

**GH-5**

# Natural Hazard Mitigation Plan Summary

## Town of Acton, Massachusetts

### February 2008

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The Metropolitan Area Planning Council (MAPC), working under contract with the Massachusetts Emergency Management Agency, is developing a multi-jurisdictional mitigation plan for 28 communities within three subregions of the metropolitan Boston area, including MetroWest Growth Management Committee, the Minuteman Area Group for Interlocal Coordination (MAGIC), and part of the North Suburban Planning Council. MAPC is developing an overall regional multiple hazard mitigation plan for these 28 communities and a detailed individual plan for each community. The plan will address mitigation of multiple natural hazards, including flood hazards, winter storm hazards, wind hazards, fire, and geologic hazards.

#### **What is Hazard Mitigation?**

To permanently reduce or prevent losses of life, injuries and property following natural hazards by using long-term strategies

#### **What is a Natural Hazard Mitigation Plan?**

- Plan for Preventing Damages from Natural Hazards
- Not an emergency response plan
- What preventive actions are being taken NOW to reduce future risks and damages? What actions can be taken in the FUTURE?
- Natural hazards only
  - *Flood-Related Hazards* (river flooding, coastal flooding, dam failures)
  - *Wind-Related Hazards* (hurricanes, coastal storms, winter storms, tornadoes)
  - *Winter-Related Hazards* (severe snow storms, ice storms)
  - *Fire Related Hazards* (drought, wildfires)
  - *Geologic Hazards* (earthquakes, landslides)

#### **Why does Acton need a Natural Hazard Mitigation Plan?**

- Federal Disaster Mitigation Act of 2000 requires that a community must adopt a local plan in order to apply for certain grants.
  - Pre-Disaster Mitigation Competitive (PDM-C)
  - Hazard Mitigation Grant Program (HMGP)
  - Flood Mitigation Assistance (FMA)
- This plan fulfills that requirement and helps the Town make good use of its resources.

#### **How is this Plan Developed and Approved?**

- Local committee met several times: Fire, Police, Public Works, Engineering, Conservation, Planning, Health, Town Manager
- MAPC gathers data from the local committee, local reports and studies, available state and local GIS data
- Public Meeting to receive further input on the plan
- Draft Plan to MEMA/FEMA for review
- MAPC/town addresses MEMA/FEMA comments and produces final draft
- Board of Selectman reviews and approves plan
- Plan is good for five years

## **What are the Major Components of the Plan?**

- Hazard Identification and Assessment
- Critical Facilities Inventory, Database, and Mapping
- Assessment of Existing Protection Measures
- Development of Proposed Natural Hazard Mitigation Measures

## **Hazard Identification and Assessment**

- Using the best available, existing data, MAPC developed a base map of areas affected by multiple natural hazards.
- MAPC used statewide data sources to map floodplains, average snowfall, wind speeds, hurricanes, earthquake risk areas, etc.
- Reviewed statewide hazard mitigation plan
- Met with Town staff to get information on future development
- Met with Town staff to get information on locally-identified hazard areas of concern, with examples in Acton such as:
  - Water Department Wells– Flooding
  - Driveway and Parking Lot to Rec. Club, House and Apartments – Flooding
  - Stow Street/Martin Street – Flooding
  - Flint Road – Flooding
  - Idylwilde Farms - Flooding
  - Boxborough Flooding from Beaver Activity in Acton
  - Nashoba – River Flooding
  - Dams: Robbins Mill Pond, Pencil Factory, Brook Street, Ice House Pond, Erickson’s Grain Mill, River Street, Assabet River, Nagog, Grassy Pond

## **Critical Facilities Inventory, Database, and Mapping**

MAPC developed a comprehensive inventory of critical facilities in the town, such as: the emergency operations center, town offices, water and wastewater treatment plants, sewage pumping stations, police or fire stations, schools, hospitals, day-care facilities, power substations, public works garages, nursing homes/elderly housing, correctional facilities, emergency shelters, dams, public water supplies, and hazardous material facilities.

## **Assessment of Existing Protection Measures**

Working with the local committee and reviewing available reports, studies, and regulations, MAPC determined Existing Mitigation Measures in Acton, with examples such as:

- *Flood-Related Mitigation*
  - On-going replacement of drainage pipes and infrastructure that need to be replaced
  - Wetlands Protection Bylaw
  - Floodplain Overlay District
  - Site Plan and Subdivision Development Drainage design controls
  - Cluster Developments
  - Dam Studies
  - Land acquisition efforts: Community Preservation Act and priority list of parcels by Open Space Committee
  - Public Education
  - Pilot Project with MIT students on reducing runoff
  - Beaver Mitigation

- *Wind-Related Mitigation*
  - Tree-trimming by town and NSTAR
  - Tree removal by town and NSTAR
- *Winter-Related*
  - Standard snow operations
- *Fire-Related Mitigation*
  - Open burning permits required
- *Earthquakes and other Geologic*
  - Police Station is new and up to earthquake standards
- *Multi-Hazard Mitigation*
  - Multi-department review of projects
  - Comprehensive Emergency Management Plan (CEMP)
  - Local Emergency Planning Committee

### **Development of Proposed Natural Hazard Mitigation Measures**

MAPC is assisting the town in developing a local mitigation strategy specific to Acton. This includes a range of mitigation actions and projects to reduce the effects of each hazard, including a list of prioritized hazard mitigation projects that best meet the needs for hazard damage reduction. Examples of Potential Proposed Mitigation Measures in Acton are as follows:

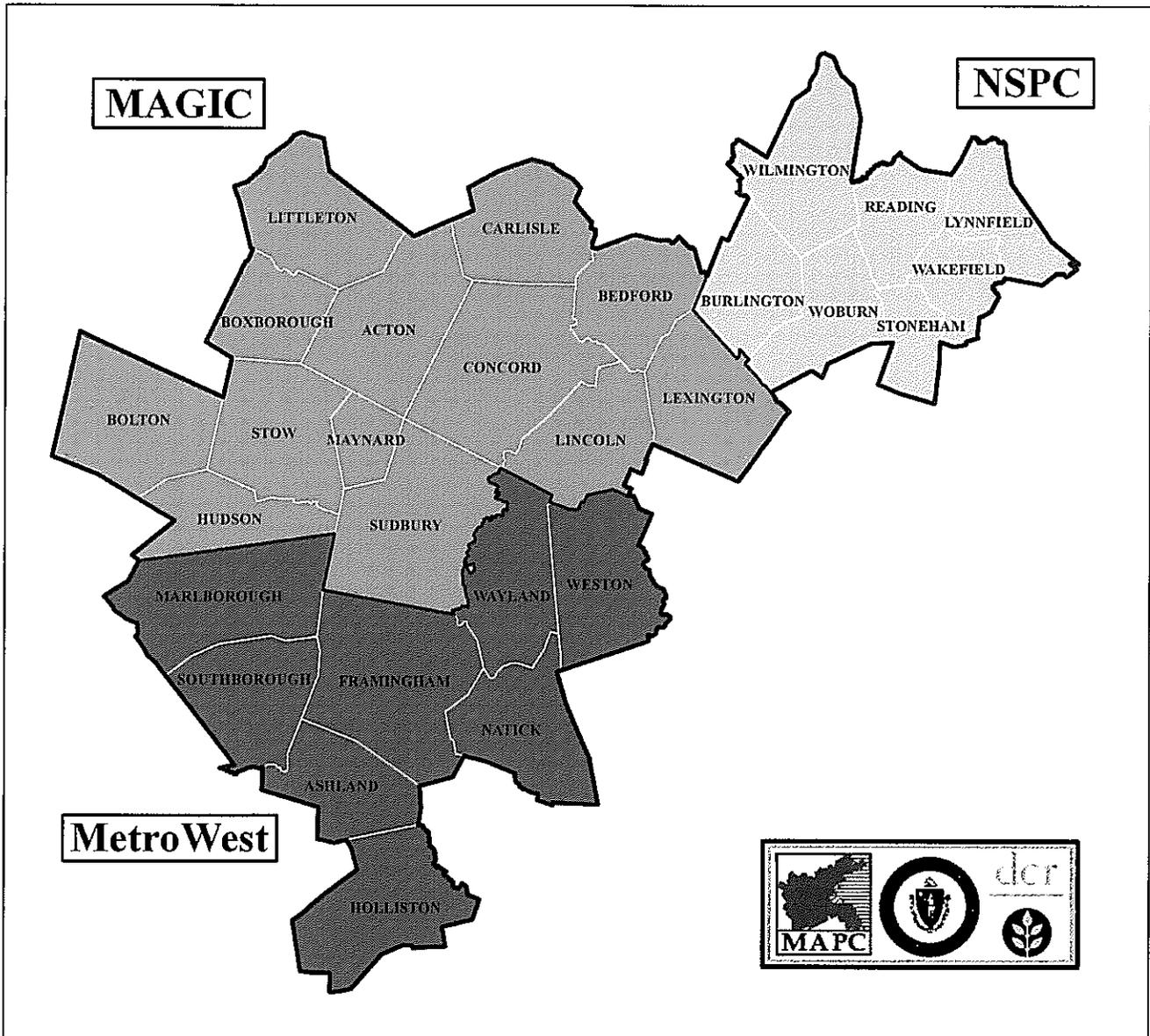
- Post-construction stormwater bylaw, including a maintenance and inspection program for private drainage facilities
- Long term solution to stop Boxborough condos from flooding
- Acquire GIS and create an inventory of drainage infrastructure
- Further Dam studies (such as an overall town dam study)
- Long-term management plan to control beaver activity
- More frequent maintenance of town-owned drainage facilities
- Land acquisition
- Funding to identify hazardous trees in the ROW and adjacent to the ROW, and funds to remove hazardous trees. Ideally a comprehensive survey should be conducted every 4 to 5 years.
- Acquire generators that run on fuels other than natural gas
- Program to upgrade communications, such as switching to fiber optic or radio. The communications equipment is affected by rain, wind and snow approximately 4 times/year.
- Reverse 911 at the schools.

### **Next Steps**

- Based on input from this meeting and the town, MAPC will revise the draft plan to submit to MEMA and FEMA.
- Once comments received from FEMA and MEMA, the plan will be revised and ready for review and approval from the Board of Selectman
- What happens after the plan is adopted and approved? The Town decides whether or not to pursue grants for projects identified in the plan.

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# THE METRO BOSTON NORTH/WEST MULTI-HAZARD MITIGATION PLAN THE ACTON ANNEX



February 19, 2008  
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**ACKNOWLEDGEMENTS AND CREDITS**

This plan was prepared for the Town of Acton by the Metropolitan Area Planning Council (MAPC) under the direction of the Massachusetts Emergency Management Agency (MEMA) and the Massachusetts Department of Conservation and Recreation (DCR). The plan was funded by the Federal Emergency Management Agency's (FEMA) Pre-Disaster Mitigation (PDM) Grant Program.

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**TABLE OF CONTENTS**

**I. Introduction**  
    Planning Requirements under the Federal Disaster Mitigation Act  
    What is Hazard Mitigation?

**II. Community Profile**  
    Overview  
    Existing Land Use  
    Existing Plans  
    Potential Future Land Use

**III. Public Participation**  
    Acton’s Participation in the Regional Committee  
    The Local Multiple Hazard Community Planning Team  
    Public Meeting

**IV. Overview of Hazards and Vulnerabilities**  
    Overview of Hazards and Impacts  
    Critical Facilities Infrastructure in Hazard Areas  
    Potential Damages to Existing Development  
    Potential Impacts to Future Development

**V. Hazards and Existing Mitigation Measures**  
    Flood-Related Hazards  
    Wind-Related Hazards  
    Winter-Related Hazards  
    Fire-Related Hazards  
    Geologic Hazards  
    Existing Multi-Hazard Mitigation Measures  
    Overarching Impacts in Acton  
    Compilation of Existing Mitigation

**VI. Hazard Mitigation Goals and Objectives**

**VII. Potential Mitigation Measures**  
    What is Hazard Mitigation?  
    Identification of Potential Mitigation Measures  
    High Priority Mitigation Measures  
    Medium Priority Mitigation Measures  
    Other Potential Mitigation Measures  
    Potential Mitigation Summary Table

**VIII. Regional and Inter-Community Considerations**  
    Regional Partners  
    Regional Facilities within Acton  
    Inter-Community Considerations

**IX. Plan Adoption and Maintenance**  
    Plan Adoption  
    Plan Maintenance  
    Implementation Schedule  
    Integration of the Plans with Other Planning Initiatives

**X. Resources**

**LIST OF TABLES**

- Table 1: Acton Characteristics from 2000 Census
- Table 2: Existing Land Use in Acton, 1999
- Table 3: Buildout Impacts in Acton, MAPC Analysis
- Table 4: Attendance at the Acton Local Multiple Hazard Community Planning Team Meetings
- Table 5: Attendance at the February 25, 2008 Board of Selectmen's Meeting
- Table 6: Frequency and Severity of Natural Hazards in the State
- Table 7: Disaster and Emergency Declarations for Middlesex County
- Table 8: Flood Insurance Policies and Claims in Acton
- Table 9: Relationship of Critical Facilities and Selected Hazard Types in Acton
- Table 10: Estimated Damage in Acton from a Category 2 or 4 Hurricane
- Table 11: Estimated Damage in Acton from a Magnitude 5.0 and 7.0 Earthquake
- Table 12: Estimated Damages from Flooding in Acton
- Table 13: Relationship of Potential Development in Hazard Areas in Acton
- Table 14: Existing Natural Hazard Mitigation Measures in Acton
- Table 15: Potential Mitigation Measures in Acton

**APPENDICES**

- Appendix A: Natural Hazards Maps
- Appendix B: Meeting Agendas for Metro Boston North/West Regional Hazard Mitigation Community Planning Team and the Local Multiple Hazard Community Planning Team
- Appendix C: Documentation of the Public Meeting
- Appendix D: Documentation of Plan Adoption by the Board of Selectmen

## **I. INTRODUCTION**

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### **Planning Requirements under the Federal Disaster Mitigation Act**

The Federal Disaster Mitigation Act, passed in 2000, requires that after November 1 2004, all municipalities that wish to continue to be eligible to receive Federal Emergency Management Agency (FEMA) funding for hazard mitigation grants, must adopt a local multi-hazard mitigation plan. This planning requirement does not affect disaster assistance funding.

Massachusetts has taken a regional approach and has encouraged the regional planning agencies to apply for grants to prepare plans for groups of communities. The Metropolitan Area Planning Council (MAPC) received a grant from FEMA under the Pre-Disaster Mitigation (PDM) Program, to assist the Town of Acton and 27 other communities in the MAGIC subregion to develop a regional multiple-hazard mitigation plan. The regional plan and this local annex, meet the requirements of the Disaster Mitigation Act.

### **What is Hazard Mitigation?**

Natural hazard mitigation planning is the process of figuring out how to reduce or eliminate the loss of life and property damage resulting from natural hazards such as floods, earthquakes and hurricanes. Hazard mitigation means to permanently reduce or alleviate the losses of life, injuries and property damage resulting from natural hazards through long-term strategies. These long-term strategies can include planning, policy changes, programs, projects and other activities.

## II. COMMUNITY PROFILE

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### Overview

Acton is located in Middlesex County and is bordered by Maynard, Stow, Boxborough, Littleton, Westford, Carlisle, Concord and Sudbury. Major roadways in Acton include Routes 2, 2A, 27, 111 and 119. A small segment of Route 62 runs through the southern tip of the town. Acton is served by the Fitchburg line of the commuter rail. A station is located in South Acton.

The town is governed by a five-member Board of Selectman and a Town Manager. The town operates under the open town meeting format. The Town Manager, appointed by the Selectmen, carries out the day-to-day governing functions of the town.

The town retains a connection to its historic settlement patterns with three village centers and aspects of rural landscapes with historic farms. The three villages are West Acton, South Acton and Acton Center. Like most communities in the larger region, Acton is faced with balancing pressures of growth and the desire to maintain its historic character. New settlement patterns, in the form of strip shopping centers and subdivisions have emerged.

There are around 10,000 jobs in Acton. Commercial development is concentrated at the Nagog Office Park in North Acton.

According to the 2000 Census, just over 20,000 people live in Acton (see Table 1) and there are 7,680 housing units. Table 1 provides statistics on potentially vulnerable populations, including the elderly and those without a car, and vulnerable housing units such as those built prior to 1940.

**Table 1. Acton Characteristics from 2000 Census**

Population = 20,331
<ul style="list-style-type: none"><li>• 7.4% are under age 5</li><li>• 8.4% are over age 65</li><li>• 4.7% speak English less than “very well” (over age 5)</li><li>• 3.1% of households have no vehicle</li><li>• 8.6% have a disability (over age 5)</li><li>• 0.7% live in group quarters</li></ul>
Number of Housing Units = 7,680
<ul style="list-style-type: none"><li>• 23.9% are renter-occupied housing units</li><li>• 11.3% of housing units were built before 1940</li></ul>
Employment = 9,784

Source: 2000 Census, Department of Workforce Development

Important characteristics to keep in mind include:

- Acton serves as a small regional hub that draws people from nearby communities due to the retail services and restaurants and the presence of two important pieces of infrastructure for commuters – Route 2 and the MBTA commuter rail.
- Acton’s small-town character and historic agricultural lands are still present, with a significant amount of open space preserved or in the process of acquisition.
- Acton is continuously growing and continues to face development, both residential and commercial.
- Acton relies solely on subsurface wells for drinking water and has a very active water department.

The Town of Acton maintains a website at <http://www.town.acton.ma.us/>

### **Existing Land Use**

The most prevalent land use in Acton is forest – forest land comprised 42% of the town’s acreage. Residential development is the next most prevalent land use, with low density development most common. Roughly 500 acres of town are still in agricultural use as cropland or pasture.

Table 2 provides a breakdown of the remaining acreage in Acton, based on 1999 aerial photography. Open Land includes areas with abandoned agriculture, power lines or areas devoid of vegetation. Urban Open Land includes undeveloped land and protected green space.

The state owns land in Acton that had been a part of the prison farm (specify prison) and leases the land to the town for recreational use.

**Table 2. Existing Land Use, Acton, 1999**

<b>Land Use</b>	<b>Acres</b>	<b>% of Town</b>
Cropland	507	3.9
Pasture	22	0.2
Forest	5,531	42.7
Non-forested Wetlands	380	2.9
Mining	87	0.7
Open Land	208	1.6
Participatory Recreation	74	0.6
Spectator Recreation	0	0
Water Recreation	5	0.04
Multi-family Residential	266	2.1
High Density Residential (less than ¼ acre lots)	55	0.4
Medium Density Residential (¼ – ½ acre lots)	1,620	12.5
Low Density Residential (Larger than ½ acre lots)	2,860	22.1
Salt Water Wetlands	0	0
Commercial	331	2.6
Industrial	458	3.5
Urban Open	198	1.5
Transportation	97	0.8
Waste Disposal	3	0.03
Water	210	1.6
Woody Perennials	54	0.4
<i>Total</i>	<i>12,966</i>	

For more information on land use categories, see [www.mass.gov/mgis/lus.htm](http://www.mass.gov/mgis/lus.htm).

### **Existing Plans**

A number of plans were reviewed to garner issues related to natural hazards. These plans include:

#### To Live in Acton, 2004

A consultant prepared this report for the town using state funding under Executive Order 418. The plan focused on housing and economic development, but also set forth goals for land use, natural resources, open space, services and facilities, and transportation and circulation. Relevant objectives include protecting the town's natural resources, strict enforcement of federal, state and local laws, and creating greenbelts along waterways. The plan also includes a build-out analysis, the results of which are discussed below, under "Future Development".

#### East Acton Village Plan, 2004

The plan outlines objectives and actions related to maintaining and enhancing this area as a village including pedestrian and parking improvements, ensuring water resources are

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not impacted, and . Items relevant to natural hazard mitigation include reducing impervious surface through shared parking and efficient design of parking spaces, allowing a 25% increase in square footage when developers transfer development from the streamside of Great Road to the other side, and supporting the creation of a greenbelt along Nashoba Brook and Ice House Pond. The plan also notes that parts of East Acton Village have problems, especially in the spring, with water pooling.

West Acton Village Plan, 1994

Goals contained in this plan include maintaining village character, improving pedestrian safety and circulation, improving traffic safety and circulation, supporting new development that enhances village vitality, encouraging small business development, promote diversity in housing, preserve and create more open space around Fort Pond Brook, and protect natural resources.

South Acton Village Plan, 1995

Goals and objectives contained in this plan include providing more open space along Mill Pond and Fort Pond Brook, preserving historic buildings in the village, improving sidewalks, promoting housing diversity and small business development. The plan called for preserving the structural integrity of the Erickson's Dam in order to maintain Mill Pond, acquiring land to develop a greenbelt along Fort Pond Brook,

Draft Open Space and Recreation Plan, 2002 – 2006.

The plan outlines three main goals: preserving Acton's character, protecting the environment, and improving recreational opportunities. A key objective most relevant to this Natural Hazard Mitigation Plan is to preserve open space along Fort Pond Brook, Nashoba Brook and the Assabet River.

The plan notes that one of the biggest challenges is having an adequate water supply. Important projects include bike paths, recreational needs, . The plan also notes flooding problems due to Beaver activity, particularly along the town's border with Boxborough and the importance of preserving the large Heath Hen Meadow floodplain which extends into Stow and Boxborough.

Storm Water Management Plan, Acton, MA, 2003

The plan outlines implementation and goals for public education and outreach, public participation, illicit discharge detection and elimination, construction site run-off control, post-construction run-off control, and pollution prevention and good housekeeping.

Sudbury – Assabet – Concord River Watershed Action Plan, 2005

The plan addresses growth and development, water quality, water quantity, land protection / open space, habitat / biodiversity, outreach and education, and recreational opportunities. The watershed has a drainage area of 377 square miles; Acton lies completely within the watershed.

Relevant goals from the plan include the promotion of smart growth to minimize impacts from development, land protection, and public education. The plan also stresses the

importance of the watershed communities and others working together to achieve the goals.

Specific actions include: encourage communities to adopt low impact development (LID) bylaws; encourage municipalities to work across boundaries; requiring developers to look at cumulative impacts; continue research studies on water balance; conserve water; increase funding for open space protection; identify priority lands for protection; and, encourage communities to adopt the CPA.

**Potential Future Land Use**

In 2000, MAPC, under contract to the Executive Office of Environmental Affairs, prepared a buildout analysis for every community in the Boston region. A buildout analysis is a tool to help communities understand the potential impacts of future growth that might occur given the amount of developable land remaining and how that land is zoned.

The buildout is based on available land within each zoning district and it estimates the number of additional housing units and commercial development that could be accommodated. Generally, the projections account only for as-of-right development. The results of the 2000 Census were not released when MAPC performed the analyses.

**Table 3: Buildout Impacts in Acton, MAPC Analysis**

Developable Land Area (acres)	2,229
Additional Residents	2,528
Additional K-12 Students	542
Additional Residential Units	996
Additional Commercial/Industrial (sq. ft.)	928,453
Additional Roadway at Buildout (miles)	21

*To Live in Acton* also conducted a built-out analysis. The analysis calculated a “likely” build-out of 10,200 dwelling units and estimated that based on current growth rates, it would take 40 years to reach this figure. The analysis calculates a population of 24,500 by 2020 and 29,300 at build-out.

Areas of Future Development

*To Live in Acton* provides information on where future growth is targeted:

- Village development in South Acton Village, West Acton Village, East Acton Village and in North Acton (along Route 27).

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- Industrial development in the far north part of town near Nagog Pond and along the southeast border with Concord. Preferably these would include technology companies, and even small and start-up R&D companies.
- Local-regional shopping services along Route 119/2A.
- Affordable housing is preferred near the villages, public transportation and commercial areas. Lower-density affordable housing should be located outside of these areas.
- In the village areas, small and micro-business is preferred.

While these statistics give an idea of how Acton could grow, MAPC consulted with town staff provide a more realistic picture of future development based on the town's recent comprehensive planning efforts and current trends and projects. The potential future development and redevelopment areas are shown on Map 2, "Potential Development" and are described below. The letters refer to those on Map 2.

96-Lot Subdivision (A)

This proposed project consists of a future 96-lot single-family subdivision off of Carlisle Road.

Avalon Acton 40B - 300 units (B)

Located in North Acton in the Nagog Woods area, this proposed affordable housing project consists of approximately 300 apartments in Acton, with approximately 80 more apartments located in Westford. Construction of 11 buildings of three stories each will be complete by Fall of 2008. In addition to the apartments, 64 age-restricted town houses will be constructed on a separate adjacent parcel in Acton.

Industrial Area (C)

This area, located in the north of Acton, is targeted as a future industrial growth area. (See "To Live in Acton" future growth target areas description above).

Acton North Village (D)

Acton North Village is targeted as a future mixed-use growth area. (See "To Live in Acton" future growth target areas description above).

Golf Course (E)

This site is a recently-constructed golf course.

Shopping Center Area (F)

This shopping center area, located in the eastern part of Acton just north of East Acton Village, is targeted as a local and regional shopping future growth area. (See "To Live in Acton" future growth target areas description above).

East Acton Village (G)

East Acton Village is targeted as a future mixed-use growth area. (See "To Live in Acton" future growth target areas description above).

Industrial Area (H)

This area, located in the southeast of Acton, is targeted as a future industrial growth area. (See “To Live in Acton” future growth target areas description above).

Alexan Concord 40B – 350 Units (I)

This future development, proposed under MGL Chapter 40B, is located at 48 and 54 Old Powdermill Road in the far west corner of Concord, and directly borders the communities of Acton, Sudbury and Maynard. The existing site consists of three manufacturing buildings, with the majority of the site cleared and graded level. The proposed project includes 350 rental housing units, including 11 3-story garden-style apartment buildings, each with 28 units; 8 townhouses, each with 4 to 6 units; and a community clubhouse.

South Acton Village (J)

South Acton Village is targeted as a future mixed-use growth area. (See “To Live in Acton” future growth target areas description above).

West Acton Village (K)

West Acton Village is targeted as a future mixed-use growth area. (See “To Live in Acton” future growth target areas description above).

### **III. PUBLIC PARTICIPATION**

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Public participation occurred primarily at two levels: the Metro Boston North/West Hazard Mitigation Community Planning Team (regional committee) and the Acton Multiple Hazard Community Planning Team (local committee). In addition, the town held one public meeting to present the plan and solicit input.

#### **Acton's Participation in the Regional Committee**

In July 2006, MAPC notified the 28 communities of the first meeting of the Metro Boston North/West Regional Hazard Mitigation Community Planning Team (HMCPT) and requested that the Chief Elected Official designate at least two municipal employees and/or officials to represent the community. The following individuals represented Acton on the regional committee:

- Bruce Stamski, P.E., Town Engineer / Director of Public Works
- Dean Charter, Director of Municipal Properties

The Metro Boston North/West Regional Hazard Mitigation Community Planning Team met over the course of the project on the following dates:

- August 17, 2006
- March 22, 2007
- October 22, 2007

Agendas from these meetings are located in Appendix B.

#### **The Local Multiple Hazard Community Planning Team**

In addition to the regional committee meetings, MAPC worked with the local community representatives to organize a local Multiple Hazard Community Planning Team (MHCPT) for Acton. This local team held its meetings on January 30, 2007 and October 22, 2007 to review existing mitigation measures, develop hazard mitigation goals, and discuss potential mitigation measures. Table 4 lists the attendees at each meeting of the team. The agendas for these meetings are included in Appendix B. In addition, MAPC collected information via one-on-one meetings, phone interviews, or email.

**Table 4: Attendance at the Acton Local Multiple Hazard Community Planning Team Meetings**

<p><u>January 30, 2007</u> Bruce Stamski, P.E., Town Engineer/Director of Public Works Tom Tidman, Director of Natural Resources Robert Craig, Fire Chief Dean Charter, Director of Municipal Properties and Tree Warden Doug Halley, Health Department Jim Deming, Acton Water District Frank Widmayer, Police</p> <p><u>October 22, 2007</u> Bruce Stamski, P.E., Town Engineer/Director of Public Works Tom Tidman, Director of Natural Resources Dean Charter, Director of Municipal Properties and Tree Warden Doug Halley, Health Department Daniel Fleury, Engineering Assistant Gary Rhodes, Building Corey York, Engineer</p>
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**Public Meeting**

The town held a public meeting on February 25, 2008 at the Acton Town Hall to introduce the plan to the public. Notice of the meeting was posted at Town Hall and was publicized as a regular Selectmen’s meeting. MAPC presented an overview of the planning process and priority mitigation strategies to attendees. MAPC then edited the plan based on the comments at the meeting. The attendance list for the meeting is below.

**Table 5: Attendance at the February 25, 2008 Board of Selectmen’s Meeting**

<b>Name</b>	<b>Representing</b>
<i>TO BE COMPLETED FOR FINAL DRAFT</i>	

## IV. OVERVIEW OF HAZARDS AND VULNERABILITIES

This section provides a general overview of how a number of natural hazards impact Acton. The next section provides more detail about impacts at specific locations and existing mitigation efforts.

### Overview of Hazards and Impacts

The 2004 Massachusetts Hazard Mitigation Plan provides an overview of natural hazards in Massachusetts. It indicates that Massachusetts is subject to the following natural hazards (listed in order of frequency): floods, heavy rainstorms, nor'easters, coastal erosion, hurricanes, tornadoes, urban and wildfires, drought and earthquakes.

Table 6 summarizes the hazard risks for the state and notes where risks in Acton differ from the state assessment. The state analysis takes into account the frequency of the hazard, historical records and variations in land use. An explanation of the definitions used can be found at the end of the table. Table 7 lists those federal disaster and emergency declarations for Middlesex County.

**Table 6: Frequency and Severity of Natural Hazards in the State**

Hazard	Frequency in State	Severity in State	Issues in Acton
Flood	High	Serious to extensive	Same as state
Dam Failure	Low	Extensive	A number of dams in Acton; concerns about down stream impacts from dams
Hurricanes	Medium	Extensive to catastrophic	Not a major issue in Acton
Severe Storms (wind, hail, lightning)	Medium	Serious	Same as state
Tornados	Medium	Extensive to catastrophic	Same as state
Winter Storms	High	Serious	Same as state
Earthquakes	Low	Catastrophic	Same as state
Landslides	Low	Minor	Not a major issue in Acton
Brush Fires	Medium	Serious	Not a major issue in Acton
<b>Definitions Used in the Commonwealth of Massachusetts State Hazard Mitigation Plan</b>			
<u>Frequency</u>			
- Very Low Frequency: Events that occur less frequently than once in 1,000 years (less than 0.1% per year).			
- Low Frequency: Events that occur from once in 100 years to once in 1,000 years (0.1% to 1% per year).			
- Medium Frequency: Events that occur from once in 10 years to once in 100 years (1% to 10% per year).			
- High Frequency: Events that occur more frequently than once in 10 years (greater than 10% per year).			

<p><b>Severity</b></p> <ul style="list-style-type: none"> <li>- Minor: Limited and scattered property damage; no damage to public infrastructure (roads, bridges, trains, airports, public parks, etc.); contained geographic area (i.e., 1 or 2 communities); essential services (utilities, hospitals, schools, etc.) not interrupted; no injuries or fatalities.</li> <li>- Serious: Scattered major property damage (more than 50% destroyed); some minor infrastructure damage; wider geographic area (several communities); essential services are briefly interrupted; some injuries and/or fatalities.</li> <li>- Extensive: Consistent major property damage; major damage to public infrastructure (up to several days for repairs); essential services are interrupted from several hours to several days; many injuries and fatalities.</li> <li>- Catastrophic: Property and public infrastructure destroyed; essential services stopped, thousands of injuries and fatalities.</li> </ul>
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**Table 7: Disaster and Emergency Declarations for Middlesex County**

<b>ID Number</b>	<b>Type</b>	<b>Date</b>
1701	Severe Storms and Inland and Coastal Flooding	April 15-25, 2007
1642	Severe storms, flooding	May 12, 2006 (continuing)
1614	Severe storms, flooding, landslides, mudslides	October 7 - 16, 2005
1512	Severe winter storms	April 1, 2004 through April 30, 2004
3191	Snowstorm	December 5 – 6, 2003
3175	Snowstorm	February 17-18, 2003
3165	Blizzard	March 2001
1364	Severe storms, flooding	March 5, 2001 through April 16, 2001
1224	Heavy rain, flooding	June 13 to July 6, 1998
1142	Heavy rain, flooding	October 1996
1090	Blizzard	January 1996
3103	Blizzard	March 1993
920	Storm	October 1991
914	Hurricane (Bob)	August 1991

Sources: [www.fema.gov](http://www.fema.gov) and *State Hazard Mitigation Plan*, MEMA and DCR, October 2004.

**Flood-Related Hazards**

Flooding was the most prevalent natural hazard identified by local officials in Acton. Flooding can occur during hurricanes, nor'easters, severe rainstorms and thunderstorms.

There have been a number of major rain storms that have resulted in significant flooding in eastern Massachusetts over the last fifty years. Excluding hurricanes, significant rain storms include:

- August 1954
- March 1968
- January 1979

- April 1987
- October 1991 (“The Perfect Storm”)
- October 1996
- June 1998
- March 2001
- April 2004
- October 2005
- May 2006
- April 2007

Through October 2007, Acton property owners filed a total of 32 losses with the National Flood Insurance Program. Of these, 21 have been paid for a total of just over \$66,055. FEMA maintains a database on these flood insurance policies and claims, which can be found at [www.fema.gov/business/nfip/statistics/pcstat.shtm](http://www.fema.gov/business/nfip/statistics/pcstat.shtm). The following table provides further detail from the database:

**Table 8: Flood Insurance Policies and Claims in Acton (as of October 31, 2007)**

Flood insurance policies in force	91
Coverage amount of flood insurance policies	\$18,833,500
Premiums paid	\$66,055
Total losses (all losses submitted regardless of the status)	32
Closed losses (Losses that have been paid)	21
Open losses (Losses that have not been paid in full)	0
CWOP losses ( Losses that have been closed without payment)	11
Total payments (Total amount paid on losses)	\$58,761.80

As defined by the Community Rating System (CRS) of the National Flood Insurance Program (NFIP), a repetitive loss property is any property for which the NFIP has paid two or more flood claims of \$1,000 or more in any given 10-year period since 1978. The state plan indicates that Massachusetts is one of the 10 states that cumulatively account for 76% of all repetitive loss buildings in the United States. There are 3 repetitive loss structures in Acton (see maps in Appendix A). For more information on repetitive losses see <http://www.fema.gov/nfip/replps.shtm>.

According to the *1988 Flood Insurance Study for Acton*, past floods in town have occurred in 1927, 1938, 1955 and 1968. This study precluded more recent floods of 1996 and 1998.

#### Wind-Related Hazards

Wind-related hazards include hurricanes and tornadoes as well as high winds during severe rainstorms and thunderstorms.

The region has been impacted by hurricanes throughout its history, starting with the Great Colonial Hurricane of 1635. The eye of one hurricane passed right through Boston in 1944. Between 1858 and 2000, Massachusetts has experienced approximately 32 tropical storms, nine Category 1 hurricanes, five Category 2 hurricanes and one Category 3 hurricane. This equates to a frequency of once every six years. Hurricanes that have occurred in the region include<sup>1</sup>:

- Great New England Hurricane\*      September 21, 1938
- Great Atlantic Hurricane\*          September 14-15, 1944
- Hurricane Doug                        September 11-12, 1950
- Hurricane Carol\*                      August 31, 1954
- Hurricane Edna\*                        September 11, 1954
- Hurricane Hazel                        October 15, 1954
- Hurricane Diane                        August 17-19, 1955
- Hurricane Donna                        September 12, 1960
- Hurricane Gloria                        September 27, 1985
- Hurricane Bob                          August 19, 1991

\*Category 3.

Not included in this list is the Portland Gale of November 26-28, 1898, which may well have been the most damaging coastal storm in Massachusetts history.

As shown in Map 5 in Appendix A, a tropical storm tracked through Acton in 1897 and a Category 1 hurricane tracked through in 1858. A hurricane or storm track is the line that delineates the path of the eye of a hurricane or tropical storm. However, the town does experience the impacts of the wind and rain of hurricanes and tropical storms regardless of whether the storm track passed through the town. The hazard mapping also indicates that the 100 year wind speed is 110 miles per hour. No tornadoes have been recorded in Acton.

Winds during other storms also can cause damage. Downed trees and limbs can be a problem due to weather conditions such as strong wind or heavy snow and ice. Tree limbs can down power and communication lines and impact major roadways.

### Winter-Related Hazards

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<sup>1</sup> Information on storms provided by Cambridge Emergency Management Department. It is assumed that these same storms affected eastern Massachusetts, including Acton.

In Massachusetts, northeast coastal storms known as nor'easters, occur one to two times per year. Winter storms are a combination of hazards because they often involve wind, ice, flooding and snow fall. The average annual snowfall for most of the town is 48 – 72 inches.

As expected, a number of public safety issues can arise during snow storms. Impassible streets are a challenge for emergency vehicles and affect residents and employers. Snow-covered sidewalks force people to walk in streets, which are already less safe due to snow, slush, puddles and ice. Large piles of snow can also block sight lines for drivers, particularly at intersections. Not all residents are able to clear their properties, especially the elderly. And when that snow melts, flooding occurs. Refreezing of melting snow can cause dangerous roadway conditions.

### Fire-Related Hazards

Brush fires and drought fall under the category of fire-related natural hazards.

According to the State Plan, the most recent severe drought in the state occurred from 2001 to 2003 and other multi-year droughts occurred in 1879-83, 1908-12 , 1929-32, 1939-44, 1961-69, and 1980- 83.

Recent wild fires in the state, according to the state plan, affected 2,600 acres in 2002, and 1,600 acres in 2003. Approximately 90% of wild fires in the past 10 years were caused by humans and 10% by lightning. In addition to obvious threats to humans and property, because wildfires burn ground vegetation and ground cover, subsequent rains can worsen erosion.

According to local officials, natural fires in Acton are not a significant issue. The town sees approximately xx brush fires annually, but these fires do not usually cause property damage or injuries. It is important, however, to remember that fire can also be a result of other events such as from the aftermath of an earthquake.

### Geologic Hazards

Geologic hazards include earthquakes, landslides, sinkholes, subsidence, and unstable soils such as fill, peat and clay.

#### *Earthquakes*

According to the State Hazard Mitigation Plan, New England experiences an average of five earthquakes per year. From 1627 to 1989, 316 earthquakes were recorded in Massachusetts. Most have originated from the La Malbaie fault in Quebec or from the Cape Anne fault located off the coast of Rockport. The region has experienced larger

earthquakes, of magnitude 6.0 to 6.5 in 1727 and 1755. Other notable earthquakes occurred here in 1638 and 1663 (Tufts University).

As shown on Map 4 in Appendix A, one earthquake epicenter has been recorded in the northeast portion of Acton. Although new construction under the most recent building codes generally will be built to seismic standards, much of the development in the town pre-dates the most recent building code.

Earthquakes can result in many impacts beyond the obvious structural impacts. Buildings may suffer structural damage that is not readily apparent. Earthquakes can cause major damage to roadways, making emergency response difficult. Water lines and gas lines can break, causing flooding and fires. Equipment in buildings can be vulnerable. For example, a hospital may be structurally engineered to withstand an earthquake, but if the equipment inside the building is not properly secured, the operations at the hospital could be severely impacted during an earthquake. Earthquakes can also trigger landslides.

The State Plan includes a map of Peak Ground Acceleration (PGA). The Plan explains that:

“PGA measures the strength of a potential earthquake in terms of the peak acceleration of ground movement. The potential damages due to an earthquake increase as the acceleration of ground movement increases. Peak ground acceleration is expressed as a percentage of a known acceleration, the acceleration of gravity... Therefore, the geographic areas with the highest PGA have the highest potential for damages during an earthquake.”

According to the State Plan, Acton is located in a section of the state with a PGA of 14 to 16 with a 2% probability of exceedance in 50 years; this is the third/fourth highest zone in the state.

### *Landslides*

Landslides can result from human activities that destabilize an area or can occur as a secondary impact from another natural hazard such as flooding. In addition to structural damage to buildings and the blockage of transportation corridors, landslides can lead to sedimentation of water bodies.

The entire town of Acton is classified as having a low risk for landslides. Local officials did not identify any significant issues related to landslides.

### Overarching Impacts from Natural Hazards

A number of impacts can occur from any of the above-mentioned natural hazards. Most common and most visible are electrical outages and closures of roadways. This can occur due to high winds that knock down wires and limbs, from heavy snow falls that take time to clear, or from a landslide that carries large boulders or soil onto a roadway. In addition to causing inconveniences, these impacts can result in economic losses to local businesses that cannot function without electricity, or their customers or employees cannot get to the business. Minimizing vulnerability to natural hazards can help to reduce these and other impacts to people’s safety, health, and overall economic viability.

**Critical Facilities Infrastructure in Hazard Areas**

Maps 1-7 in Appendix A and Table 9 list critical infrastructure in Acton. Critical infrastructure includes those facilities that perform an important function during a natural disaster such as shelters and emergency operation centers. Critical infrastructure also includes locations that house sensitive populations, such as schools or nursing homes. There are other critical facilities and infrastructure that are not mapped because the information was not available. These include utilities, communication facilities, or transportation corridors.

**Table 9: Relationship of Critical Facilities and Selected Hazard Types in Acton**

<b>ID</b>	<b>Name</b>	<b>Type</b>	<b>Earthquake</b>	<b>Landslide</b>	<b>Hurricane Category</b>	<b>Flood Zone</b>
1	<i>TABLE TO BE COMPLETED FOR FINAL DRAFT</i>					
2						

Explanation of Columns in Table 9

*Column 1: ID #:* ID number which appears on the maps. See Appendix A.

*Column 2: Site Name:* Name of the site. If no name appears in this column, this information was not provided to MAPC by the community.

*Column 3: Site Type:* Type of site.

*Column 4: Landslide Risk:* The degree of landslide risk for that site. This information came from NESEC. The landslide information shows areas with moderate susceptibility to landslides based on mapping of geological formations. This mapping is highly general in nature. For more information, refer to <http://pubs.usgs.gov/pp/p1183/pp1183.html>. If there is no entry, it indicates that the site is located in an area with little or no risk of landslides. The other two risk categories, low and moderate, indicate higher degrees of risk.

*Column 5: Flood Zone:* Risk of flooding. No entry in this column means that the site is not within any of the mapped risk zones on the Flood Insurance Rate Maps (FIRM). If there is an entry in this column, it indicates the type of flood zone as follows:

**Zone A - Zone A** is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study (FIS) by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs (base flood elevations) or depths are shown within this zone. Mandatory flood insurance purchase requirements apply.

**Zone AE and A1-A30 - Zones AE and A1-A30** are the flood insurance rate zones that correspond to the 100-year floodplains that are determined in the FIS by detailed methods. In most instances, BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.

**Zones B, C, and X500 - Zones B, C, and X** are the flood insurance rate zones that correspond to areas outside of the 100-year floodplains, areas of 100-year sheet flow flooding where average depths are less than 1 foot, areas of 100-year stream flooding where the contributing drainage area is less than 1 square mile, or areas protected from the 100-year flood by levees. No BFEs or depths are shown within this zone.

**Zone VE - Zone VE** is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.

*Column 6: Hurricane Surge Area:* Whether the site is located within a hurricane surge area and the potential degree of inundation during a hurricane. The following explanation of hurricane surge areas is taken from the U.S. Army Corps of Engineers web site:

"Hurricane storm surge is an abnormal rise in sea level accompanying a hurricane or other intense storm. Along a coastline a hurricane will cause waves on top of the surge. Hurricane Surge is estimated with the use of a computer model called SLOSH. SLOSH stands for Sea Lake and Overland Surge from Hurricanes. The SLOSH models are created and run by the National Hurricane Center. There are about 40 SLOSH models from Maine to Texas. The SLOSH model results are merged with ground elevation data to determine areas that will be subject to flooding from various categories of hurricanes. Hurricane categories are defined by the Saffir-Simpson Scale." <http://www.sam.usace.army.mil/hesdata/General/hestasks.htm>

According to the Saffir-Simpson Scale, the least damaging storm is a Category 1 (winds of 74-95 miles per hour) and the most damaging storm is a Category 5 (winds greater than 155 miles per hour).

*Column 7: Earthquake Liquefaction Risk:* Whether there is a high or moderate risk for liquefaction during an earthquake. This data was provided by Tufts University.

## **Potential Damages to Existing Development**

The purpose of the vulnerability assessment is to estimate the extent of potential damages from natural hazards of varying types and intensities. A vulnerability assessment and estimation of damages was performed for hurricanes, earthquakes and flooding. The methodology used for hurricanes and earthquakes was the HAZUS-MH software. The methodology for flooding was developed specifically to address the issue in many of the communities where flooding was not solely related to location within a floodplain.

### Introduction to HAZUS-MH

HAZUS-MH is a tool to help estimate potential damages from certain types of natural hazards. We used HAZUS to estimate losses from a hurricane and earthquake. We did not use HAZUS to estimate flooding damages, for reasons explained below. The following overview of the HAZUS-MH is taken from the FEMA website. For more information, go to <http://www.fema.gov/plan/prevent/hazus/>.

“HAZUS-MH is a nationally applicable standardized methodology and software program that contains models for estimating potential losses from earthquakes, floods, and hurricane winds. HAZUS-MH was developed by the Federal Emergency Management Agency (FEMA) under contract with the National Institute of Building Sciences (NIBS). Loss estimates produced by HAZUS-MH are based on current scientific and engineering knowledge of the effects of hurricane winds, floods and earthquakes. Estimating losses is essential to decision-making at all levels of government, providing a basis for developing and evaluating mitigation plans and policies as well as emergency preparedness, response and recovery planning.

HAZUS-MH uses state-of-the-art geographic information system (GIS) software to map and display and display hazard data and the results of damage and economic loss estimates for buildings and infrastructure. It also allows users to estimate the impacts of hurricane winds, floods and earthquakes on populations.”

There are three modules included with the HAZUS-MH software: hurricane wind, flooding, and earthquakes. There are also three levels at which HAZUS-MH can be run. Level 1 uses national baseline data and is the quickest way to begin the risk assessment process. The analysis that follows was completed using Level 1 data.

Level 1 relies upon default data on building types, utilities, transportation, etc. from national databases as well as census data. While the databases include a wealth of information on the communities that are a part of this study, it does not capture all relevant information. In fact, the HAZUS training manual notes that the default data is “subject to a great deal of uncertainty.”

However, for the purposes of this plan, the analysis is useful. This plan is attempting to only generally indicate the possible extent of damages due to certain types of natural disasters and allow for a comparison between different types of disasters. Therefore, this analysis should be considered a starting point to understanding potential damage from the hazard events. If interested, communities could build a more accurate database and further test disaster scenarios.

Table 10 displays damages from category 2 and 4 hurricanes. Table 11 displays damages if an historic earthquake were to occur today and if a stronger (7.0) earthquake were to occur.

### Estimated Damages from Hurricanes

According to the State Hazard Mitigation Plan, between 1858 and 2000, there were 15 hurricanes: 60% were Category 1, 33% were Category 2 and 7% were Category 3. For the purposes of this plan a Category 2 and a Category 4 storms were chosen to illustrate damages. While the region has not experienced a Category 4 hurricane, modeling one helps to illustrate a “worst case scenario.” This can help planners and emergency personnel evaluate the impacts of storms that might be more likely in the future, as we enter into a period of more intense and frequent storms.

**Table 10: Estimated Damage in Acton from a Category 2 or 4 Hurricane**

	<b>Cat. 2</b>	<b>Cat 4*</b>
<b>Building Characteristics</b>		
Estimated total buildings		6,032
Estimated total building replacement value (Year 2002 \$)		\$1,565,409,000
<b>General Building Damage</b>		
# of buildings sustaining minor damage	1,895	365
# of buildings sustaining moderate damage	609	1,120
# of buildings sustaining severe damage	71	1,733
# of buildings destroyed	49	2,775
<b>Population Needs</b>		
% of hospital beds available on day of event	n/a	n/a
# of households displaced	155	6,101
# of people seeking public shelter	30	1,151
<b>Debris</b>		
Building debris generated (tons)	10,209	160,072
Tree debris generated (tons)	155,378	312,582
# of truckloads to clear building debris	408	6,403
<b>Value of Damages</b>		
Total property damage	\$87,692,630	\$1,520,064,740
Total business interruption loss	\$10,158,090	\$206,401,780

\*No category 4 or 5 hurricanes have been recorded in New England. However, a Category 4 hurricane was included to help the communities understand the impacts of a hurricane beyond what has historically occurred in New England.

Estimated Damages from Earthquakes

The HAZUS earthquake module allows users to define different types of earthquakes and to input various parameters. The module is more useful where there is a great deal of data available on earthquakes. In New England, defining the parameters of a potential earthquake is much more difficult because there is little historical data. The earthquake module does offer the user the opportunity to select a number of historical earthquakes that occurred in Massachusetts. For the purposes of this plan, two earthquakes were selected: a 1963 earthquake with a magnitude of 5.0 and an earthquake with a magnitude of 7.0.

**Table 11: Estimated Damage in Acton from a Magnitude 5.0 and 7.0 Earthquake**

	<b>Magnitude 5.0</b>	<b>Magnitude 7.0</b>
<b>Building Characteristics</b>		
Estimated total number of buildings		6,032
Estimated total building replacement value (Year 2002 \$)		\$1,565,409,000
<b>Building Damages</b>		
# of buildings sustaining slight damage	4	1,228
# of buildings sustaining moderate damage	1	404
# of buildings sustaining extensive damage	0	66
# of buildings completely damaged	0	10
<b>Population Needs</b>		
# of households displaced	0	103
# of people seeking public shelter	0	19
<b>Debris</b>		
Building debris generated (tons)	0	26,000
# of truckloads to clear building debris	0	1,040
<b>Value of Damages</b>		
Total property damage	\$270,000	\$62,290,000
Total losses due to business interruption	\$20,000	\$12,630,000

Estimated Damages from Flooding

MAPC did not use HAZUS-MH to estimate flood damages in Acton. In addition to technical difficulties with the software, the riverine module is not a reliable indicator of flooding in areas where inadequate drainage systems contribute to flooding even when those structures are not within a mapped flood zone. In addition to encroachment of developments in the floodplain and increasingly growing amounts of impervious areas, much of the flooding in Acton is due to deficiencies in drainage systems. In lieu of using HAZUS, MAPC developed a methodology to give a rough approximation of flood damages.

**Table 12: Estimated Damages from Flooding in Acton**

<b>ID</b>	<b>Flood Hazard Area</b>	<b>Approximate Area (Acres)</b>	<b>% of Total Land Area in Acton</b>	<b># of Structures</b>	<b>Replacement Value</b>	<b>Low Estimate of Damages</b>	<b>High Estimate of Damages</b>
1	<i>TABLE TO BE COMPLETED FOR FINAL DRAFT</i>						
2							
<i>Total</i>							

**Potential Impacts to Future Development**

The Town of Acton has identified a number of parcels where development has been proposed, is underway or is expected to occur in the future. Table 13 indicates where areas of likely future development may be located within or partially within a natural hazard area.

**Table 13: Relationship of Potential Development in Hazard Areas in Acton**

<b>Parcel</b>	<b>Flood Zone</b>	<b>Other Risks</b>
<i>TABLE TO BE COMPLETED FOR FINAL DRAFT</i>		

## V. HAZARDS AND EXISTING MITIGATION MEASURES

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This section provides more detail on how certain natural hazards affect specific parts of Acton. Existing mitigation measures are discussed under each hazard heading and existing mitigation measures for all natural hazards are compiled in Table 14.

### **Flood-Related Hazards**

#### Overview of Town-Wide Flooding

Acton is located entirely within the SuAsCo watershed (Sudbury – Assabet – Concord) and all of Acton’s water drains to the Assabet River. Major brooks include Fort Pond Brook and Nashoba Brook and there are a number of tributaries. Because of Acton’s topography many of the brooks flow very slowly and many historic farming drainage ditches have filled. These and other circumstances can result in flooding. Major water bodies include Nagog Pond (a water supply reservoir for Concord), Grassy Pond and Ice House Pond.

Map 3 shows that there are extensive areas of 100 year flood plain throughout the town, but particularly along Fort Pond Brook and Nashoba Brook, along the town’s boundary with Boxborough and in the very northern tip of town. Flooding in Acton is occasional, usually within or near floodplain areas. Damage may consist of flooding of basements or yards. According to a 1988 Flood Insurance Study by FEMA, there are some single-family houses and businesses located in flood plains. Today, an increasing amount of impervious surface from new development contributes to flooding issues, but since the 1970’s and the issuance of flood plain regulations, no new construction has occurred in flood plains. Flooding issues tend to be related to rising water rather than velocity.

In many areas of town, flooding occurs due to extensive beaver activity. Virtually every brook in town has had some degree of beaver activity in the past few years, however much of the beaver trapping does tend to occur along Nashoba Brook. Beaver mitigation is an important step in controlling flooding in Acton, and there is a need to strike balance of allowing beavers to exist and reducing flooding.

Roadways in Acton tend to flood every other year, but this does not lead to many major hazards since usually the roads remain passable. Older pipes in town can pose problems if they are undersized or in poor condition, but the town has an ongoing maintenance program to upgrade drainage infrastructure. Flooding is exacerbated when freezing temperatures are followed by rain, causing catch basin blockage. Since most of the flooding in town tends to occur in the flood plains and not as a result of inadequate drainage infrastructure, structural solutions to flooding have not been the main focus.

With regards to private drainage facilities, one challenge the town faces is with maintenance. It often difficult to enforce maintenance and inspections of private

facilities. This issue will become even more important as the town sees more development.

*Existing Town-Wide Mitigation for Flood-Related Hazards*

Acton employs a number of practices to help minimize potential flooding and impacts from flooding, and to maintain existing drainage infrastructure. Existing town-wide mitigation measures include:

- *Participation in the National Flood Insurance Program (NFIP)* – FEMA maintains a database on flood insurance policies and claims. This database can be found on the FEMA website at [www.fema.gov/business/nfip/statistics/pcstat.shtm](http://www.fema.gov/business/nfip/statistics/pcstat.shtm)
- *On-going Drainage Improvement Program* – The Department of Public Works (DPW) routinely maintains and replaces old and failing pipes and drainage infrastructure (such as disintegrating aluminum pipes up to 70 years old). This program is part of DPW's operating budget.
- *Wetlands Protection Bylaw and Regulations* – The town has a wetlands protection bylaw to protect resource areas in and around wetlands, including land subject to flooding. The Bylaw also has requirements for setbacks ranging from 0-100 feet depending upon the activity. The wetland regulations provide more detail with regards to submittal requirements and performance standards. The Conservation Commission reviews development plans with potential impacts to water resources.
- *The Massachusetts Stormwater Policy* – This Policy is applied to developments within the jurisdiction of the Conservation Commission.
- *Floodplain Overlay District* – The town has a floodplain overlay district (Zoning Section 4.1) that restricts certain activities and requires a special permit for activities located within a flood zone. Floodplain regulations have been effective at preventing new construction in the flood plains.
- *Subdivision Development Drainage Design Controls* – The subdivision regulations require that the proposed drainage system is approved in writing by the appropriate town entity (Section 5.3.17) and the stormwater calculations must be provided by a licensed engineer (Section 5.3.18). The applicant must include provisions for handling drainage that flows off-site (5.3.20). Finally, an Erosion and Sediment Control plan is required (5.3.22). The Board of Health must review and approve or disapprove subdivision plans (5.5). Section 8.2 provides drainage/stormwater standards for subdivisions. The subdivision regulations encourage a preliminary submission to discuss development issues up-front with the Planning Board prior to a significant investment in design efforts. Runoff from subdivision developments may not increase in proposed conditions more than in existing conditions for the 10-year storm, and drainage facilities must be designed for the 10-year storm. The Subdivision Regulations also require the preparation of

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Development Impact Reports. Applicants must provide information on impacted resources, such as flood plains.

- *Site Plan Development Drainage Design Controls* - For uses requiring site plans special permits, the peak rate of storm water runoff from the development site shall not exceed the rate existing prior to the new construction based on a 10-year design storm. Commercial and industrial developments must treat first inch of rainfall onto impervious surfaces.
- *Reviews and Inspections of New Developments* - Town staff provides drainage reviews and the Engineering Department inspects streets and drainage once construction is completed of a site.
- *Cluster Developments* – The town residential zoning provides provisions for cluster developments (open space developments in Zoning section 4.2) for all residential zones.
- *Groundwater Protection Overlay District* - The town has a Groundwater Protection District (Zoning section 37) with stringent development controls, including recharge requirements, open space requirements, and maximum allowable impervious areas based upon proximity to the public wells. These regulations are designed to protect the town’s sole drinking water supply.
- *Land acquisition efforts: Community Preservation Act* - The town adopted the Community Preservation Act with a 1.5% surcharge in 2002. The town has not yet used CPA funds for land acquisition, but likely will be soon. Land acquisition has not been a line item in the town’s budget, but the town has bonded for purchases.
- *Land acquisition efforts: Priority list of parcels by Open Space Committee* – Town will be updating its Open Space Plan and the Conservation Commission has an Open Space Committee that is working on a list of priority parcels. They have not targeted properties solely based on flood protection purposes, but flood storage may be one of several important environmental features on a piece of conserved land.
- *Public Education* – The town continues to implement its NPDES Phase II stormwater program which includes public education programs. Elements of the public education program include: partnering with SuAsCo for media toolkits, stormwater business flyers, educational signs adjacent to a constructed wetland, teacher lesson plans, traveling stormwater display at town buildings, and storm drain stenciling. In addition, the Acton Stream Team raises community awareness regarding issues facing water resources in the town.
- *Pilot Project with MIT students on reducing runoff* – MIT graduate students developed a low-impact design (LID) for reducing runoff effects at Jones Field consisting of a rain garden. The town expects to focus on municipally-owned land and have a few pilot projects at other locations.

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- *Beaver Mitigation* – The town hires a trapper to mitigate beaver activity as necessary. A permit to do so is required by state law through the local Board of Health per state law. The mitigation includes removal of the dam and beaver and possibly installation of pipes to when property owners call to complain about flooding. The town usually uses its own staff and equipment to address the issue, and the cost can reach \$1,000 for each incident. To trap a beaver, the town is usually charged around \$150 to \$200 per animal.
- *Drainage System Maintenance* - The town strives to clean all catch basins annually. They no longer use sand, which has made a tremendous impact by allowing less frequent cleaning of the basins. The Health Department and DPW track catch basin and outfall cleanings. Maintenance of the storm drain system is scheduled based on known problem areas. The town has mapped its drainage system on paper maps and hopes to eventually set up in GIS if the town obtains GIS. The town owns two street sweepers.

### Site-Specific Flooding

The following sites were identified by Town staff as areas more prone to flooding. The numbers in parentheses refer to the Areas of Concern on Map 8 in Appendix A.

#### *Water Department Well (Kennedy Wellfield off of Route 27) (1)*

This town-owned and operated water well located off of Route 27 in the northeast part of Acton is vulnerable to flooding due to beaver dams on Butter Brook. If the water table is high enough, surface water will intrude into the well and potentially impact water quality.

#### *Great Road (2)*

Some properties at Great Road near Wetherbee Street flood occasionally. The parking lot and driveway of a private recreation club can be cut off; a house upstream has flooded as well as a parking lot at an apartment building next to gas station floods. No special action has been taken by Town. A house upstream does flood and the owner thinks the bridge at the club may be restricting flow. In addition, parts of the East Acton village may have pooling water, but this could be due to the associated with Nashoba Brook.

#### *Stow Street/Martin Street (3)*

Properties at Stow Street and Martin Street flood once every 3 to 4 years. Beaver dams have been found near this location. Impacts include flooded basements and roads. The road is closed when it floods, but there is an easy detour around it. Emergency management assists residents with pumping out basements.

#### *Flint Road (4)*

Homes in the Flint Road area south of Mass. Ave. have seen flooding once every few years due to beaver activity.

*Existing Mitigation*

- The town has removed beaver dams at the end of Flint Road.

*Water Department Well (Whit-Clapp Wellfield off of Route 111) (5)*

This town-owned and operated water well located off of Route 111 in the southwest part of Acton is vulnerable to flooding due to beaver dams near Inch Brook and Guggins Brook. If the water table is high enough, surface water will intrude into well and potentially impact water quality.

*Idylwilde Farms (6)*

The Idylwilde Farm area is near flood plain, and as a result agricultural fields have experienced flooding. The houses are uphill so they have not been impacted by flooding here.

*Existing Mitigation*

- The landowners here have trapped a beaver at their own expense.

*Condominiums in Boxborough (7)*

Flooding at a condominium complex in Boxborough has been caused by beaver activity in Acton. The flooding also impacted the functionality of the condo's septic system.

*Existing Mitigation*

- Acton installed a pipe in the beaver dam to improve flow, however, a long-term solution is needed.

*Nashoba Brook – River Flooding (8)*

Flooding has occurred on a stretch from Route 2A to Concord Road along Nashoba Brook, often due to beaver activity, but also due to floodplain. The flooding affects properties, but not houses. A good portion of the land along this brook is town-owned.

*Existing Mitigation*

- Beavers have been removed from this area.

Dams

According to data provided by the Town and the Massachusetts Department of Conservation and Recreation, there are several dams in Acton. Some have studies underway, some are in need of a study and/or repairs, and some no longer serve a purpose. Several measures are in place to mitigate against damages from dam breaches as described below:

*Existing Town-Wide Mitigation for Dam Hazards*

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- *DCR dam safety regulations* – All dams are subject to the Division of Conservation and Recreation’s dam safety regulations. Dams are required to be inspected regularly with reports filed to the DCR Office of Dam Safety.
- *Permits required for construction* – State law requires a permit for the construction of any dam.
- *The Comprehensive Emergency Management Plan* – The CEMP addresses dam safety.
- *Dam Studies* – A SuAsCo dam study is underway for dams on the Assabet River. The Assabet River Dam has an emergency action plan and restoration of the dam is currently underway (see detailed description below).

In general throughout the town, there is a need for a town-wide assessment of all the dams to ensure which ones should be restored and which ones should be removed. Descriptions of each dam are provided below. The numbers in parentheses refer to the Areas of Concern on Map 8 in Appendix A.

*Robbins Mill Pond Dam (9)*

The Robbins Mill Pond Dam impounds the Nashoba Brook at Wheeler Lane in the Nashoba Brook Conservation Area. The town rebuilt this dam in 1990 by replacing an earthen dam with a new dam in 1990. The dam is getting weaker as water leaks through, but it is not a high risk.

*Pencil Factory Dam (10)*

This dam is located on the Nashoba Brook.

*Brook Street Dam (11)*

This is a small stone dam located on Nashoba Brook.

*Ice House Pond Dam (12)*

Also called the Allen Dam, this is a privately-owned stone dam on Nashoba Brook at Ice House Pond. The dam was rebuilt by the town in 1995 and now allows periodic drawdowns. If the dam were to breach, downstream impacts would be of concern.

*Erickson’s Grain Mill Dam (13)*

This dam, located on Fort Pond Brook, is privately owned, but is important for maintaining the water body as a scenic and recreational resource. It is made of stone masonry and is in poor condition. There are concerns about the downstream impacts if this dam is breached. A development is occurring nearby and the commuter rail is also nearby. An assessment of potential downstream impacts would be warranted for this site.

*River Street Dam (14)*

This dam is located at River Street on Fort Pond Brook. This dam does back up in the spring and floods. As with Erickson’s Grain Mill Dam, there are concerns about the downstream impacts if this dam is breached. A development is occurring nearby and the

commuter rail is also nearby. A large amount of water would be stored behind the dam during a large storm. An assessment of potential downstream impacts would be warranted for this site.

*Assabet River Dam (15)*

This dam (also known as the Powder Mill Dam, or Old High Street Dam) is located on the Assabet River At Old High Street. It is privately-owned by the Acton Hydro Company. It has a hydro-electric component, is a wood crib dam, has a manual intake and sluice gates, and is partially dismantled. There are concerns about downstream impacts if the dam is breached. Downstream are a number of commercial uses, including at least two sites that may contain hazardous materials.

*Existing Mitigation*

- Work is underway to repair the dam.
- An Emergency Action Plan was prepared for the dam in 2004 that includes list of downstream properties to be evacuated.
- Routine measures include daily inspections by the owner, monitoring weather conditions, monitoring flow rates via upstream USGS gaging station, staffed 24-hours during extreme flood conditions, and an annual detailed inspection by the owner.

*Nagog Pond Dam (16)*

This dam is located on Nagog Brook at Nagog Pond. Nagog Pond is owned by the Town of Concord for water supply. The dam appears to be in good condition and has not caused any concerns.

*Grassy Pond Brook Dam (17)*

This dam is cement with a 24-foot opening on a brook segment between Freedom Farm Road and Arlington Street.

**Wind-Related Hazards**

As shown on Map 5 in Appendix A, a tropical storm tracked through Acton in 1897 and a Category 1 hurricane tracked through in 1858. The hazard mapping also indicates that the 100 year wind speed is 110 miles per hour. No tornadoes have been recorded in Acton.

Tree damage during high winds has the potential to be a hazard in Acton. Trees can knock out power lines and block major roadways, which hinders emergency response.

High winds are not a frequent issue in Acton and power outages are infrequent, but the town does see microbursts in the summer that can cause problems. Trees on private land tend to cause more problems than trees in the Right-of-Way. The town does have a tree maintenance program, but if the trees are not within the Right-of-Way, there is little staff or personnel to assist. The tree program in general is lacking sufficient funding to keep

up with its 2-3 year back log. New subdivisions that open up mature forest stands, especially white pine stands, tend to result in damaged, more vulnerable trees 5 to 10 years after construction.

Approximately 30 to 40% of septic systems in town rely on power, so prolonged outages could have health impacts. Fortunately Acton has not really seen prolonged power outages in a number of years. However, many of the generators used in town and for town buildings rely on natural gas. If the natural gas lines are impacted, the generators will not function.

Another significant issue with regards to power outages is the condition of the town's communications equipment. They have lost the repeater on Great Hill (affected by wind, rain and snow around 4 times per year). When this occurs, they need to rely on their emergency communication system which has reduced capacity.

The town of Acton makes every effort to mitigate against damage due to high winds. Some of the specific actions are provided below.

*Existing Mitigation for Wind-Related Hazards (Town-wide)*

- *Tree Trimming and Removal by the Town* - The town has a Tree Warden that oversees trimming and tree removal on public properties, and contractors are hired to help with maintenance. At times full Right-of-Ways will be cleared and replanted. The tree warden does try to identify hazardous trees on private property and will contact the landowner. Approximately 6 times per year the town will remove private trees, but it is up to the landowner to remove the debris.
- *Tree Trimming and Removal by NSTAR* - NSTAR does full town tree inspection every 3 years along its power lines and will take down problem trees. The routine maintenance and trimming is effective, but the three-year tree-removal program is not completely effective because hazardous trees that are more difficult to address are not always dealt with.
- The town has a fully powered emergency generator for the public safety building, one for the fire station, and one for the public works facility, town hall, sewer treatment plant, schools, Water Department, and portable generator for pumps. However, many of the generators used in town and for town buildings rely on natural gas. If the natural gas lines are impacted, the generators will not function.
- The town buildings are robust with hurricane-resistant glass. The Police Station is new and up to the most recent building codes. However, the state building code does not address tornadoes.

**Winter-Related Hazards**

Map 6 in Appendix A indicates that the average annual average snowfall in Acton is between 48.1 inches to 72 inches. The Town provides standard snow plowing operations, and clearing snow has not posed any real challenges. Heavy, wet snow can damage trees and bring down limbs. Some of the roads in town are steep and pose a minor challenge for snow clearing, but in general the snow operations run smoothly.

The town of Acton currently employs a number of measures to mitigate for winter storm events. These are described below.

*Existing Town-Wide Mitigation for Winter-Related Hazards*

- The town provides standard snow plowing operations, and uses outside contractors as necessary. They have moved away from using sand, which helps reduce catch basin clogging.
- MassHighway clears Routes 2, 2A, and 111.
- Both the town and NSTAR provide tree trimming and removal in order to prevent limbs from coming down during heavy and wet snow events. (See more detailed description above under the Wind section)
- In the event of power outages due to downed limbs or ice, the town does have numerous backup generators for town buildings (See more detailed description above under the Wind section)

**Fire-Related Hazards**

The state is divided into 6 drought regions (see state plan). Acton is located in the Northeast Drought Region. The state has rated communities according to fire risk based on past occurrences, and Acton is rated as a low risk.

According to local officials, natural fires in Acton are not a significant issue. The town sees approximately xx brush fires annually, but these fires do not usually cause property damage or injuries. It is important, however, to remember that fire can also be a result of other events such as from the aftermath of an earthquake.

*Existing Town-Wide Mitigation for Fire-Related Hazards*

- The town allows controlled open burning in accordance with state regulations, but a permit is required from the Fire Chief for each day of intended burning.
- The Fire department reviews all subdivision and site plans for compliance with site access, water supply needs, and all other applicable regulations.

**Geologic Hazards**

Earthquakes

## *DRAFT*

Most municipal officials acknowledged that earthquakes were the hazard for which their community was least prepared. One earthquake epicenter in the northeast portion of the town has been within Acton. If an earthquake hits, the entire region, not just the town, would face significant challenges. Earthquakes often trigger fires. The water distribution system may be disrupted, thus posing a risk for public health and fighting the fires.

Although new construction under the most recent building codes generally will be built to seismic standards, much of the development in the town predates the most recent building code. A major vulnerability is that all 3 fire stations are unreinforced masonry construction, built 40 years ago, and could not likely withstand a major earthquake. The Public Works building is also unreinforced masonry built in the 1960s. The Police Station however is brand new and up to the most recent earthquake standards.

95% of the town is served by fire hydrants. If the water system goes down, it would be difficult to find water for fire fighting. There are some fire ponds in Acton, but not likely enough if a major earthquake hits.

Many of the town buildings and services (such as water) have generators, but they are predominantly powered by natural gas. If power is lost, the natural gas lines may not be able to withstand a major earthquake and therefore the generators would be inoperable. Two of the fire stations have generators that rely on natural gas.

If a major earthquake were to hit, the commuter rail and major roadways and bridges would be affected. As it is, many of the bridges are in dire need of repair.

### *Existing Town-Wide Mitigation for Earthquake Hazards*

- The Police Station is new, steel-framed, and up to earthquake standards
- The town does have an evacuation plan as specified in its Comprehensive Emergency Management Plan (CEMP).
- A tanker task force is available through State Fire mobilization. FEMA has 8-12 tankers that can be deployed anywhere in the US within 72 hours.
- The El Paso gas company provides educational information and training on hazard mitigation for its Tennessee Gas Pipeline located in several communities, including Acton.

### Landslides

According to the Master Plan, most of Acton is characterized by gently rolling hills and the only slopes over 15% are located south of Routes 2 and 111. Map 4 indicates that all of Acton has a low susceptibility to land slides. This seems consistent with local opinions that landslides or areas of erosion are not a major threat or occurrence in Acton.

Most of the steep areas in town have already been developed. There are localized issues during construction, but those areas are stabilized once construction is completed.

*Existing Town-Wide Mitigation for Landslide Hazards*

- Town design standards in the subdivision and site plan regulations address erosion and sediment controls for temporary and permanent slopes.
- The edge of Brook Street (Conant Property) was recently stabilized to prevent erosion.
- A berm was recently installed at 2 Broadview Road to prevent erosion.
- Work was completed at the intersection of Homestead Street and Arlington Street to prevent erosion.
- The town recently installed a new box culvert at School Street and Lawsbrook Road that helps to slow down water flow and prevent erosion.

**Existing Multi-Hazard Mitigation Measures**

The Town of Acton has several mitigation measures in place that address more than one hazard. The following describes these measures:

*Existing Town-Wide Mitigation for Multiple Hazards*

- *Multi-Department Review of Developments* – Multiple departments, such as Planning, Zoning, Health, Public Works, Engineering, Fire, Police, and Conservation, review all subdivision and site plans prior to approval.
- *Comprehensive Emergency Management Plan (CEMP)* – Every community in Massachusetts is required to have a Comprehensive Emergency Management Plan. These plans address mitigation, preparedness, response and recovery from a variety of natural and man-made emergencies. These plans contain important information regarding flooding, dam failures and winter storms. Therefore, the CEMP is a mitigation measure that is relevant to many of the hazards discussed in this plan. The CEMP is available online through secure access for town personnel.
- *Enforcement of the State Building Code* – The Massachusetts State Building Code contains many detailed regulations regarding wind loads, earthquake resistant design, flood-proofing and snow loads.
- Acton has a *Local Emergency Management Planning Committee (LEPC)*
- The town has a fully powered emergency generator for the public safety building, one for the fire station, and one for the public works facility, town hall, sewer treatment plant, schools, Water Department, and portable generator for pumps. However, many of the generators used in town and for town buildings rely on natural gas. If the natural gas lines are impacted, the generators will not function.

- The town has reverse 911 and public announcements in the event of an emergency.
- The emergency communications system has limited capacity, and communications systems in town are highly dependent on cell phones (cell tower is located on Great Hill). The town looks to have a program to have proper communications facilities and fiber optics.

### **Other Hazards**

*The Haartz Chemical Plant* is located near the high school, but is not in a vulnerable location with respect to natural hazards. This facility has tanker traffic containing chemicals, vapors and explosives. The facility is likely up to modern building codes. Haartz has its own emergency plan.

*The Weigh Station*, located on Lawsbrook Road, takes in and redistributes pressurized gas. This area is not impacted by flooding, but high winds may be of concern. If the Weigh station does have an emergency plan, the owner should share it with the town. If they do not have one, then one should be developed.

**Compilation of Existing Mitigation**

The following table summarizes many existing natural hazard mitigation measures already in place in Acton. Because of the number of entities, public and private, involved in natural hazard mitigation, it is likely that this list is a starting point for a more comprehensive inventory of all measures. Updates of the plan should continue to add to this table.

**Table 14: Existing Natural Hazard Mitigation Measures in Acton**

<b>Hazard</b>	<b>Area</b>	<b>Mitigation Measure</b>
		<i>TABLE TO BE COMPLETED FOR FINAL DRAFT</i>

## **VI. HAZARD MITIGATION GOALS AND OBJECTIVES**

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The Acton Local Multiple Hazard Community Planning Team endorsed the following eight hazard mitigation goals at its October 22, 2007 team meeting:

1. Prevent and reduce the loss of life, injury, public health impacts and property damages resulting from all major natural hazards.
2. Identify and seek funding for measures to mitigate or eliminate each known significant flood hazard area.
3. Integrate hazard mitigation planning as an integral factor in all relevant municipal departments, committees and boards.
4. Prevent and reduce the damage to public infrastructure resulting from all hazards.
5. Encourage the business community, major institutions and non-profits to work with the Town to develop, review and implement the hazard mitigation plan.
6. Work with surrounding communities, state, regional and federal agencies to ensure regional cooperation and solutions for hazards affecting multiple communities.
7. Ensure that future development meets federal, state and local standards for preventing and reducing the impacts of natural hazards.
8. Take maximum advantage of resources from FEMA and MEMA to educate Town staff and the public about hazard mitigation.

## VII. POTENTIAL MITIGATION MEASURES

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### **What is Hazard Mitigation?**

Hazard mitigation means to permanently reduce or alleviate the losses of life, injuries and property damage resulting from natural and human-made hazards through long-term strategies. These long-term strategies include planning, policy changes, programs, projects and other activities. FEMA currently has three mitigation grant programs: the Hazards Mitigation Grant Program (HGMP), the Pre-Disaster Mitigation program (PDM), and the Flood Mitigation Assistance (FMA) program. See <http://www.fema.gov/government/grant/government.shtm> for more information.

### **Identification of Potential Mitigation Measures**

During the local hazard team meetings, officials in Acton determined possible mitigation measures for the various natural hazards that have impacted or could impact the town. In addition, MAPC solicited suggestions for mitigation measures when it collected hazard information from town officials and from other town plans and studies. MAPC compiled all suggested strategies into a matrix.

Local officials then prioritized the measures using the matrix. Prior to choosing priorities, participants reviewed the project Goals and STAPLEE evaluation considerations, such as:

- Is there political support and public support to implement the mitigation measures?
- Can the town provide the necessary maintenance when the mitigation measure is completed?
- Does the cost seem reasonable when considering the size of the problem and likely benefits from mitigation?

The breakdown of high and medium priority measures, along with all other possible measure is provided in the discussions below.

### **High Priority Mitigation Measures**

#### Long-Term Management Plan To Control Beaver Activity

Generally every brook in town has had some degree of beaver activity in the past few years. Development of a long-term management plan for beaver mitigation and for areas impacted by beaver dams is a high priority.

#### Assessment of River Street Dam

This dam is located at River Street on Fort Pond Brook. This dam does back up in the spring and floods and there are concerns about the downstream impacts if this dam is breached. A development is occurring nearby and the commuter rail is also nearby. A large amount of water would be stored behind the dam during a large storm. An assessment of this dam is needed, such as an investigation of removal of the dam to reduce the risk of having an impoundment of water here, and an assessment of current risks to downstream development, future downstream development and the commuter rail.

#### Post-Construction Stormwater Bylaw Revisions to Include a Maintenance and Inspection Program For Private Drainage Facilities

The bylaw should require aggressive and legally-binding operation and maintenance plans and reporting, with enforcement mechanisms, for private drainage facilities. In addition, further resources need to be put into town staffing to have a more robust maintenance and inspection program.

#### Overall Town-Wide Dam Study

Due to the numerous amounts of dams in Acton, a town-wide evaluation of which dams should be restored and which ones should be removed will help prevent future impacts to property and human safety.

#### Acquire Generators that Run on Fuels other than Natural Gas

The town has a fully powered emergency generator for the public safety building, one for the fire station, and one for the public works facility, town hall, sewer treatment plant, schools, Water Department, and portable generator for pumps. However, many of the generators used in town and for town buildings rely on natural gas. If the natural gas lines are impacted, such as during an earthquake, the generators will not function. Two of the fire stations have generators that rely on natural gas. The town needs to invest in additional generators that do not run on natural gas in order to ensure continual emergency service during a hazard event. In addition, the Senior Center needs a generator, and homeowners should be encouraged to buy generators for their septic systems (if they require power).

#### Program To Upgrade Communications

The communications systems in the town need upgrades to ensure reliable and efficient service. This could include switching to a fiber optic system or radio system. Currently the communications equipment is affected by rain, wind and snow approximately 4 times per year, which requires a dependence on reduced capacity backup systems and cell phones.

#### Reverse 911 at the Schools

In addition to reverse 911 in the town, reverse 911 should be installed at the schools.

#### Upgrades to Fire Stations

The Fire Stations in Acton are unreinforced older structures that are at risk in the event of a major earthquake. The town is in the process of considering a new fire station, but if this does not occur, an assessment should be made to look into options for securing the stations from damage during a major earthquake.

#### Tree Maintenance Program Funding

The town needs additional funding to identify hazardous trees in the ROW and adjacent to the ROW, and funds to remove hazardous trees. Ideally a comprehensive survey should be conducted every 4 to 5 years. Perhaps the town could set up funding for partial reimbursements for taking down hazardous trees on private properties.

### **Medium Priority Mitigation Measures**

#### Assessment of Erickson's Grain Mill Dam

This dam, located on Fort Pond Brook, is privately owned, but important for maintaining the water body as a scenic and recreational resource. It is made of stone masonry and is in poor condition. An assessment of this dam is needed, such as an investigation of current risks to downstream development, future downstream development and the commuter rail.

#### Ongoing Culvert and Drainage Upgrades

The town should continue to monitor and alleviate localized flooding problems with culvert or pipe upgrades, as it has done successfully in the past.

#### More Frequent Maintenance of Town-Owned Drainage Facilities

Additional funding for more frequent maintenance of town-owned drainage facilities would be helpful (removal of sediment, etc.). The town should develop a map and schedule for catch basin cleaning.

#### Acquire GIS And Create An Inventory Of Drainage Infrastructure

The town should acquire GIS and create an inventory of drainage infrastructure.

#### Land Acquisition / Protection of Open Space

Although Acton does not see significant flooding in the town compared to more urbanized towns, protection of open space in the wake of development is important in order to ensure future development does not increase flooding. The town should continue its efforts for open space purchases and negotiate conservation restrictions and easements

### **Other Potential Mitigation Measures**

A number of additional mitigation measures arose during the course of the project. These additional measures were either considered to be a low priority, a better alternative was

deemed a medium or high priority, or they were not considered feasible. However, it is worth recording them in the plan, because they could be revisited in the future. They include:

Long-Term Solution to Stop Boxborough Condominiums From Flooding

A long-term solution is needed to stop flooding at the condominium complex in Boxborough that floods as a result of beaver activity in Acton.

Expand MIT Low-Impact Pilot Project

MIT graduate students developed a low-impact design (LID) for reducing runoff effects at Jones Field consisting of a rain garden. The town should continue the pilot projects and secure funding to construct the LID techniques.

Assessment of Options for Fire Water Service if an Earthquake

95% of the town is served by fire hydrants. If the water system goes down, such as a result of a major earthquake, it would be difficult to find water for fire fighting. There are some fire ponds in Acton, but not likely enough if a major earthquake hit. An assessment of options for water service in the event of an earthquake should be completed.

## **Potential Mitigation Summary Table**

The following columns are included in the summary table:

Description of the Mitigation Measure – The description of each mitigation measure is brief.

Priority – The designation of high, medium or low priority was determined by the Local Multiple Hazard Community Planning Team meeting. The designations could change as conditions in the community change. Low priority and non-prioritized measures are not included in the table.

Lead Implementation – MAPC designated implementation responsibility based on general knowledge of the community. It is likely that most mitigation measures will require that several departments work together and assigning staff is the sole responsibility of the governing body of each community. In some cases, a non-local entity would ideally be the lead implementer.

Time Frame – The time frame was based on a combination of the priority for that measure, the complexity of the measure and whether or not the measure is conceptual, in design, or already designed and awaiting funding. The identification of a likely time frame is not meant to constrain a community from taking advantage of funding opportunities as they arise.

Estimated Cost – The cost data are estimates that represent a point in time and would need to be adjusted for inflation and for any changes or refinements in the design of a particular mitigation measure. Cost information is approximate only and is either provided by the community or from MAPC staff experience. The cost data represent a point in time and would need to be adjusted for inflation and for any changes or refinements in the design of a particular mitigation measure.

Potential Funding Sources – This column attempts to identify possible sources of funding for a specific measure. This information is preliminary and varies depending on a number of factors such as whether a mitigation measure has been studied, evaluated or designed or is still in the conceptual stages. Each grant program and agency has specific eligibility requirements that would need to be taken into consideration. In most instances, the measure will require a number of different funding sources. Identification of a potential funding source in this table does not guarantee that a project will be eligible for or selected for funding. Upon adoption of this plan, the local committee responsible for its implementation should begin to explore the funding sources in more detail.

The best way to determine eligibility for a particular funding source is to review the project with the funding agency. The following websites provide an overview of programs and funding sources.

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Army Corps of Engineers (ACOE) – The website for the North Atlantic district office is <http://www.nae.usace.army.mil/>. The ACOE provides assistance for a number of types of projects including shoreline/streambank protection, flood damage reduction, flood plain management services and planning services.

FEMA – As noted earlier, see <http://www.fema.gov/government/grant/government.shtm> for more information.

Massachusetts Emergency Management Agency (MEMA) – The grants page <http://www.mass.gov/dem/programs/mitigate/grants.htm> has a useful table that compares eligible projects for the Hazard Mitigation Grant Program and the Flood Mitigation Assistance Program.

United States Department of Agriculture – The USDA has programs by which communities can get grants for fire fighting needs. See the link below for examples. <http://www.rurdev.usda.gov/rd/newsroom/2002/cfg.html>

**Table 15: Potential Mitigation Measures in Acton**

Mitigation Measure	Priority	Lead Implementation	Time Frame	Estimated Cost	Potential Funding Sources
<i>TABLE TO BE COMPLETED FOR FINAL DRAFT</i>					

**Abbreviations Used in Table 15**

FEMA Mitigation Grants includes:

- FMA = Flood Mitigation Assistance Program.
- HMGP = Hazard Mitigation Grant Program.
- PDM = Pre-Disaster Mitigation Program

ACOE = Army Corps of Engineers.

MHD = Massachusetts Highway Department.

EOT = Executive Office of Transportation.

DCR = Department of Conservation and Recreation

DHS/EOPS = Department of Homeland Security/Emergency Operations

EPA/DEP (SRF) = Environmental Protection Agency/Department of Environmental Protection (State Revolving Fund)

USDA = United States Department of Agriculture

## **VIII. REGIONAL AND INTER-COMMUNITY CONSIDERATIONS**

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Some hazard mitigation issues are strictly local. The problem originates primarily within the municipality and can be solved at the municipal level. Other issues are inter-community and require cooperation between two or more municipalities. There is a third level of mitigation which is regional and may involve a state, regional or federal agency or three or more municipalities.

### **Regional Partners**

In many communities, mitigating natural hazards is more than a local issue. The facilities that serve these communities are complex systems owned and operated by a wide array of agencies, government, and private entities. In Acton, this includes but is not limited to the Town of Acton, Massachusetts Highway Department (MassHighway), the Massachusetts Bay Transportation Authority (MBTA), and the Department of Fisheries and Wildlife. The planning, construction, operations and maintenance of these facilities are integral to the hazard mitigation efforts of communities. These agencies must be considered the communities' regional partners in hazard mitigation. These agencies also operate under the same constraints as communities do, including budgetary and staffing constraints and numerous competing priorities. In the sections that follow, the plan includes recommendations for activities to be undertaken by these other agencies. Implementation of these recommendations will require that all parties work together to develop solutions.

### **Regional Facilities within Acton**

Major facilities owned, operated and maintained by federal, state, regional or private entities in Acton include Routes 2, 27, 2A, 111, 119, 62 (MassHighway) and the MBTA Fitchburg line Commuter Rail and a station with service to Boston (MBTA). According to the town's Open Space Plan, the state owns roughly 200 acres of land in Acton. Land includes the Department of Corrections Farm (land that was part of the prison farm – it is leased to the town for recreational fields), a State Police horse barn and fields, land taken to build Route 2 that lies outside of the right-of-way and land owned by the Department of Fisheries and Wildlife.

### **Inter-Community Considerations**

As Acton is undergoing significant development, so are adjacent communities. For example, a 40B housing development is in the works across Acton's eastern border in Concord. In order to avoid impacts from any residential and commercial development, communication between Acton and the surrounding communities, including input in the review processes, is vital.

Another regional development issue includes the neighboring Stowe airfield. Heath Hen Meadow is adjacent to the airfield and is a major flood plain shared by Acton, Boxborough and Stow. This is a swampy area with feeders to Fort Pond Brook. The portion in Acton is conservation land. If the airfield were ever expanded, impacts to the natural area and its ability to act as flood storage would be of concern.

In addition, according to Acton's Open Space Plan, a regional approach to open space preservation should be taken in order to create linkages and ensure that open space of regional significance is identified and protected.

Another regional issue of significance is the widespread effects of beaver dams in the area. Much of the localized flooding that occurs is due to beaver activity. The towns will mitigate the problem temporarily by hiring trappers, removing dams, or installing pipes, but a long-term comprehensive approach should be considered.

## **IX. PLAN ADOPTION AND MAINTENANCE**

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### **Plan Adoption**

The Acton Annex of the MAGIC Regional Multi-Hazard Mitigation Plan was adopted by the Board of Selectmen on xx, 2008. See Appendix D for documentation.

### **Plan Maintenance**

MAPC recommends the following approach to plan maintenance.

#### Regional Implementation Group

In order to ensure that the regional plan is monitored, evaluated and updated, MAPC recommends that the MAGIC Hazard Mitigation Community Planning Team which was established for this planning process, continue to meet on an as-needed basis to function as the Regional Implementation Group for the regional plan. Because the grantee is a regional planning agency which does not have the authority to appoint this committee, the chief elected officials of the nine communities would need to take this step.

This group will select a chair that is willing to provide regional leadership, oversee the implementation schedule detailed below and provide administrative support to the process. An alternative approach would be for each community to secure funding to hire a consultant or MAPC to provide support for the process described below. Because the plan was prepared by MAPC, having MAPC continue to monitor and prepare an updated plan would ensure a level of continuity and consistency that would benefit the communities. Contingent on funding being available, MAPC could take on this role.

#### Local Implementation Group

MAPC worked with the local teams to prepare this annex. In Acton, this Team was an ad hoc group pulled together for this project. MAPC recommends that this group continue to meet on an as-needed basis to function as the Local Implementation Group. Additional members will be added to the local implementation group from businesses, non-profits and institutions.

### **Implementation Schedule**

#### Yearly Survey and Annual Report

Once a year the chair of the Regional Implementation Group will prepare and distribute a survey to all of the local implementation groups. The survey will poll the local groups on any changes, revisions and accomplishments from the local and regional perspective and will also survey the communities to determine if any new hazards or problem areas have been identified.

This information will be used to prepare an annual report or addendum to the regional plan and the annexes. The Local Implementation Groups will have primary responsibility for updating the annexes.

The Regional Implementation Group will meet after all communities have responded to the survey to review any changes in regional goals or mitigation measures and to be briefed on any changes that may have occurred in the Federal Disaster Mitigation Act or hazard mitigation guidelines.

#### Yearly Review of Regional Mitigation Measures

The Regional Implementation Group will meet twice a year (at a minimum) to review the list of regional mitigation measures and begin to develop a priority list for implementation.

#### Develop Fourth Year Update Subcommittee

At the start of the fourth year after initial plan adoption, the chair of the Regional Implementation Group will convene a subcommittee to prepare an update of the plan. At this point, the Regional Implementation Group may decide to undertake the update themselves, contract with the MAPC to update the plan, or hire another consultant.

#### Prepare and Adopt New Community Annexes and Regional Plan

However the Regional Implementation Group decides to update the plan, the group will need to review the current disaster mitigation plan guidelines for any changes. The plan update subcommittee will present the full Regional Implementation Group with a new plan for each community to adopt and forward to MEMA and DCR for review and to FEMA for approval.

### **Integration of the Plans with Other Planning Initiatives**

Upon approval of the regional plan and annexes by FEMA, each local committee will provide all interested parties and implementing departments with a copy of the plan and will initiate a discussion regarding how the plan can be integrated into that department's ongoing work. At a minimum, the plan will be reviewed and discussed with the following departments:

- Fire / Emergency Management
- Police
- Public Works / Highway
- Engineering
- Planning and Community Development
- Conservation
- Parks and Recreation
- Health
- Building

Other groups that will be coordinated with include large institutions (hospitals, colleges), Chambers of Commerce, land conservation organizations and watershed groups. The plans will also be posted on a community's website with the caveat that each community will review the plan for sensitive information that would be inappropriate for public posting. The posting of the plan on a web site will include a mechanism for citizen feedback such as an e-mail address to send comments.

## X. RESOURCES

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### *RESOURCE LIST TO BE COMPLETED FOR FINAL DRAFT*

- State Haz mit plan
- US Census
- MAPC Buildout
- FEMA flood maps
- McConnell Land Use Stats
- FEMA How-to Guides
- Suasco Study, 2005
- Master Plan update, 1998
- Open Space & Rec Plan -2002
- To Live in Acton Community Development EO 418 Plan, 2004
- SWMP NPDES Plan, 2003
- East Acton Village Plan, 2004
- South Acton Village Plan, 1995
- West Acton Village Plan, 1994
- Acton Reconnaissance Report, Massachusetts Heritage Landscape Inventory Program, 2006
- Acton Shoreline survey, 1998
- 1988 Flood Insurance Study
- Stormwater Mitigation Records, 2005
- Construction Site Runoff Assessment, 2005
- Post-Construction Assessment, 2005
- Assabet Dam Emergency Action Plan, 2004
- NPDES Stormwater Plan Annual Report, 2007
- Morrison Farm Reuse, January 2007
- Kelly's Corner Specific Area Plan, 1995
- Water Management Plan, 2004
- Zoning Map
- Groundwater Protection Map
- Zoning bylaw, 2007
- Subdivision Rules and Regulations, 2001
- Wetland Bylaw
- Wetlands Regulations, 2004
- Acton Conservation Land Map
- CEMP plan
- LEPC
- <http://www.town.acton.ma.us/>
- <http://www.actonconservationtrust.org/>
- <http://www.actontrails.org/>
- <http://www.actonstreams.org/> (Acton Stream Team)
- Acton Water District: <http://www.actonh2o.com/>

## APPENDIX A: NATURAL HAZARDS MAPS

The MAPC GIS (Geographic Information Systems) Lab produced a series of maps for each community. Some of the data came from the Northeast States Emergency Consortium (NESEC). More information on NESEC can be found at <http://www.serve.com/NESEC/>. Due to the various sources for the data and varying levels of accuracy, the identification of an area as being in one of the hazard categories must be considered as a general classification that should always be supplemented with more local knowledge. The documentation for some of the hazard maps was incomplete as well.

The map series consists of four panels with two maps each plus one map taken from the State Hazard Mitigation Plan.

Map 1.	Population Density
Map 2.	Potential Development
Map 3.	Flood Zones
Map 4.	Earthquakes and Landslides
Map 5.	Hurricanes and Tornadoes
Map 6.	Average Snowfall
Map 7.	Composite Natural Hazards
Map 8.	Hazard Areas

**Map 1: Population Density** – This map uses the US Census block data for 2000 and shows population density as the number of people per acre in seven categories with 60 or more people per acre representing the highest density areas.

**Map 2: Potential Development** – This map shows potential future developments, and critical infrastructure sites. MAPC consulted with town staff to determine areas that were likely to be developed or redeveloped in the future.

**Map 3: Flood Zones** – The map of flood zones used the FEMA Q3 Flood Zones as its source. For more information, refer to [http://www.fema.gov/fhm/fq\\_q3.shtm](http://www.fema.gov/fhm/fq_q3.shtm). The definitions of the flood zones are described in more detail at [http://www.fema.gov/fhm/fq\\_term.shtm](http://www.fema.gov/fhm/fq_term.shtm). The flood zone map for each community also shows repetitive loss sites, critical infrastructure and municipally owned and protected open space. As defined by the Community Rating System (CRS) of the National Flood Insurance Program (NFIP), a repetitive loss property is any property, which the NFIP has paid two or more flood claims of \$1,000 or more in any given 10-year period since 1978. For more information on repetitive losses see <http://www.fema.gov/nfip/replps.shtm>.

**Map 4: Earthquakes and Landslides** – This information came from NESEC. For most communities, there was no data for earthquakes because only the epicenters of an earthquake are mapped.

The landslide information shows areas with either a low susceptibility or a moderate susceptibility to landslides based on mapping of geological formations. This mapping is highly general in nature. For more information on how landslide susceptibility was mapped, refer to <http://pubs.usgs.gov/pp/p1183/pp1183.html>.

**Map 5: Hurricanes and Tornadoes** – This map shows a number of different items. The map includes the storm tracks for both hurricanes and tropical storms. This information must be viewed in context. A storm track only shows where the eye of the storm passed through. In most cases, the effects of the wind and rain from these storms were felt in other communities even if the track was not within that community. This map also shows the location of tornadoes with a classification as to the level of damages. What appears on the map varies by community since not all communities experience the same wind-related events. These maps also show the 100 year wind speed.

**Map 6: Average Snowfall** - - This map shows the average snowfall, repetitive loss structures and open space. It also shows storm tracks for nor'easters, if any storms tracked through the community.

**Map 7: Composite Natural Hazards** - This map shows four categories of composite natural hazards for areas of existing development. The hazards included in this map are 100 year wind speeds of 110 mph or higher, low and moderate landslide risk, FEMA Q3 flood zones (100 year and 500 year) and hurricane surge inundation areas. Areas with only one hazard were considered to be low hazard areas. Moderate areas have two of the hazards present. High hazard areas have three hazards present and severe hazard areas have four hazards present.

**Map 8: Hazard Areas** – For each community, locally identified hazard areas are overlaid on an aerial photograph dated April, 2001. The critical infrastructure sites and repetitive loss sites are also shown. The source of the aerial photograph is Mass GIS.

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**APPENDIX B:**

**MEETING AGENDAS FOR:**

**METRO BOSTON NORTH/WEST REGIONAL HAZARD  
MITIGATION COMMUNITY PLANNING TEAM**

**AND**

**LOCAL MULTIPLE HAZARD COMMUNITY PLANNING TEAM**

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**APPENDIX C:**

**DOCUMENTATION OF THE PUBLIC MEETING**

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**APPENDIX D:**

**DOCUMENTATION OF PLAN ADOPTION BY THE BOARD OF  
SELECTMEN**