-report.html.

Impact

To approximate the potential impact to property and people that could be affected by this hazard, the Town's median home value of $220,300 (2008-12 ACS) and average household size of 2.6 (U.S. 2010 Census) is used.

An estimated 20 percent of damage would occur to each structure in the 100-year flood plain, resulting in a total of $2,863,900 worth of damage and 15 people affected. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

Vulnerability

Based on the above analysis, the risk of flooding is 1.

Severe Snowstorms / Ice Storms

Hazard Description

Severe winter storms can pose a significant risk to property and human life. The rain, freezing rain, ice, snow, cold temperatures and wind associated with these storms can cause the following hazards:

- Disrupted power and phone service
- Unsafe roadways and increased traffic accidents
- Infrastructure and other property are also at risk from severe winter storms and the associated flooding that can occur following heavy snow melt.
- Tree damage and fallen branches that cause utility line damage and roadway blockages
- Damage to telecommunications structures
- Reduced ability of emergency officials to respond promptly to medical emergencies or fires.

Location

The entire Town of Granville is susceptible to severe snowstorms. Because these storms occur regionally, they impact the entire town.

The town has had ice problems on the following roadways:

Because of severe grades and 1100 ft. of elevation, winter storms in the Hilltowns are often more severe than predicted for adjacent low lying areas. Traffic patterns require 24 hour, 7 day vigilance to ensure safe travel conditions because the result of a large percentage of commuters to urban centers and regional schools.

Although the Commonwealths ice and snow recommendations have evolved toward pure salt application, Granville DPW has resisted a 100% salt program until ground water and drinking water impacts are better understood.

The following areas have been identified by the Hazard Mitigation Committee as areas where snow drifts form during winter storm events:

Shaunessey Swamp, Cross Sodom intersection, Blandford Road, South Lane, Trumble, Crest, and Hartland Hollow Road are areas prone to drifting. Drifting is a function of snow conditions and wind direction.

Extent

The Northeast Snowfall Impact Scale (NESIS) developed by Paul Kocin of The Weather Channel and Louis Uccellini of the National Weather Service (Kocin and Uccellini, 2004) characterizes and ranks high-impact Northeast snowstorms. These storms have large areas of 10-inch snowfall accumulations and greater. NESIS has five categories: Extreme, Crippling, Major, Significant, and Notable. The index differs from other meteorological indices in that it uses population information in addition to meteorological measurements. Thus NESIS gives an indication of a storm's societal impacts.

NESIS scores are a function of the area affected by the snowstorm, the amount of snow, and the number of people living in the path of the storm. The aerial distribution of snowfall and population information are combined in an equation that calculates a NESIS score which varies from around one for smaller storms to over ten for extreme storms. The raw score is then converted into one of the five NESIS categories. The largest NESIS values result from storms producing heavy snowfall over large areas that include major metropolitan centers.

Northeast Snowfall Impact Scale Categories		
Category	**NESIS Value**	**Description**
1	1—2.499	Notable
2	2.5—3.99	Significant
3	4—5.99	Major
4	6—9.99	Crippling
5	10.0+	Extreme

Source: http://www.ncdc.noaa.gov/snow-and-ice/rsi/nesis

Previous Occurrences

New England generally experiences at least one or two severe winter storms each year with varying degrees of severity. Severe winter storms typically occur during January and February; however, they can occur from late September through late April.

Based on data available from the National Oceanic and Atmospheric Administration, there are 47 winter storms since 1958 that have registered on the NESIS scale. Of these, approximately 26 storms resulted in snow falls in the Pioneer Valley of at least 10 inches. These storms are listed in the table on the next page, in order of their NESIS severity.

Winter Storms Producing Over 10 inches of Snow in the Pioneer Valley, 1958-2013			
Date	NESIS Value	NASIS Category	NESIS Classification
3/12/1993	13.2	5	Extreme
3/2/1960	8.77	4	Crippling
2/15/2003	7.5	4	Crippling
2/2/1961	7.06	4	Crippling
1/21/2005	6.8	4	Crippling
1/19/1978	6.53	4	Crippling
12/25/1969	6.29	4	Crippling
2/10/1983	6.25	4	Crippling
2/14/1958	6.25	4	Crippling
2/5/1978	5.78	3	Major
2/23/2010	5.46	3	Major
2/8/1994	5.39	3	Major
1/9/2011	5.31	3	Major
2/18/1972	4.77	3	Major
12/11/1960	4.53	3	Major
2/7/2013	4.35	3	Major
2/22/1969	4.29	3	Major
1/18/1961	4.04	3	Major
2/8/1969	3.51	2	Significant
2/5/1967	3.5	2	Significant
4/6/1982	3.35	2	Significant
3/4/2013	3.05	2	Significant
3/15/2007	2.54	2	Significant
3/31/1997	2.29	1	Notable
2/2/1995	1.43	1	Notable
1/25/1987	1.19	1	Notable

Source: http://www.ncdc.noaa.gov/snow-and-ice/rsi/nesis

Probability of Future Events

Based upon the availability of records for Hampden County, the likelihood that a severe snow storm will hit Granville in any given year is greater than 50 percent.

Research on climate change indicates that there is great potential for stronger, more frequent storms as the global temperature increases. More information about the effect of Climate Change can be found in the Pioneer Valley Planning Commission's Climate Action Plan, available at www.sustainableknowledgecorridor.org.

The Massachusetts State Climate Change Adaptation Report has additional information about the impact of climate change and can be accessed at www.mass.gov/eea/air-water-climate-change/climate-change/climate-change-adaptation-report.html.

Impact

To approximate the potential impact to property and people that could be affected by this hazard, the total value of all property in town, $192,800,680 is used.

An estimated 20 percent of damage would occur to 10 percent of structures, resulting in a total of $ 385,600 worth of damage and 15 people affected. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

Vulnerability

Based on the above assessment, Granville faces a 2 risk from severe snow storms and ice storms.

Hurricanes

Hazard Description

Hurricanes are classified as cyclones and defined as any closed circulation developing around a low-pressure center in which the winds rotate counter-clockwise in the Northern Hemisphere (or clockwise in the Southern Hemisphere) and whose diameter averages 10 to 30 miles across. The primary damaging forces associated with these storms are high-level sustained winds and heavy precipitation. Hurricanes are violent rainstorms with strong winds that can reach speeds of up to 200 miles per hour and which generate large amounts of precipitation. Hurricanes generally occur between June and November and can result in flooding and wind damage to structures and above-ground utilities.

Location

Because of the hazard's regional nature, all of Granville is at risk from hurricanes. Ridgetops are more susceptible to wind damage.

Extent

As an incipient hurricane develops, barometric pressure (measured in millibars or inches) at its center falls and winds increase. If the atmospheric and oceanic conditions are favorable, it can intensify into a tropical depression. When maximum sustained winds reach or exceed 39 miles per hour, the system is designated a tropical storm, given a name, and is closely monitored by the National Hurricane Center in Miami, Florida. When sustained winds reach or exceed 74 miles per hour the storm is deemed a hurricane. Hurricane intensity is further classified by the Saffir-Simpson Hurricane Wind Scale, which rates hurricane wind intensity on a scale of 1 to 5, with 5 being the most intense.

SAFFIR-SIMPSON SCALE	
Category	**Maximum Sustained Wind Speed (MPH)**
1	74–95
2	96–110
3	111–129
4	130–156
5	157 +

Source: National Hurricane Center, 2012

Previous Occurrences

Hurricanes that have affected the Pioneer Valley are show in the following table.

Major Hurricanes in the Pioneer Valley		
Hurricane/Storm Name	**Year**	**Saffir/Simpson Category (when reached MA)**
Great Hurricane of 1938	1938	3
Great Atlantic Hurricane	1944	1
Carol	1954	3
Edna	1954	1
Diane	1955	Tropical Storm
Donna	1960	Unclear, 1 or 2
Groundhog Day Gale	1976	Not Applicable
Gloria	1985	1
Bob	1991	2
Floyd	1999	Tropical Storm
Irene	2011	Tropical Storm
Sandy	2012	Super Storm

Probability of Future Events

Granville's location in Western Massachusetts reduces the risk of extremely high winds that are associated with hurricanes, although it can experience some high wind events. Based upon past occurrences, it is reasonable to say that there is a low probability of hurricanes in Granville in any given year.

Impact

A description of the damages that could occur due to a hurricane is described by the Saffir-Simpson scale, as shown below.

Hurricane Damage Classifications			
Storm Category	**Damage Level**	**Description of Damages**	**Wind Speed (MPH)**
1	MINIMAL Very dangerous winds will produce some damage	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also, some coastal flooding and minor pier damage. An example of a Category 1 hurricane is Hurricane Dolly (2008).	74-95
2	MODERATE Extremely dangerous winds will cause extensive damage	Some roofing material, door, and window damage. Considerable damage to vegetation, mobile homes, etc. Flooding damages piers and small craft in unprotected moorings may break their moorings. An example of a Category 2 hurricane is Hurricane Francis in 2004.	96-110
3	EXTENSIVE Devastating damage will occur	Some structural damage to small residences and utility buildings, with a minor amount of curtain wall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures, with larger structures damaged by floating debris. Terrain may be flooded well inland. An example of a Category 3 hurricane is Hurricane Ivan (2004).	111-129
4	EXTREME Catastrophic damage will occur	More extensive curtain wall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Terrain may be flooded well inland. An example of a Category 4 hurricane is Hurricane Charley (2004).	130-156
5	CATASTROPHIC Catastrophic damage will occur	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Flooding causes major damage to lower floors of all structures near the shoreline. Massive evacuation of residential areas may be required. An example of a Category 5 hurricane is Hurricane Andrew (1992).	157+

Using a total a value of all structures in town of , $192,800,680 and an estimated wind damage of 5 percent of all structures with 10 percent damage to each structure, an estimated $ 96,400 of damage would occur. Estimated flood damage to 10 percent of the structures with 20 percent damage to each structure would result in $ 385,600 of damage. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

Vulnerability

Based on the above analysis, Granville faces a 3 risk from hurricanes.

Severe Thunderstorms / Wind / Tornadoes

Hazard Description

A thunderstorm is a storm with lightning and thunder produced by a cumulonimbus cloud, usually producing gusty winds, heavy rain, and sometimes hail. Effective January 5, 2010, the NWS modified the hail size criterion to classify a thunderstorm as 'severe' when it produces damaging wind gusts in excess of 58 mph (50 knots), hail that is 1 inch in diameter or larger (quarter size), or a tornado (NWS, 2013).

Wind is air in motion relative to surface of the earth. For non-tropical events over land, the NWS issues a Wind Advisory (sustained winds of 31 to 39 mph for at least 1 hour or any gusts 46 to 57 mph) or a High Wind Warning (sustained winds 40+ mph or any gusts 58+ mph). For non-tropical events over water, the NWS issues a small craft advisory (sustained winds 25-33 knots), a gale warning (sustained winds 34-47 knots), a storm warning (sustained winds 48 to 63 knots), or a hurricane force wind warning (sustained winds 64+ knots). For tropical systems, the NWS issues a tropical storm warning for any areas (inland or coastal) that are expecting sustained winds from 39 to 73 mph. A hurricane warning is issued for any areas (inland or coastal) that are expecting sustained winds of 74 mph. Effects from high winds can include downed trees and/or power lines and damage to roofs, windows, etc. High winds can cause scattered power outages. High winds are also a hazard for the boating, shipping, and aviation industry sectors.

Tornadoes are swirling columns of air that typically form in the spring and summer during severe thunderstorm events. In a relatively short period of time and with little or no advance warning, a tornado can attain rotational wind speeds in excess of 250 miles per hour and can cause severe devastation along a path that ranges from a few dozen yards to over a mile in width. The path of a tornado may be hard to predict because they can stall or change direction abruptly. Within Massachusetts, tornadoes have occurred most frequently in Worcester County and in communities west of Worcester, including towns in eastern Hampshire County. High wind speeds, hail, and debris generated by tornadoes can result in loss of life, downed trees and power lines, and damage to structures and other personal property (cars, etc.).

Location

As per the Massachusetts Hazard Mitigation Plan, the entire town is at risk of high winds, severe thunderstorms, and tornadoes.

Extent

An average thunderstorm is 15 miles across and lasts 30 minutes; severe thunderstorms can be much larger and longer. Southern New England typically experiences 10 to 15 days per year with severe thunderstorms.

Tornadoes are measured using the enhanced F-Scale, shown with the following categories and corresponding descriptions of damage:

Enhanced Fujita Scale Levels and Descriptions of Damage			
EF-Scale Number	**Intensity Phrase**	**3-Second Gust (MPH)**	**Type of Damage Done**
EF0	Gale	65–85	Some damage to chimneys; breaks branches off trees; pushes over shallow-rooted trees; damages to sign boards.
EF1	Moderate	86–110	The lower limit is the beginning of hurricane wind speed; peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos pushed off the roads; attached garages may be destroyed.
EF2	Significant	111–135	Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars pushed over; large trees snapped or uprooted; light object missiles generated.
EF3	Severe	136–165	Roof and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted.
EF4	Devastating	166–200	Well-constructed houses leveled; structures with weak foundations blown off some distance; cars thrown and large missiles generated.

Previous Occurrences

Because thunderstorms and wind affect the town regularly on an annual basis, there are not significant records available for these events. For tornadoes, there are typically 1 to 3 tornadoes somewhere in southern New England per year. Most occur in the late afternoon and evening hours, when the heating is the greatest. The most common months are June, July, and August, but the Great Barrington, MA tornado (1995) occurred in May and the Windsor Locks, CT tornado (1979) occurred in October.

Within Massachusetts, tornadoes have occurred most frequently in Worcester County and in communities west of Worcester. In 2011, a tornado ranked F3 (Severe Damage) on the Fujita Scale of Tornado Intensity, blew through the towns of West Springfield, Westfield, Springfield, Monson, Wilbraham, Brimfield, Sturbridge, and Southbridge. The tornado and related storm killed 3 people and resulted in hundreds of injuries across the state.

Probability of Future Events

One measure of tornado activity is the tornado index value. It is calculated based on historical tornado events data using USA.com algorithms. It is an indicator of the tornado level in a region. A higher tornado index value means a higher chance of tornado events. Data was used for Hampden County to determine the Tornado Index Value as shown in the table below.

Tornado Index for Hampden County	
Hampden County	138.23
Massachusetts	87.60
United States	136.45

Source: USA.com, http://www.usa.com/hampden-county-ma-natural-disasters-extremes.htm

Based upon the available historical record, as well as Granville's location in a high-density cluster of state-wide tornado activity, it is reasonable to estimate that there is a low frequency of tornado occurrence in Granville in any given year.

As per the Massachusetts Hazard Mitigation Plan, there are approximately 10 to 30 days of thunderstorm activity in the state each year.

Impact

The potential for locally catastrophic damage is a factor in any severe weather event. In Montgomery, a tornado that hit residential areas would leave much more damage than a tornado with a travel path that ran along the town's forested areas, where little settlement has occurred. Most buildings in town have not been built to Zone 1, Design Wind Speed Codes. The first edition of the Massachusetts State Building Code went into effect on January 1, 1975, with most of the town's housing built before this date.

To approximate the potential impact to property and people that could be affected by severe weather, tornado, or wind, the total value of all property in town, $192,800,680 is used.

An estimated 100 percent of damage would occur to 1 percent of structures, resulting in a total of $1,928,006 worth of damage and 15 people affected. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

Vulnerability

Based on the above assessment, Granville faces a _2_ risk of severe thunderstorms, wind, and tornadoes.

Wildfire / Brushfire

Hazard Description

Wildland fires are typically larger fires, involving full-sized trees as well as meadows and scrublands. Brushfires are uncontrolled fires that occur in meadows and scrublands, but do not involve full-sized trees. Both wildland fires and brushfires can consume homes, other buildings and/or agricultural resources. Typical causes of brushfires and wildfires are lightning strikes, human carelessness, and arson.

FEMA has classifications for 3 different classes of wildland fires:

- Surface fires – the most common type of wildland fire, surface fires burn slowly along the floor of a forest, killing or damaging trees.
- Ground fires burn on or below the forest floor and are usually started by lightening
- Crown fires move quickly by jumping along the tops of trees. A crown fire may spread rapidly, especially under windy conditions.

Location

Hampden County has approximately 273,000 acres of forested land, which accounts for 67% of total land area. In Granville 88 percent of the land is forested, and is therefore at risk of fire. A large wildfire could damage most of the town's land mass in a short period of time. However, Massachusetts receives more than 40 inches of rain per year and much of the landscape is fragmented, and together these two traits make wildfires uncommon in Massachusetts. Nevertheless, in drought conditions, a brushfire or wildfire would be a matter of concern.

Extent

Wildfires can cause widespread damage to the areas that they affect. They can spread very rapidly, depending on local wind speeds and be very difficult to get under control. Fires can last for several hours up to several days.

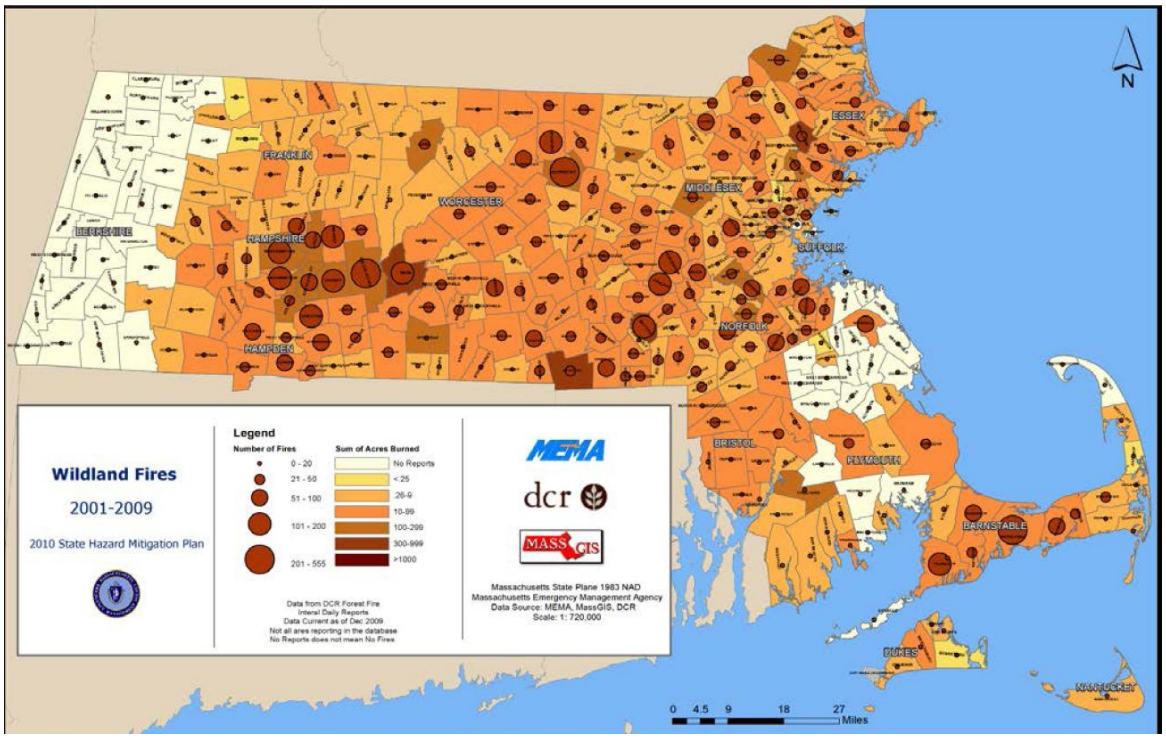
Previous Occurrences

During the past 100 years, there have not been many wildfires occurring in the Pioneer Valley. However, several have occurred during the past 20 years, as shown in the list below:

- 1995 – Russell, 500 acres burned on Mt. Tekoa
- 2000 – South Hadley, 310 acres burned over 14 days in the Litihia Springs Watershed
- 2001 – Ware, 400 acres burned
- 2010 – Russell, 320 acres burned on Mt. Tekoa
- 2012 – Eastern Hampden County, dry conditions and wind gusts created a brush fire in Brimfield, and burned 50 acres

According to the Granville Fire Department, there are 5 unauthorized burns or brushfires in town on an annual basis. As a point of comparison, 149 burn permits were issued in 2012.

Wildland Fires in Massachusetts, 2001-2009



Source: Massachusetts Hazard Mitigation Plan

Probability of Future Events

In accordance with the Massachusetts Hazard Mitigation Plan, the Town Hazard Mitigation Committee found it is difficult to predict the likelihood of wildfires in a probabilistic manner because the number of variables involved. However, given the proximity of previous wildfires, and their proximity to the Town, the likelihood of a future wildfire is determined to be Low.

Climate scenarios project summer temperature increases between 2ºC and 5ºC and precipitation decreases of up to 15 percent. Such conditions would exacerbate summer drought and further promote high-elevation wildfires, releasing stores of carbon and further contributing to the buildup of greenhouse gases. Forest response to increased atmospheric carbon dioxide—the so-called "fertilization effect"—could also contribute to more tree growth and thus more fuel for fires, but the effects of carbon dioxide on mature forests are still largely unknown.

Impact

To approximate the potential impact to property and people that could be affected by this hazard, the total value of all property in town, $192,800,680 is used.

An estimated 100 percent of damage would occur to 1 percent of structures, resulting in a total of $1,928,006 worth of damage and 15 people affected. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

Vulnerability

Based on the above assessment, Granville faces a 4 risk from wildfires.

Earthquakes

Hazard Description

An earthquake is a sudden, rapid shaking of the ground that is caused by the breaking and shifting of rock beneath the Earth's surface. Earthquakes can occur suddenly, without warning, at any time of the year. New England experiences an average of 30 to 40 earthquakes each year although most are not noticed by people.[1] Ground shaking from earthquakes can rupture gas mains and disrupt other utility service, damage buildings, bridges and roads, and trigger other hazardous events such as avalanches, flash floods (dam failure) and fires. Un-reinforced masonry buildings, buildings with foundations that rest on filled land or unconsolidated, unstable soil, and mobile homes not tied to their foundations are at risk during an earthquake.[2]

Location

Because of the regional nature of the hazard, the entire town is equally susceptible to earthquakes.

Extent

The magnitude of an earthquake is measured using the Richter Scale, which measures the energy of an earthquake by determining the size of the greatest vibrations recorded on the seismogram. On this scale, one step up in magnitude (from 5.0 to 6.0, for example) increases the energy more than 30 times. The intensity of an earthquake is measured using the Modified Mercalli Scale. This scale quantifies the effects of an earthquake on the Earth's surface, humans, objects of nature, and man-made structures on a scale of I through XII, with I denoting a weak earthquake and XII denoting a earthquake that causes almost complete destruction.

Richter Scale Magnitudes and Effects	
Magnitude	**Effects**
< 3.5	Generally not felt, but recorded.
3.5 - 5.4	Often felt, but rarely causes damage.
5.4 - 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1 - 6.9	Can be destructive in areas up to about 100 kilometers across where people live.
7.0 - 7.9	Major earthquake. Can cause serious damage over larger areas.
8 or >	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

[1] Northeast States Emergency Consortium Web site: *www.nesec.org/hazards/earthquakes.cfm.*

[2] Federal Emergency Management Agency Web site: *www.fema.gov/hazards/earthquakes/quake.shtm.*

Modified Mercalli Intensity Scale for and Effects			
Scale	**Intensity**	**Description Of Effects**	**Corresponding Richter Scale Magnitude**
I	Instrumental	Detected only on seismographs.	
II	Feeble	Some people feel it.	< 4.2
III	Slight	Felt by people resting; like a truck rumbling by.	
IV	Moderate	Felt by people walking.	
V	Slightly Strong	Sleepers awake; church bells ring.	< 4.8
VI	Strong	Trees sway; suspended objects swing, objects fall off shelves.	< 5.4
VII	Very Strong	Mild alarm; walls crack; plaster falls.	< 6.1
VIII	Destructive	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged.	
IX	Ruinous	Some houses collapse; ground cracks; pipes break open.	< 6.9
X	Disastrous	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread.	< 7.3
XI	Very Disastrous	Most buildings and bridges collapse; roads, railways, pipes and cables destroyed; general triggering of other hazards.	< 8.1
XII	Catastrophic	Total destruction; trees fall; ground rises and falls in waves.	> 8.1

Source: US Federal Emergency Management Agency

Previous Occurrences

The most recent earthquakes to affect New England are shown in the table below.

New England Earthquakes with a Magnitude of 4.2 or more, 1924 – 2012		
Location	**Date**	**Magnitude**
Ossipee, NH	December 20, 1940	5.5
Ossipee, NH	December 24, 1940	5.5
Dover-Foxcroft, ME	December 28, 1947	4.5
Kingston, RI	June 10, 1951	4.6
Portland, ME	April 26, 1957	4.7
Middlebury, VT	April 10, 1962	4.2
Near NH Quebec Border, NH	June 15, 1973	4.8
West of Laconia, NH	Jan. 19, 1982	4.5
Plattsburg, NY	April 20, 2002	5.1
Bar Harbor, NH	October 3, 2006	4.2
Hollis Center, ME	October 16, 2012	4.6

Source: Northeast States Emergency Consortium website, www.nesec.org/hazards/earthquakes.cfm

New England States Record of Historic Earthquakes		
State	**Years of Record**	**Number Of Earthquakes**
Connecticut	1668 - 2007	137
Maine	1766 - 2007	544
Massachusetts	1668 - 2007	355
New Hampshire	1638 - 2007	360
Rhode Island	1776 - 2007	38
Vermont	1843 - 2007	73
New York	1840 - 2007	755
Total Number of Earthquakes within the New England states between 1638 and 1989 is 2262.		

Source: Northeast States Emergency Consortium website, *www.nesec.org/hazards/earthquakes.cfm*

Probability of Future Events

One measure of earthquake activity is the Earthquake Index Value. It is calculated based on historical earthquake events data using USA.com algorithms. It is an indicator of the earthquake activity level in a region. A higher earthquake index value means a higher chance of earthquake events. Data was used for Hampden County to determine the Earthquake Index Value as shown in the table below.

Earthquake Index for Hampden County	
Hampden County	0.24
Massachusetts	0.70
United States	1.81

Based upon existing records, there is a low frequency of earthquakes in Granville with between a 1 percent and 2 percent chance of an earthquake occurring in any given year.

Impact

Massachusetts introduced earthquake design requirements into their building code in 1975 and improved building code for seismic reasons in the 1980s. However, these specifications apply only to new buildings or to extensively-modified existing buildings. Buildings, bridges, water supply lines, electrical power lines and facilities built before the 1980s may not have been designed to withstand the forces of an earthquake. The seismic standards have also been upgraded with the 1997 revision of the State Building Code.

To approximate the potential impact to property and people that could be affected by this hazard, the total value of all property in town, $192,800,680 is used.

An estimated 100 percent of damage would occur to 1 percent of structures, resulting in a total of , $1,928,006 worth of damage and 15 people affected. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

Vulnerability

Based on the above analysis, Granville faces a _5_ risk from earthquakes.

Dam Failure

Hazard Description

Dams and their associated impoundments provide many benefits to a community, such as water supply, recreation, hydroelectric power generation, and flood control. However, they also pose a potential risk to lives and property. Dam failure is not a common occurrence, but dams do represent a potentially disastrous hazard. When a dam fails, the potential energy of the stored water behind the dam is released rapidly. Most dam failures occur when floodwaters above overtop and erode the material components of the dam. Often dam breaches lead to catastrophic consequences as the water rushes in a torrent downstream flooding an area engineers refer to as an "inundation area." The number of casualties and the amount of property damage will depend upon the timing of the warning provided to downstream residents, the number of people living or working in the inundation area, and the number of structures in the inundation area.

Many dams in Massachusetts were built during the 19th Century without the benefit of modern engineering design and construction oversight. Dams of this age can fail because of structural problems due to age and/or lack of proper maintenance, as well as from structural damage caused by an earthquake or flooding.

The Massachusetts Department of Conservation and Recreation Office of Dam Safety is the agency responsible for regulating dams in the state (M.G.L. Chapter 253, Section 44 and the implementing regulations 302 CMR 10.00). To be regulated, these dams are in excess of 6 feet in height (regardless of storage capacity) and have more than 15 acre feet of storage capacity (regardless of height). Dam safety regulations enacted in 2005 transferred significant responsibilities for dams from the State of Massachusetts to dam owners, including the responsibility to conduct dam inspections.

Location

The Massachusetts Emergency Management Agency (MEMA) identifies 18 dams in Granville.

Dams in Granville	
Dam	**Hazard Level**
Borden Brook Reservoir	High
Cobble Mountain Reservoir	High
Phelon Pond	Low
Lower Arnold Pond	NA
Wells Mills	NA
Strong Pond	NA
Granville Reservoir	High
Winchell Reservoir	Significant
Japhet Reservoir	NA
Don Noble Pond	NA
E.A. Jensen Pond	NA
Degano Pond	Low
Dickinson Pond	Low
Woodger Pond	NA
Noble and Cooley Drum Shop Pond	NA
Cooley Lake	Significant
Granville S.F.	NA
Bahre Pond	Low

Source: MassGIS

Extent

Often dam breaches lead to catastrophic consequences as the water ultimately rushes in a torrent downstream flooding an area engineers refer to as an "inundation area." The number of casualties and the amount of property damage will depend upon the timing of the warning provided to downstream residents, the number of people living or working in the inundation area, and the number of structures in the inundation area.

Dams in Massachusetts are assessed according to their risk to life and property. The state has three hazard classifications for dams:

- *High Hazard*: Dams located where failure or improper operation will likely cause loss of life and serious damage to homes, industrial or commercial facilities, important public utilities, main highways, or railroads.

- *Significant Hazard*: Dams located where failure or improper operation may cause loss of life and damage to homes, industrial or commercial facilities, secondary highways or railroads or cause interruption of use or service of relatively important facilities.

- *Low Hazard*: Dams located where failure or improper operation may cause minimal property damage to others. Loss of life is not expected.

Previous Occurrences

To date, there have been no dam failures in Granville. However, during Hurricane Irene, the spillway at the Granville Reservoir did fail. It was empty for two years and repairs have recently been completed.

Probability of Future Events

As Granville's dams age, and if maintenance is deferred, the likelihood of a dam failure will increase, but, currently the frequency of dam failures is very low with a less than 1 percent chance of a dam failing in any given year.

As described in the Massachusetts Hazard Mitigation Plan, dams are designed partly based on assumptions about a river's flow behavior, expressed as hydrographs. Changes in weather patterns can have significant effects on the hydrograph used for the design of a dam. If the hygrograph changes, it is conceivable that the dam can lose some or all of its designed margin of safety, also known as freeboard. If freeboard is reduced, dam operators may be forced to release increased volumes earlier in a storm cycle in order to maintain the required margins of safety. Such early releases of increased volumes can increase flood potential downstream. Throughout the west, communities downstream of dams are already increases in stream flows from earlier releases from dams. Dams are constructed with safety features known as "spillways." Spillways are put in place on dams as a safety measure in the event of the reservoir filling too quickly. Spillway overflow events, often referred to as "design failures," result in increased discharges downstream and increased flooding potential. Although climate change will not increase the probability of catastrophic dam failure, it may increase the probability of design failures.

Impact

To approximate the potential impact to property and people that could be affected by this hazard, the total value of all property in town, $192,800,680 is used.

An estimated 100 percent of damage would occur to 20 percent of structures, resulting in a total of $ 3,856,600 worth of damage and 30 people affected. The cost of repairing or replacing the roads, bridges, utilities, and contents of structures is not included in this estimate.

It is the communities below Granville that may be at risk if the dams in Granville fail. The communities of Westfield and Southwick are vulnerable. The EMD from Granville is in regular communication with EMDs in Westfield and Southwick.

Vulnerability

Based on this analysis, Granville faces a 4 risk from dam failure.

Drought

Drought is a normal, recurrent feature of climate. It occurs almost everywhere, although its features vary from region to region. In the most general sense, drought originates from a deficiency of precipitation over an extended period of time, resulting in a water shortage for some activity, group, or environmental sector. Reduced crop, rangeland, and forest productivity; increased fire hazard; reduced water levels; increased livestock and wildlife mortality rates; and damage to wildlife and fish habitat are a few examples of the direct impacts of drought. Of course, these impacts can have far-reaching effects throughout the region and even the country.

Location

Because of this hazard's regional nature, a drought would impact the entire town.

Extent

The severity of a drought would determine the scale of the event and would vary among town residents depending on whether the residents' water supply is derived from a private well or the public water system. Granville has a small section of the community served by a water system and the majority of residents have private wells.

The U.S. Drought Monitor also records information on historical drought occurrence. Unfortunately, data could only be found at the state level. The U.S. Drought Monitor categorizes drought on a D0-D4 scale as shown below.

U.S. Drought Monitor		
Classification	**Category**	**Description**
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered
D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested
D2	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed
D3	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies

Source: US Drought Monitor, http://droughtmonitor.unl.edu/classify.htm

Previous Occurrences

In Massachusetts, six major droughts have occurred statewide since 1930[3]. They range in severity and length, from three to eight years. In many of these droughts, water-supply systems were found to be inadequate. Water was piped in to urban areas, and water-supply systems were modified to permit withdrawals at lower water levels. The following table indicates previous occurrences of drought since 2000, based on the US Drought Monitor:

Annual Drought Status	
Year	**Maximum Severity**
2000	No drought
2001	D2 conditions in 21% of the state
2002	D2 conditions in 99% of the state
2003	No drought
2004	D0 conditions in 44% of the state
2005	D1 conditions in 7% of the state
2006	D0 conditions in 98% of the state
2007	D1 conditions in 71% of the state
2008	D0 conditions in 57% of the state
2009	D0 conditions in 44% of the state
2010	D1 conditions in 27% of the state
2011	D0 conditions in 0.01% of the state
2012	D2 conditions in 51% of the state

Source: US Drought Monitor

Probability of Future Events

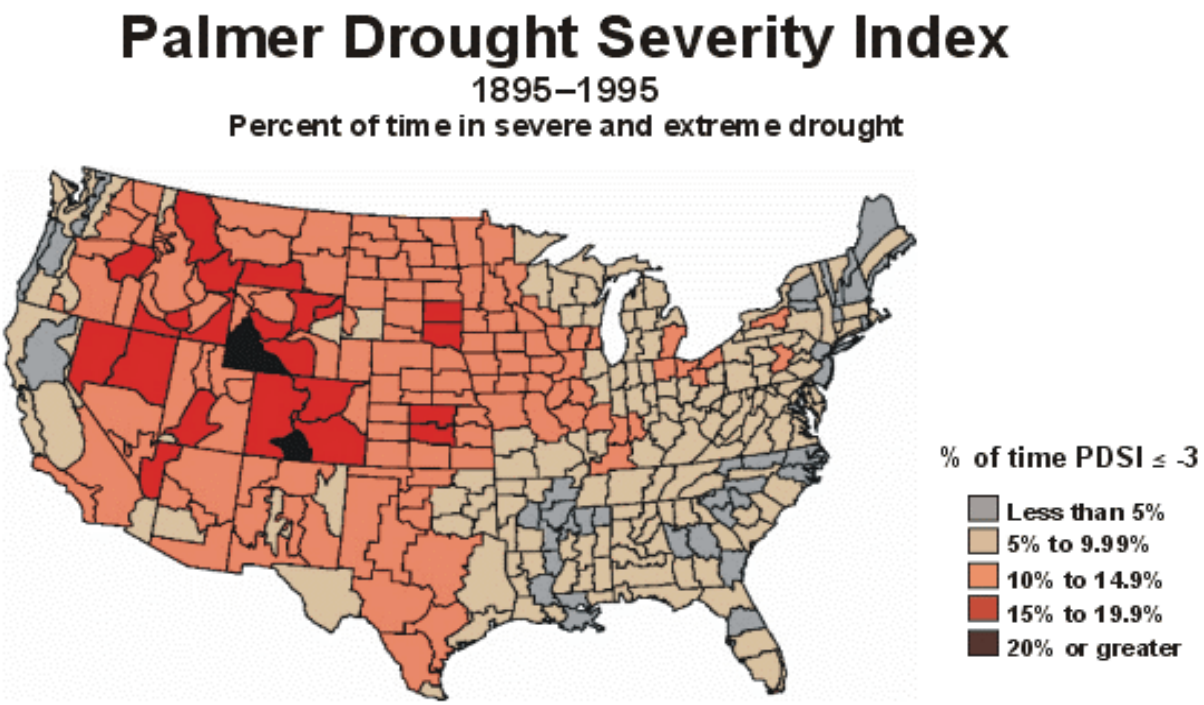
In Granville, as in the rest of the state, drought occurs at a rate of between 1 percent and 10 percent in a single given year.

Based on past events and current criteria outlined in the Massachusetts Drought Management Plan, it appears that western Massachusetts may be more vulnerable than eastern Massachusetts to severe drought conditions. However, many factors, such as water supply sources, population, economic factors (i.e., agriculture based economy), and infrastructure, may affect the severity and length of a drought event. When evaluating the region's risk for drought on a national level, utilizing a measure called the Palmer Drought Severity Index, Massachusetts is historically in the lowest percentile for severity and risk of drought.[4] However, global warming and climate change may have an effect on drought risk in the

[3] US Geological Survey Water-Supply Paper 2375. "National Water Summary 1989 – Floods and Droughts: Massachusetts." Prepared by S. William Wandle, Jr., US Geological Survey.

[4] National Drought Mitigation Center – http://drought.unl.edu

region. With the projected temperature increases, some scientists think that the global hydrological cycle will also intensify. This would cause, among other effects, the potential for more severe, longer-lasting droughts.



Impact

Due to the water richness of Western Massachusetts, Granville is unlikely to be adversely affected by anything other than a major, extended drought. While such a drought would require water saving measures to be implemented, there would be no foreseeable damage to structures or loss of life resulting from the hazard.

Vulnerability

Based on the above assessment, there is a 5 risk of drought.

Other Hazards

In addition to the hazards identified above, the Hazard Mitigation Team reviewed the full list of hazards listed in the Massachusetts Hazard Mitigation Plan. Due to the location and context of the Town, coastal erosion, landslides, and tsunamis, were determined to not be a threat.

4: CRITICAL FACILITIES

Facility Classification

A Critical Facility is defined as a building, structure, or location which:

- Is vital to the hazard response effort
- Maintains an existing level of protection from hazards for community residents and property
- Would create a secondary disaster if a hazard were to impact it

The Critical Facilities List for the Town of Granville has been identified utilizing a Critical Facilities List provided by the State Hazard Mitigation Officer. Granville's Hazard Mitigation Committee has broken up this list of facilities into four categories:

- Facilities needed for emergency response in the event of a hazard event.

- Facilities identified as non-essential and not required in an emergency response event, but which are considered essential for the everyday operation of the Town.

- Facilities or institutions that include special populations which would need additional attention in the event of a hazard event.

The critical facilities and evacuation routes potentially affected by hazard areas are identified following this list. The Past and Potential Hazards/Critical Facilities Map (Appendix D) also identifies these facilities.

Category 1 – Emergency Response Facilities

The Town has identified the emergency response facilities as the highest priority in regards to protection from natural hazards:

Emergency Operations Center	707 Main Road
Center Fire Station	707 Main Road
West Granville Fire Station	1578 Main Road
Police Station	707 Main Road
Department of Public Works	69 Old Westfield Road
Water Department	89 Blandford Road
Fuel Stations	Granville Country Store - 11 Granby Road
Facilities with Backup Power	707 Main Road 69 Old Westfield Road
Emergency Shelters	707 Main Road (Town Hall) 409 Main Road (Granville Village School)
Helicopter Landing Sites (Lifeflight-Lifestar preapproved)	
Communications	504 Main Road (Verizon Telephone Switch) Cell Tower/Public Service Communications - Sodom Mountain Cell Tower – 450 Blandford Road Cell Tower – 172 North Lane
Hospitals	Noble Hospital (Westfield, MA)
Primary Evacuation Routes	Main Road (RT57) Granby Road (RT189) Old Westfield Road

Culverts Located on Evacuation Route	Main Road Route 57 – Pond, Potash, Valley, Ellis, Shurtleff, and Dickenson Brook Granby Road (RT189) – Trumble, Dickenson, and East Branch of Salmon Brook Old Westfield Road – Holliston, Tillotson, and Japhet Brook

Category 2 – Non-Emergency Response Facilities

The Town has identified these facilities as non-emergency facilities; however, they are considered essential for the everyday operation of Granville.

Water Supply

~~Drinking Water Treatment Plants~~

~~Water Storage~~

~~Waste Water Treatment Plants~~

Critical Culverts (roads with stream crossings)

- West Hartland Road – Halfway Brook, Hubbard River
- Hartland Hollow Road – Hubbard River
- Borden Brook Road – Borden Brook
- Barnard Road – Trumble Brook
- South Lane – Trumble Brook
- Trumble Lane – Trumble Brook
- Water Street – Seymour Brook

Category 3 – Facilities / Institutions with Special Populations

The Town has identified these facilities as the location of populations who may need special attention during a hazard event.

~~Special Needs Population~~

~~Elderly Housing/Assisted Living~~

Public Buildings/Areas

Schools - Granville Village School – 409 Main Road

Library – Granville Public Library - 2 Granby Road

Places of Worship – Granville Federated Church - 16 Granby Road

US Post Office – 467 Main Road

~~Apartment Complexes (5 units or more)~~

~~Major Employers (Industrial Parks, Factories, etc.)~~

Campgrounds -- private- Prospect Mountain Campground - 1360 Main Road
- public--Granville State Forest - West Hartland Road

Critical Facilities and Evacuation Routes Potentially Affected by Hazard Areas			
Hazard Type	**Hazard Area**	**Critical Facilities Affected**	**Evacuation Routes Affected**
Flooding	Ellis Brook, Trumble Brook, Dickenson Brook, Hollister Brook, Tillotson Brook	DPW Garage; Village School Emergency Shelter; Granville Country Store; Verizon Telephone Switch	Main Road (RT57) Granby Road (RT189) Old Westfield Road
Severe Snowstorms / Ice Storms	Entire Town	Emergency Operations Center; Fire Stations; Police Station; Emergency shelters; DPW Garage; Town Hall	Main Road (RT57) Granby Road (RT189) Old Westfield Road
Severe Thunderstorms / wind / tornadoes	Entire Town	Site Specific	Site Specific
Hurricanes	Ellis Brook, Trumble Brook, Dickenson Brook, Hollister Brook, Tillotson Brook	DPW Garage; Village School Emergency Shelter; Granville Country Store; Verizon Telephone Switch	Main Road (RT57) Granby Road (RT189) Old Westfield Road.
Wildfire/Brushfire	Entire Town	Site Specific	Site Specific
Earthquakes	Entire Town	Emergency Operations Center; Fire Stations; Police Station; Emergency shelters; DPW Garage; Town Hall	Main Road (RT57) Granby Road (RT189) Old Westfield Road
Dam Failure	Varies depending on structure	Site Specific	Main Road (RT57) Old Westfield Road
Drought	Entire Town	Fire fighting operations Town Services Water Supply	None

(Past & Potential Hazards/Critical Facilities Map Located In Appendix D)

5: EXISTING MITIGATION STRATEGIES

Informed by the hazard identification process and the list of critical facilities that would be affected by hazards, the Town of Granville Hazard Mitigation Committee has determined a set of hazard mitigation strategies. This chapter discusses existing mitigation strategies for the Town of Wilbraham. It also provides a prioritized list of mitigation strategies that the Town should undertake, as well as an explanation of the methodology used to determine this list.

The Town of Granville has developed the following goal to serve as a framework for mitigation of the hazards identified in this plan.

Goal Statement

To minimize the loss of life, damage to property, and the disruption of governmental services and general business activities due to the following hazards: flooding, severe snowstorms/ice storms, severe thunderstorms, hurricanes, tornadoes, wildfires/brushfires, earthquakes, dam failures, and drought.

For the extent of this analysis, the Committee reviewed the following Town documents:

- Zoning By-Laws
- Subdivision Rules and Regulations
- Comprehensive Emergency Management Plan
- Town Open Space and Recreation Plan

Existing Strategies

The Hazard Mitigation Committee has identified the following mitigation strategies that were in place prior to the development of this Hazard Mitigation Plan.

Strategy	Action Type	Description	Hazards Mitigated	Effectiveness
Reduction of frontage required for open space preservation.	Zoning Bylaws	Allow for single-family lots that have less required frontage, in exchange for preserving open space. (Zoning Code 3.9)	Flooding	
Adequate drainage for driveways	Zoning Bylaws	Driveways must be constructed with grade, length, and location that provides adequate drainage and culverts where necessary (Zoning Code 3.9.2.k)	Flooding	
Fire and drainage requirements for Commercial Recreation Areas	Zoning Bylaws	Commercial Recreation Areas can only be approved if they present no hazard from fire, sanitary and drainage conditions, and will not load storm drainage pipes beyond reasonable capacity (Zoning Code 4.1.2)	Flooding Wildfire	
Floodplain Overlay Districts	Zoning Bylaws	Overlay district protect areas delineated as part of the 100-year floodplain by regulating uses and special permit requirements (Zoning Code 4.3)	Flooding	
Restrictions on locations of mobile homes	Zoning Bylaws	Use of a trailer or a mobile home as a dwelling for a period of two years is prohibited except by special authorization. (Zoning Bylaw, Section 3.3 Uses Permitted on Special Authorization)	Severe thunderstorms / wind / tornadoes / hurricanes /	

Strategy	Action Type	Description	Hazards Mitigated	Effectiveness
Special Permit	Zoning Bylaws	Some uses require special permit approval, and must meet environmental standards, such as not creating increased flood hazards, water pollution, erosion, or sedimentation. (Zoning Bylaw 3.3 Uses Permitted on Special Authorization)	Floods	
Conformance with State Building Code	State Regulation	Adoption of the Massachusetts State Building Code, which promotes construction of buildings that can withstand hazards to a certain degree.	All hazards	
Wetlands Protection Regulations	State Regulation	Require all new development to conform to regulations set forth in Wetlands Protection Act	Flooding	
Dam inspections	State Regulation	DCR requires property owners to inspect dams based on the hazard rating of the dam (low, medium, high hazard).	Dam failure	
Conformance with National Flood Insurance Program	Federal regulation	Continue to comply with NFIP program by maintaining Floodplain Overlay District and limiting development in 100-year floodplain	Flooding	
Burn permits	Municipal Operations	Residents must obtain burn permits from town and Fire Department is notified of days on which burns will occur.	Wildfire / brushfire	

New Strategies

Based on the hazard identification and risk assessment, list of critical facilities that would be affected by hazards, and evaluation of the effectiveness of current mitigation strategies, the Hazard Mitigation Committee identified several new strategies to pursue.

Strategy Prioritization Methodology

The Hazard Mitigation Planning Committee reviewed and prioritized a list of new mitigation strategies using the following criteria:

Application to multiple hazards – Strategies are given a higher priority if they assist in the mitigation of several natural hazards.

Time required for completion – Projects that are faster to implement, either due to the nature of the permitting process or other regulatory procedures, or because of the time it takes to secure funding, are given higher priority.

Estimated benefit – Strategies which would provide the highest degree of reduction in loss of property and life are given a higher priority. This estimate is based on the Hazard Identification and Analysis Chapter, particularly with regard to how much of each hazard's impact would be mitigated.

Cost effectiveness – in order to maximize the effect of mitigation efforts using limited funds, priority is given to low-cost strategies. For example, regular tree maintenance is a relatively low-cost operational strategy that can significantly reduce the length of time of power outages during a winter storm. Strategies that have identified potential funding streams, such as the Hazard Mitigation Grant Program, are also given higher priority.

The following categories are used to define the priority of each mitigation strategy:

- **Low** – Strategies that would not have a significant benefit to property or people, address only one or two hazards, or would require funding and time resources that are impractical
- **Medium** – Strategies that would have some benefit to people and property and are somewhat cost effective at reducing damage to property and people
- **High** – Strategies that provide mitigation of several hazards and have a large benefit that warrants their cost and time to complete

- **Very High** – extremely beneficial projects that will greatly contribute to mitigation of multiple hazards and the protection of people and property. These projects are also given a numeric ranking within the category.

Cost Estimates

Each of the following implementation strategies is provided with a cost estimate. Projects that already have secured funding are noted as such. Where precise financial estimates are not currently available, categories were used with the following assigned dollar ranges:

- **Low** – cost less than $50,000
- **Medium** – cost between $50,000 – $100,000
- **High** – cost over $100,000

Cost estimates take into account the following resources:

- Town staff time for grant application and administration (at a rate of $25 per hour)
- Consultant design and construction cost (based on estimates for projects obtained from town and general knowledge of previous work in town)
- Town staff time for construction, maintenance, and operation activities (at a rate of $25 per hour)

Project Timeline

Each strategy is provided with an estimated length of time it will take for implementation. Where funding has been secured for the project, a specific future date is provided for when completion will occur. However, some projects do not currently have funding and thus it is difficult to know exactly when they will be completed. For these projects, an estimate is provided for the amount of time it will take to complete the project once funding becomes available.

New Mitigation Strategies Prioritized									
Status	**Action Name**	**Action Type**	**Description**	**Hazards Mitigated**	**Responsible Agency**	**Priority**	**Cost**	**Funding Source**	**Timeframe**
New	Evaluation of bridges and culverts	Town operations	Evaluate all bridges and culverts situated along Evacuation Routes – Main Road (Route 57), Granby Road (Route 189), and Old Westfield Road	Flood	DPW	High	Low	DPW	3 years
New	Culvert Replacement	Capital construction	Replacement of the culvert at Pond Brook crossing of Main Road (Route 57)	Flood	DPW	High	Medium	DPW HMPG funding	5 years
New	Culvert Replacement	Capital construction	Replacement of the culvert at Potash Brook crossing of Main Road (Route 57)	Flood	DPW	High	Medium	DPW HMPG funding	5 years
New	Emergency Shelter Generator Acquisition	Town operations	Procure and install a Generator to power Emergency Shelter at Granville Village School	All hazards	EMD	High	Medium	EMD	4 years
New	Training of volunteers and first responders	Town operations	Recruit residents to serve as volunteer emergency personnel and first responders	All hazards	Fire Department, EMD	High	Low	Town	4 years
New	Brush Truck replacement	Town operations	Replacement of existing fire 4X4 Brush Truck equipment	Wildfire / brushfire	Fire Department	High	Medium	Fire Department	3 years

New Mitigation Strategies Prioritized									
Status	**Action Name**	**Action Type**	**Description**	**Hazards Mitigated**	**Responsible Agency**	**Priority**	**Cost**	**Funding Source**	**Timeframe**
New	Dam Emergency Action Plan	Town operations	Develop an Emergency Action Plan for High Risk Dams in Coordination with downstream Communities of Southwick and Westfield.	Dam failure	DPW, EMD Fire Department	Medium	Low	EMD	2 years
New	Drainage improvements	Capital construction	Implement improvements for all previously-identified flooding problem areas	Flooding	DPW	Medium	High	DPW HMPG funding	5 years
New	Education for homeowners in floodplain	Education and Outreach	All residents with homes located within the FEMA 100-year floodplain will be notified in the Tolland Tattler newsletter of the requirement to purchase flood insurance	Flooding	Council on Aging	Medium	Low	COA	2 years

6: PLAN REVIEW, EVALUATION, IMPLEMENTATION, AND ADOPTION

Plan Adoption

Upon completion of the draft Hazard Mitigation Plan, a public meeting was held by the town staff and the Pioneer Valley Planning Commission to present and request comments from town officials and residents. The Hazard Mitigation Plan was then submitted to the Massachusetts Emergency Management Agency (MEMA) and the Federal Emergency Management Agency for their review. Upon receiving conditional approval of the plan by FEMA, the plan was presented to the Town's Select Board and adopted.

Plan Implementation

The implementation of this plan began upon its formal adoption by the Town Select Board and approval by MEMA and FEMA. Those town departments and boards responsible for ensuring the development of policies, bylaw revisions, and programs as described in Sections 5 and 6 of this plan will be notified of their responsibilities immediately following approval. The Town's Hazard Mitigation Committee will oversee the implementation of the plan.

Plan Monitoring and Evaluation

The Town's Emergency Management Director will call meetings of all responsible parties to review plan progress an annual basis in each of the following years: 2014, 2015, 2016, 2017, 2018 and as needed (*i.e.*, following a natural disaster). The public will be notified of these meetings in advance through a posting of the agenda at Town Hall. Responsible parties identified for specific mitigation actions will be asked to submit their reports in advance of the meeting. Meetings will entail the following actions:

- Review events of the year to discuss and evaluate major issues, effectiveness of current mitigation, and possible mitigation for future events.
- Assess how the mitigation strategies of the plan can be integrated with other Town plans and operational procedures, including the Zoning Bylaw and Emergency Management Plan.
- Review and evaluate progress toward implementation of the current mitigation plan based on reports from responsible parties.
- Amend current plan to improve mitigation practices.

Following these discussions, it is anticipated that the committee may decide to reassign the roles and responsibilities for implementing mitigation strategies to different town departments and/or revise the goals and objectives contained in the plan. The committee will review and update the Hazard Mitigation Plan every five years. The next updated plan will be submitted to MEMA and FEMA in the spring of 2018.

7: APPENDICES

Appendix A – Technical Resources

1) Agencies

Massachusetts Emergency Management Agency (MEMA)……..508/820-2000
Hazard Mitigation Section 617/626-1356
Federal Emergency Management Agency (FEMA) 617/223-4175
MA Regional Planning Commissions:
Berkshire Regional Planning Commission (BRPC)……..413/442-1521
Cape Cod Commission (CCC)……..508/362-3828
Central Massachusetts Regional Planning Commission (CMRPC)…….. 508/693-3453
Franklin Regional Council of Governments (FRCOG)……..413/774-3167
Martha's Vineyard Commission (MVC)……508/693-3453
Merrimack Valley Planning Commission (MVPC)……..978/374-0519
Metropolitan Area Planning Council (MAPC)……..617/451-2770
Montachusett Regional Planning Commission (MRPC)……978/345-7376
Nantucket Planning and Economic Development Commission (NP&EDC)……..508/228-7236
Northern Middlesex Council of Governments (NMCOG)……978/454-8021
Old Colony Planning Council (OCPC)……508/583-1833
Pioneer Valley Planning Commission (PVPC)……..413/781-6045
Southeastern Regional Planning and Economic Development District (SRPED……508/823-1803
MA Board of Building Regulations & Standards (BBRS)……617/227-1754
MA Coastal Zone Management (CZM)……..617/626-1200
DCR Water Supply Protection……617/626-1379
DCR Waterways……617/626-1371
DCR Office of Dam Safety……..508/792-7716
DFW Riverways……617/626-1540
MA Dept. of Housing & Community Development……..617/573-1100
Woods Hole Oceanographic Institute……508/457-2180
UMass-Amherst Cooperative Extension……413/545-4800
National Fire Protection Association (NFPA)……..617/770-3000
New England Disaster Recovery Information X-Change (NEDRIX – an association of private companies & industries involved in disaster recovery planning)……781/485-0279
MA Board of Library Commissioners……..617/725-1860
MA Highway Dept, District 2……413/582-0599
MA Division of Marine Fisheries……617/626-1520
MA Division of Capital & Asset Management (DCAM)……617/727-4050
University of Massachusetts/Amherst……..413/545-0111
Natural Resources Conservation Services (NRCS)……413/253-4350
MA Historical Commission……..617/727-8470

U.S. Army Corps of Engineers……978/318-8502
Northeast States Emergency Consortium, Inc. (NESEC).....781/224-9876
National Oceanic and Atmospheric Administration: National Weather Service……508/824-5116
US Department of the Interior: US Fish and Wildlife Service 413/253-8200
US Geological Survey.....508/490-5000

2) Mitigation Funding Resources

404 Hazard Mitigation Grant Program (HMGP) ……..MA Emergency Management Agency
406 Public Assistance and Hazard Mitigation .....MA Emergency Management Agency
Community Development Block Grant (CDBG)……DHCD, also refer to RPC
Dam Safety Program.....MA Division of Conservation and Recreation
Disaster Preparedness Improvement Grant (DPIG) ……MA Emergency Management Agency
Emergency Generators Program by NESEC‡ .....MA Emergency Management Agency
Emergency Watershed Protection (EWP) Program.....USDA, Natural Resources Conservation
Service Flood Mitigation Assistance Program (FMAP)……..MA Emergency Management Agency
Flood Plain Management Services (FPMS).....US Army Corps of Engineers
Mitigation Assistance Planning (MAP).....MA Emergency Management Agency
Mutual Aid for Public Works.....Western Massachusetts Regional Homeland Security Advisory Council
National Flood Insurance Program (NFIP) † ……..MA Emergency Management Agency
Power of Prevention Grant by NESEC‡ .....MA Emergency Management Agency
Roadway Repair & Maintenance Program(s).....Massachusetts Highway Department
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……MA Department of Conservation and Recreation
Various Forest and Lands Program(s).....MA Department of Environmental Protection
Wetlands Programs .....MA Department of Environmental Protection

‡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 NESEC 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. MEMA can provide additional information regarding participation in the NFIP-CRS Program.

3) Internet Resources

Sponsor	Internet Address	Summary of Contents
Natural Hazards Research Center, U. of Colorado	http://www.colorado.edu/litbase/hazards/	Searchable database of references and links to many disaster-related websites.
Atlantic Hurricane Tracking Data by Year	http://wxp.eas.purdue.edu/hurricane	Hurricane track maps for each year, 1886 – 1996
National Emergency Management Association	http://nemaweb.org	Association of state emergency management directors; list of mitigation projects.
NASA – Goddard Space Flight Center "Disaster Finder:	http://www.gsfc.nasa.gov/ndrd/dis aster/	Searchable database of sites that encompass a wide range of natural disasters.
NASA Natural Disaster Reference Database	http://ltpwww.gsfc.nasa.gov/ndrd/main/html	Searchable database of worldwide natural disasters.
U.S. State & Local Gateway	http://www.statelocal.gov/	General information through the federal-state partnership.
National Weather Service	http://nws.noaa.gov/	Central page for National Weather Warnings, updated every 60 seconds.
USGS Real Time Hydrologic Data	http://h20.usgs.gov/public/realtime.html	Provisional hydrological data
Dartmouth Flood Observatory	http://www.dartmouth.edu/artsci/g eog/floods/	Observations of flooding situations.
FEMA, National Flood Insurance Program, Community Status Book	http://www.fema.gov/fema/csb.html	Searchable site for access of Community Status Books
Florida State University	http://www.met.fsu.edu/explores/tropical.html	Tracking and NWS

Sponsor	Internet Address	Summary of Contents
Atlantic Hurricane Site		warnings for Atlantic Hurricanes and other links
The Tornado Project Online	http://www.tornadoroject.com/	Information on tornadoes, including details of recent impacts.
National Severe Storms Laboratory	http://www.nssl.uoknor.edu/	Information about and tracking of severe storms.
Independent Insurance Agents of America IIAA Natural Disaster Risk Map	http://www.iiaa.iix.com/ndcmap.html	A multi-disaster risk map.
Earth Satellite Corporation	http://www.earthsat.com/	Flood risk maps searchable by state.
USDA Forest Service Web	http://www.fs.fed.us/land	Information on forest fires and land management.

Appendix B – Documentation of the Planning Process

Appendix C – List of Acronyms

FEMA	Federal Emergency Management Agency
MEMA	Massachusetts Emergency Management Agency
PVPC	Pioneer Valley Planning Commission
EPA	Environmental Protection Agency
DEP	Massachusetts' Department of Environmental Protection
NWS	National Weather Service
HMGP	Hazard Mitigation Grant Program
FMA	Flood Mitigation Assistance Program
SFHA	Special Flood Hazard Area
CIS	Community Information System
DCR	Massachusetts Department of Conservation and Recreation
FERC	Federal Energy Regulatory Commission
TRI	Toxics Release Inventory
FIRM	Flood Insurance Rate Map
NFIP	National Flood Insurance Program
CRS	Community Rating System
BOS	Board of Selectmen
DPW	Department of Public Works
LEPC	Local Emergency Planning Committee
EMD	Emergency Management Director
Con Com	Conservation Commission
Ag Com	Agricultural Commission
EOC	Emergency Operations Center
CEM Plan	Comprehensive Emergency Management Plan
EMA	Emergency Management Agency
RACES	Radio Amateur Civil Emergency Service
WMECO	Western Massachusetts Electric Company
HAZMAT	Hazardous Materials

Appendix D – Past and Potential Hazards/Critical Facilities Map

Appendix E – Photos

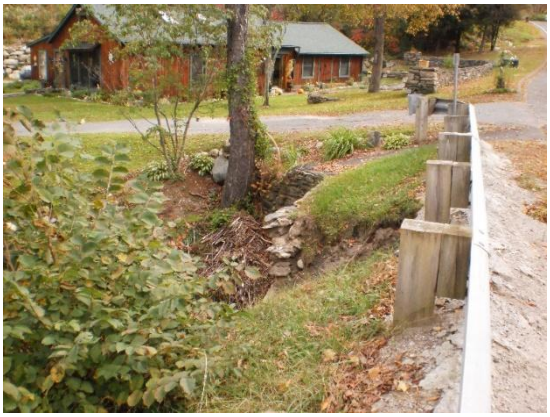
Photos

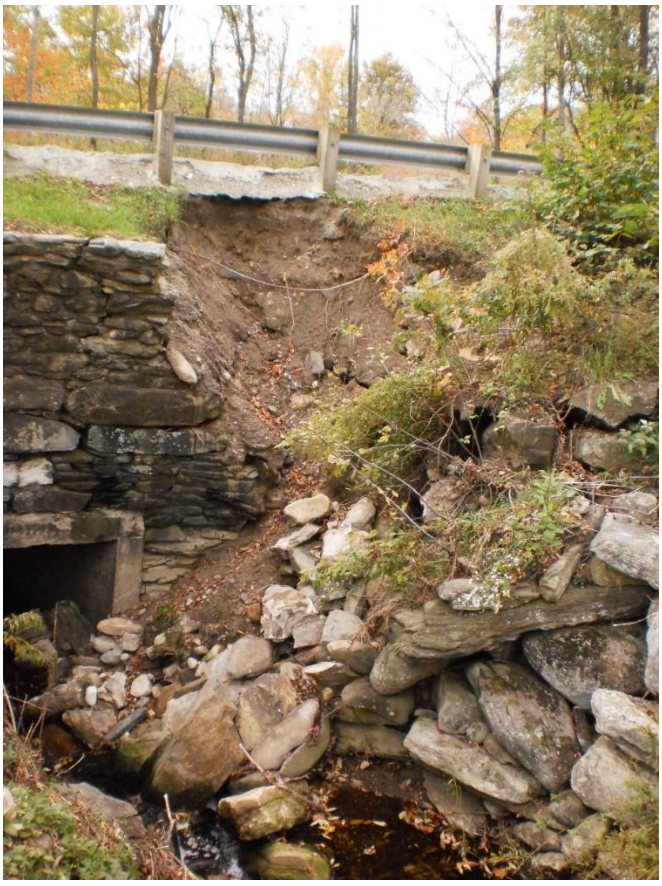
Potash Brook (Inlet)

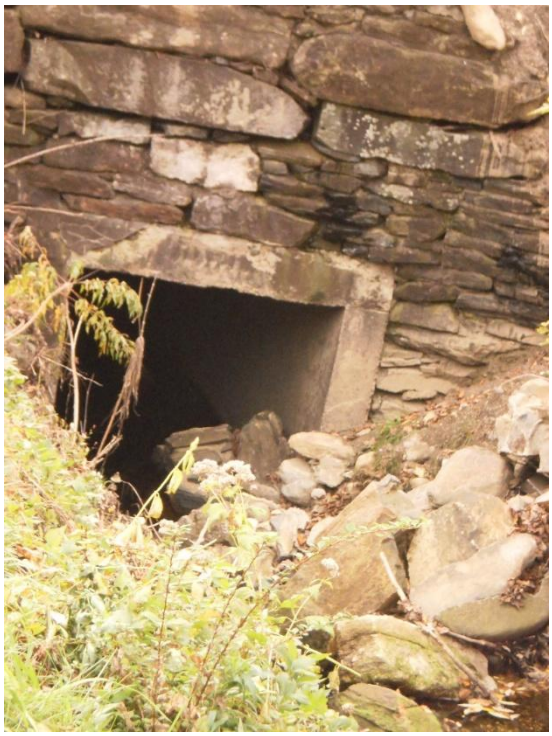
Potash Brook (Outlet)

Present Conditions: Snow is blocking guardrail, but the bend has worsened since the pictures (left) were taken a couple of years ago.

Pond Brook







<COMMUNITY LETTERHEAD>

CERTIFICATE OF ADOPTION

Town of Granville, MASSACHUSETTS

BOARD OF SELECTMEN

A RESOLUTION ADOPTING THE TOWN OF GRANVILLE HAZARD MITIGATION PLAN

WHEREAS, the Town of Granville established a Committee to prepare the Hazard Mitigation plan; and

WHEREAS, the Town of Granville participated in the development of the Town of Granville Hazard Mitigation Plan;

and WHEREAS, the Town of Granville Hazard Mitigation Plan contains several potential future projects to mitigate potential impacts from natural hazards in the Town of Montgomery, and

WHEREAS, a duly-noticed public meeting was held by the Board of Selectmen on _____ for the public and municipality to review prior to consideration of this resolution; and

WHEREAS, the Town of Granville authorizes responsible departments and/or agencies to execute their responsibilities demonstrated in the plan, and

NOW, THEREFORE BE IT RESOLVED that the Town of Granville Board of Selectmen formally approves and adopts the Town of Granville Hazard Mitigation Plan, in accordance with M.G.L. c. 40.

ADOPTED AND SIGNED this ____,_____

ATTEST