



# **CITY OF MEDFORD HAZARD MITIGATION PLAN**

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# CITY OF MEDFORD HAZARD MITIGATION PLAN

## ACKNOWLEDGEMENTS AND CREDITS

This plan was prepared for the City of Medford 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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## I. EXECUTIVE SUMMARY

Hazard Mitigation planning is a proactive effort to identify actions that can be taken to reduce the dangers to life and property from natural hazard events. In the communities of the Boston region of Massachusetts, hazard mitigation planning tends to focus most on flooding, the most likely natural hazard to impact these communities. The Federal Disaster Mitigation Act of 2000 requires all municipalities that wish to be eligible to receive FEMA funding for hazard mitigation grants, to adopt a local multi-hazard mitigation plan and update this plan in five year intervals.

### **Planning Process**

Planning for the Medford Hazard Mitigation Plan update was led by the Medford Local Hazard Mitigation Planning Committee, composed of staff from a number of different City Departments. This committee discussed where the impacts of natural hazards most affect the City, goals for addressing these impacts, and hazard mitigation measures that would benefit the City.

Public participation in this planning process is important for improving awareness of the potential impacts of natural hazards and to build support for the actions the City takes to mitigate them. The City hosted two public meetings, the first on May 2, 2013 and the second on June 11, 2013. The draft plan also was posted on the City's website for public review and comment for a ten day period following the second public meeting and completion of the first draft of the Plan. Both meetings included a description of the hazard mitigation planning process and an overview of the plan, and the second meeting included a summary of the proposed mitigation actions as well as directions on how the public could access the draft plan on the City website and make comments. The public was given time to ask questions and comment at all public meetings. A list of those submitting public comments can be found in Appendix C.

Preceding these meetings, a public, regional meeting of the Metro Boston Multiple Hazard Community Planning Team was held April 13, 2012 to re-introduce participating communities to the hazard mitigation planning process and to identify inter-community hazard mitigation issues.

### **Risk Assessment**

The Medford Hazard Mitigation Plan assesses the potential impacts to the City from flooding, high winds, severe storms, brush fire, and geologic hazards. Flooding, as a result of hurricanes, nor'easters and other severe storms, clearly presents the greatest hazard to the City, most especially in locations where the drainage system has under capacity infrastructure or has issues such as siltation that have limited the existing capacity of pipes and channels. This is the case in locations such as South Medford and areas around Meetinghouse Brook.

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The Medford Local Committee identified those areas where flooding most frequently occurs, comprising approximately 9% of the City's land area, and approximately 1,436 buildings worth an estimated \$429,017,480.

### **Hazard Mitigation Goals**

1. Prevent and reduce the loss of life, injury 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 City 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 all applicable standards for preventing and reducing the impacts of natural hazards.
8. Take maximum advantage of resources from FEMA, MEMA and other agencies to educate City staff and the public about hazard mitigation.

### **Hazard Mitigation Strategy**

The Medford Local Committee identified a number of mitigation measures that would serve to reduce the City's vulnerability to natural hazard events. Largely these are related to maintaining the integrity of the drainage system through addressing maintenance, reconstruction and replacements issues. There is also a strong emphasis on preventative measures such as working with private landowners to clear catch basins and working with utility companies to trim trees around utility lines so that both hazard mitigation and emergency response can be handled efficiently and effectively.

Overall, the hazard mitigation strategy recognizes that mitigating hazards for Medford will be an ongoing process as our understanding of natural hazards and the steps that can be taken to mitigate their damages changes over time. Global climate change and the accompanying changes to precipitation amounts and frequency and average temperatures impact the City's vulnerability, and local officials will need to work together across municipal lines and with state and federal agencies in order to understand and address

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these changes. The Hazard Mitigation Strategy will be incorporated into other related plans and policies.

### Plan Review and Update Process

**Table 1. Plan Review and Update**

Chapter	Reviews and Updates
III – Planning Process and Public Participation	The Medford Local Committee placed an emphasis on public participation for the update of the Hazard Mitigation Plan, discussing strategies to enhance participation opportunities at the first local committee meeting. During plan development, the plan was discussed at a two public meetings hosted by the City. The second meeting, which was a Committee of the Whole meeting. The plan was also available on the City’s website for public comment.
IV – Risk Assessment	MAPC gathered the most recently available hazard and land use data and met with City staff to identify changes in local hazard areas and development trends. City staff reviewed critical infrastructure with MAPC staff in order to create an up-to-date list. MAPC also used the most recently available version of HAZUS and assessed the potential impacts of flooding using the latest data.
V - Goals	The Hazard Mitigation Goals from the 2008 Plan were reviewed and endorsed by the Local Hazard Mitigation Committee.
VI – Existing Mitigation Measures	The list of existing mitigation measures was updated to reflect current mitigation activities in the City.
VII & VIII – Hazard Mitigation Strategy	Mitigation measures from the 2008 plan were reviewed and assessed as to whether they were completed, on-going, or deferred. The Local Committee determined whether to carry forward measures into the 2013 plan or delete them. The 2013 Hazard Mitigation Strategy reflects both new measures and measures carried forward from the 2008 plan. The Committee re-prioritized all of these measures based on current conditions.
IX – Plan Adoption & Maintenance	This section of the plan was updated with a new on-going plan implementation review and five year update process that will assist the City in incorporating hazard mitigation issues into other City planning and regulatory review processes and better prepare the City to update the plan in 2017.

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As indicated on Table 18, Medford has made progress on implementing mitigation measures identified in the 2008 Hazard Mitigation Plan. While some of the measures identified in that plan were completed, many more still require the continued study and identification of funding resources to support construction and/or equipment purchases. Moving forward into the next five year plan implementation period, there will be many more opportunities to incorporate hazard mitigation into the City's decision making processes.

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## II. INTRODUCTION

### **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 FEMA funding for hazard mitigation grants, must adopt a local multi-hazard mitigation plan and update this plan in five year intervals. This planning requirement does not affect disaster assistance funding.

Federal hazard mitigation planning and grant programs are administered by the Federal Emergency Management Agency (FEMA) in collaboration with the states. These programs are administered in Massachusetts by the Massachusetts Emergency Management Agency (MEMA) in partnership with the Department of Conservation and Recreation (DCR). Massachusetts has taken a regional approach and has encouraged the regional planning agencies to apply for grants to prepare plans for groups of their member communities. The Metropolitan Area Planning Council (MAPC) received a grant from FEMA under the Pre-Disaster Mitigation (PDM) Program to assist the City of Medford, and seven other municipalities in the Inner Core region, to update their local Hazard Mitigation Plans, which were first adopted in 2008 as part of a Metro-Boston Multi Hazard Mitigation Plan. These local Hazard Mitigation Plan updates are designed to meet the requirements of the Disaster Mitigation Act for each community.

In order to address multijurisdictional and regional issues, the participating municipalities were afforded the opportunity to meet with their neighboring communities during plan development. A public, regional meeting of the Metro Boston Multiple Hazard Community Planning Team was held April 13, 2012 to re-introduce participating communities to the hazard mitigation planning process and to identify inter-community hazard mitigation issues.

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

Natural hazard mitigation planning is the process of determining how to systematically 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 resulting from natural hazards through long-term strategies. These long-term strategies include planning, policy changes, programs, projects, and other activities.

### **Previous Federal/State Disasters**

The City of Medford has experienced 16 natural hazards that triggered federal or state disaster declarations since 1991. These are listed in Table 2. The vast majority of these events involved flooding.

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**Table 2. Previous Federal/State Disaster Declarations**

<b>DISASTER NAME (DATE OF EVENT)</b>	<b>TYPE OF FEDERAL ASSISTANCE PROVIDED</b>	<b>DECLARED AREAS IN MA</b>
Hurricane Bob (August 1991)	FEMA Public Assistance Project Grants	Counties of Barnstable, Bristol, Dukes, Essex, Hampden, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Hampden, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk (16 projects)
No-Name Storm (October 1991)	FEMA Public Assistance Project Grants	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk
	FEMA Individual Household Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk
March Blizzard (March 1993)	FEMA Public Assistance Project Grants	Statewide
January Blizzard (January 1996)	FEMA Public Assistance Project Grants	Statewide
October Flood (October 1996)	FEMA Public Assistance Project Grants	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
	FEMA Individual Household Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
	Hazard Mitigation Grant Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
(1997)	Community Development Block Grant-HUD	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
June Flood (June 1998)	FEMA Individual Household Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester

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**Table 2. Previous Federal/State Disaster Declarations**

<b>DISASTER NAME (DATE OF EVENT)</b>	<b>TYPE OF FEDERAL ASSISTANCE PROVIDED</b>	<b>DECLARED AREAS IN MA</b>
	Community Development Block Grant-HUD	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
March Flood (March 2001)	FEMA Individual Household Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester (16 projects)
February Snowstorm (Feb 17-18, 2003)	FEMA Public Assistance Project Grants	Statewide
January Blizzard (January 22-23, 2005)	FEMA Public Assistance Project Grants	Statewide
Hurricane Katrina (August 29, 2005)	FEMA Public Assistance Project Grants	Statewide
May Rainstorm/Flood (May 12-23, 2006)	Hazard Mitigation Grant Program	Statewide
April Nor'easter (April 15-27, 2007)	Hazard Mitigation Grant Program	Statewide
Flooding (March, 2010)	FEMA Public Assistance FEMA Individuals and Households Program SBA Loan	Bristol, Essex, Middlesex, Suffolk, Norfolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Statewide
Tropical Storm Irene (August 27-28, 2011)	FEMA Public Assistance	Statewide
Hurricane Sandy (October 27-30, 2012)	FEMA Public Assistance	Statewide

(Source: database provided by MEMA)

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### FEMA Funded Mitigation Projects

Over the last 20 years the City of Medford has received funding from FEMA for one mitigation project under the Hazard Mitigation Grant Program (HMGP). These project totaled \$718,350 with \$535,850 covered by FEMA grants and \$182,500 by funding from the City. The projects are summarized in Table 3 below.

**Table 3. FEMA-Funded Mitigation Projects**

<b>Year</b>	<b>Project Title (Funding Source)</b>	<b>Scope of Work</b>	<b>Total Cost</b>	<b>Federal Funding</b>	<b>Local Funding</b>
2012	Wright's Pond Dam Improvements	Construct secondary outlet and emergency riprap lined spillway; modify existing outlet; install culvert and pipe	\$718,350	\$535,850	\$182,500

(Source: database provided by MEMA)

### Community Profile

The City of Medford is a suburban city located on the Mystic River, approximately 5 miles north and west of the City of Boston. The City has a land area of 8.29 square miles, and it is bordered by the Towns of Winchester and Stoneham to the north, the Cities of Malden and Everett to the east, the City of Somerville to the south, and City of Arlington to the west. Interstate 93 runs north to south through the central section of the City, and State Routes 28 and 38 run north to south and State Routes 16 and 60 run east to west. The MBTA Wellington Orange Subway line stop is located in the southeast section of the City, and the West Medford stop of the MBTA Lowell Commuter Rail Line is located in the northwest section. The MBTA Green Line service is planned for an extension into Medford along the Lowell Commuter Rail corridor.

Originally the site of estates owned by Governors Cradock and Winthrop, Medford was founded in 1630 and was incorporated as a city in 1892. The city's colonial prosperity was based on being a tidewater seaport with shipbuilding and distilling. One early industry was shipbuilding using lumber harvested from the Fells. Other early industries included brick yards and quarrying Medford granite. Tufts University was founded in 1852. Fueled by its industrial prosperity, Medford grew quickly; between 1870 and 1910 the city doubled in population every 20 years. There are now many suburban neighborhoods in Medford resulting from the rapid and dense development which followed after the First World War

Two rivers intersect with the City, with the Mystic River running from the Mystic Lakes along the southern portion of the City and the Malden River running along the eastern border of the City. Medford is located entirely within the Mystic River Watershed, which is a sub-watershed of the Boston Harbor Watershed.

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**Table 4. Medford Characteristics, 2010**

Population = 56,173
<ul style="list-style-type: none"><li>• 5.2% are under age 5</li><li>• 15.2% are over age 65</li><li>• 11.9% speak English less than “very well” (over age 5)</li><li>• 10.8% of households have no vehicle</li><li>• 3.5% live in group quarters</li></ul>
Number of Housing Units = 24,046
<ul style="list-style-type: none"><li>• 60.3% of housing units were built prior to 1940</li></ul>

Source: Source: U.S. Census, 2010. 2006-2010 American Community Survey

The City maintains a website at <http://www.medford.org/>

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## III. PLANNING PROCESS AND PUBLIC PARTICIPATION

MAPC employs a six step planning process based on FEMA’s hazard mitigation planning guidance focusing on local needs and priorities but maintaining a regional perspective matched to the scale and nature of natural hazard events. Public participation is a central component of this process, providing critical information about the local occurrence of hazards while also serving as a means to build a base of support for hazard mitigation activities. MAPC supports participation by the general public and other plan stakeholders through Regional and Local Hazard Mitigation Planning Committees, two public meetings hosted by the City, posting of the plan to the City’s website, and invitations sent to neighboring cities and towns, City boards and commissions, and other local or regional entities to review the plan and provide comment.

### Planning Process Summary

The six-step planning process outlined below is based on the guidance provided by FEMA in the Local Multi-Hazard Mitigation Planning Guidance, July 1, 2008. Public participation is a central element of this process, which attempts to focus on local problem areas and identify needed mitigation measures based on where gaps occur in the existing mitigation efforts of the municipality. By working on municipal hazard mitigation plans in groups of neighboring cities and towns, MAPC is able to identify regional opportunities for collaboration and facilitate communication between communities. In plan updates, the process described below allows staff to bring the most recent hazard information into the plan, including new hazard occurrence data, changes to a municipality’s existing mitigation measures, and progress made on actions identified in previous plans.



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1. Map the Hazards – MAPC relies on data from a number of different federal, state, and local sources in order to map the areas with the potential to experience natural hazards. This mapping represents a multi-hazard assessment of the municipality and is used as a set of base maps for the remainder of the planning process. A particularly important source of information is the knowledge drawn from local municipal staff on where natural hazard impacts have occurred, which is collected. These maps can be found in Appendix B.
2. Assess the Risks & Potential Damages – Working with local staff, critical facilities, infrastructure, vulnerable populations, and other features are mapped and contrasted with the hazard data from the first step to identify those that might represent particular vulnerabilities to these hazards. Land use data and development trends are also incorporated into this analysis. In addition, MAPC develops estimates of the potential impacts of certain hazard events on the community.
3. Review Existing Mitigation – Municipalities in the Boston Metropolitan Region have an active history in hazard mitigation as many have adopted flood plain zoning districts, wetlands protection programs, and other measures as well as enforcing the State building code, which has strong provisions related to hazard resistant building requirements. All current municipal mitigation measures must be documented.
4. Develop Mitigation Strategies – MAPC works with the local municipal staff to identify new mitigation measures, utilizing information gathered from the hazard identification, vulnerability assessments, and the community's existing mitigation efforts to determine where additional work is necessary to reduce the potential damages from hazard events. Additional information on the development of hazard mitigation strategies can be found in Chapter VII.
5. Plan Approval & Adoption – Once a final draft of the plan is complete it is sent to MEMA for the state level review and, following that, to FEMA for approval. Typically, once FEMA has approved the plan the agency issues a conditional approval with the condition being adoption of the plan by the municipality. More information on plan adoption can be found in Chapter IX and documentation of plan adoption can be found in Appendix D.
6. Implement & Update the Plan – Implementation is the final and most important part of any planning process. Hazard Mitigation Plans must also be updated on a five year basis making preparation for the next plan update an important on-going activity. Chapter IX includes more detailed information on plan implementation.

### **2008 Plan Implementation and Maintenance**

The 2008 Medford Annex to the Metro Boston Regional Multi-Hazard Mitigation Plan contained a risk assessment of identified hazards for the City and mitigation measures to address the risk and vulnerability from these hazards. Since approval of the plan by FEMA and local adoption, progress has been made on implementation of the measures.

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The City has advanced a number of projects for implementation, including drainage improvements planned for Sydney Street, Cradock Avenue and Winter Brook as well as an improvement study and project for Wright's Pond Dam. The City has also updated plans such as the 2011 Open Space and Recreation Plan Update to integrate concerns about areas of flooding and adopted a Wetland Ordinance to serve as a preventative measure for planned developments.

The City has advanced these projects in a fiscal environment that is often constrained and where municipal staff is often conducting work in multiple roles. As such, much of the coordination around projects that either directly or indirectly address mitigation measures has occurred through small groups rather than through a regular convening of a local mitigation team. In addition, the City was prepared to engage in the plan update process from the Regional Committee meeting through to the local team and public meetings.

### **2013 Plan Update**

#### Medford's Participation in the Regional Committee

On February 28, 2010 a letter was sent notifying the communities of the first meeting of the Metro Boston Hazard Mitigation Planning Committee and requesting that the Chief Elected Official designate a minimum of two municipal employees and/or officials to represent the community. The following individuals were appointed to represent Medford on the regional committee:

Leo Sacco, Jr.	Police Chief
Frank Gilberti Jr.	Fire Chief
Paul Mochi	Building Commissioner
Paul Gere	Department of Public Works
Fred Mangone	Emergency Management

In addition, Stephanie M. Burke, Director of Budget and Personnel, provided assistance in coordinating local team meetings and information sharing throughout the update process.

The regional committee serves as an opportunity for neighboring communities to discuss hazard mitigation issues of shared concern. The Metro Boston Regional Committee met on April 13, 2010 and was attended by representatives from the neighboring municipalities of Brookline, Cambridge, Chelsea, Everett, Malden, Medford, Melrose, and Somerville. At that meeting, the communities began the process of reviewing and revising their 2008 Natural Hazard Mitigation Plans and were re-introduced to the following items:

- The Massachusetts State Hazard Mitigation Plan and the FEMA hazard mitigation planning and grant process;
- The concept of each community engaging staff and the public to update its current Natural Hazard Mitigation Plan;

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- FEMA plan overview and requirements and plan eligibility;
- Review of the overall scope of work and plan revision schedule
- Question and of Discussion of local issues, inter-community and Metro Boston Region hazard mitigation issues and how to address.
- Re-introduction to identifying and mapping municipal Critical Facilities, municipal Areas of Concern, Inter-Community Areas of Concern, and Regional Shared areas of Concern.
- Municipal representatives were also briefed on the importance of trying to create a diversified presence on the local Multiple Hazard Community Planning Team in advance of local team meetings, being asked to contact major employers, business owners, schools and non-profit organizations to participate in the process.

In addition, as the same group of MAPC staff is working on each community’s plan, these issues of shared concern, and other issues that may arise between neighboring communities, are discussed in greater detail in local committee meetings and resulting actions are reflected in the identified mitigation measures, as noted in Chapter VI.

### The Local Hazard Mitigation Planning Team

The Local Hazard Mitigation Planning Team is central to the planning process as it is the primary body tasked with developing a mitigation strategy for the community. Given this role, it is important that the committee include a diverse representation of community stakeholders and knowledgeable municipal staff.

Given the City of Medford’s large number of stakeholders and staff whose participation in this process was desirable, it was decided that a project steering committee would be given oversight of the planning process and tasked with setting plan goals while smaller working groups would used, when needed, to provide information on the impacts of hazards on the City, existing mitigation measures, and help to develop new mitigation measures. The steering committee membership can be found in the table below. The steering committee met on March 11, 2013, March 27, 2013 and May 3, 2013.

**Table 5. Medford Local Hazard Mitigation Planning Team**

<b>Name</b>	<b>Representing</b>
Stephanie Burke	Personnel and Budget
Paul F. Mochi	Building Department
Cassandra Koutalidis, P.E.	Engineering Division
Mark Shea	Engineering Division
Penny Antonoglou	Engineering Division
Mark E. Rumley	Law Department
Alicia Hunt	Energy and Environment
Paul Gere	Department of Public Works
Lauren DiLorenzo	Office of Community Development
Clodagh Stoker-Long	Office of Community Development

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**Table 5. Medford Local Hazard Mitigation Planning Team**

<b>Name</b>	<b>Representing</b>
Laura Glynn	Office of Community Development
Chief Frank Gilberti, Jr.	Fire Department
Deputy Fire Chief Martin Cunniff	Fire Department
Captain Richard Colorusso	Fire Department
Chief Leo Sacco, Jr.	Police Department
Captain Barry Clemente	Police Department
Fred Mangone	Civil Defense/Emergency Management

### Public Meetings

Public participation in the hazard mitigation planning process is important, both for plan development and for later implementation of the plan. Residents, business owners, and other community members are an excellent source for information on the historic and potential impacts of natural hazard events and particular vulnerabilities the community may face from these hazards. Their participation in this planning process also builds understanding of the concept of hazard mitigation, potentially creating support for mitigation actions taken in the future to implement the plan. To gather this information and educate residents on hazard mitigation, the City hosted two public meetings, one during the planning process and one after a complete draft plan was available for review.

Natural hazard mitigation plans unfortunately rarely attract much public involvement in the Boston region, unless there has been a recent hazard event. One of the best strategies for overcoming this challenge is to include discussion of the hazard mitigation plan on the agenda of an existing board or commission. With this strategy, the meeting receives widespread advertising and a guaranteed audience of the board or commission members plus those who attend the meeting. These board and commission members represent an engaged audience that is informed and up to date on many of the issues that relate to hazard mitigation planning in the locality and will likely be involved in plan implementation, making them an important audience with which to build support for hazard mitigation measures. In addition, these meetings frequently receive press coverage expanding the audience that has the opportunity to hear the presentation and provide comment by phoning or emailing local staff.

The public had an opportunity to provide input to the Medford hazard mitigation planning process during a public meeting, on May 2, 2013 held in the Medford City Hall. A draft of the plan update was presented at Committee of the Whole meeting held on June 11, 2013. This meeting was also held in the Medford City Hall.

The first meeting was publicized as a standalone public meeting. The presentation of the draft plan update was publicized as a Committee of the Whole meeting. The attendance list for each meeting can be found in Table 6.

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**Table 6. Attendance at Public Meetings**

<b>Name</b>	<b>Organization or Neighborhood</b>
<b><u>First Public Meeting – May 3, 2013</u></b>	
Mayor Michael J. McGlynn	Office of the Mayor
Lauren DiLorenzo	Community Development
John Bavuso	Code Enforcement Officer
Alicia Hunt	Energy and Environment
Dale Bryan	Tufts University
<b><u>Second Public Meeting – June 11, 2013</u></b>	
Robert Maiocco	Councillor, President
Frederick Dello Russo, Jr.	Councillor, Vice President
Richard Caraviello	Councillor
Breanna Lungo-Koehn	Councillor
Robert Penta	Councillor
Michael Marks	Councillor
Edward Finn	City Clerk
Stephanie Burke	Personnel and Budget
Cassandra Koutalidis, P.E.	Engineering Division
Chief Frank Gilberti, Jr.	Fire Department
Fred Mangone	Civil Defense/Emergency Management
Alicia Hunt	Energy and Environment
Dale Bryan	Tufts University

Other Opportunities for Public Involvement

*Review by Neighboring Communities and Organizations*

Notice *is being* sent to the following organizations and neighboring municipalities inviting them to review the Medford Hazard Mitigation Plan and submit their comments to the City. Many of these organizations were also invited to participate in the collaborative working group meetings.

- City of Medford Boards and Commissions
- Town of Winchester
- Town of Stoneham
- City of Malden
- City of Everett
- City of Somerville
- City of Arlington
- Mystic River Watershed Association
- Division of Conservation and Recreation

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### *Website*

Draft copies of the Medford Hazard Mitigation Plan update *are being posted* on the City's website. Members of the public could access the draft document and submit comments or questions.

### Incorporation of Other Existing Plans and Studies

The Plan incorporates information from a number of other previously produced plans, and studies as well as applicable regulatory documents. These include:

- City of Medford Zoning Ordinance
- City of Medford Open Space and Recreation Plan Update, 2011
- City of Medford CPMP Annual Action Plan, 2012
- Medford Square Master Plan, 2005
- City of Medford Community Development Plan, 2004

A full listing of the documents incorporated in the development of this plan is included in Section VIII – List of References.

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## IV. RISK ASSESSMENT

The risk assessment analyzes the potential natural hazards that could occur within the City of Medford as well as the relationship between those hazards and current land uses, potential future development, and critical infrastructure. This section also includes a vulnerability assessment that estimates the potential damages that could result from certain large scale natural hazard events.

### Update Process

In order to update Medford’s risk assessment, MAPC gathered the most recently available hazard and land use data and met with City staff to identify changes in local hazard areas and development trends. MAPC also used the most recently available version of HAZUS (described below).

### Overview of Hazards and Impacts

The Massachusetts Hazard Mitigation Plan 2010 (state plan) provides an in-depth overview of natural hazards in Massachusetts. The state plan indicates that Massachusetts is subject to the following natural hazards (listed in order of frequency); floods, heavy rainstorms, nor’easters or winter storms, coastal erosion, hurricanes, tornadoes, wildfires, drought and earthquakes. Previous state and federal disaster declarations since 1991 are summarized in Table 2.

Table 6 summarizes the hazard risks for Medford. This evaluation takes into account the frequency of the hazard, historical records, and variations in land use. This analysis is based on the vulnerability assessment in the Commonwealth of Massachusetts State Hazard Mitigation Plan, 2010. The statewide assessment was modified to reflect local conditions in Medford using the definitions for hazard frequency and severity listed below Table 7.

**Table 7. Hazard Risks Summary**

<b>Hazard</b>	<b>Frequency</b>		<b>Severity</b>	
	<b>Massachusetts</b>	<b>Medford</b>	<b>Massachusetts</b>	<b>Medford</b>
Flooding	High	High	Serious	Serious
Dam failures	Very Low	Medium	Serious	Serious
Coastal Hazards	High	Very Low	Serious	Serious
Winter storms	High	High	Minor	Minor
Hurricanes	Medium	Medium	Serious	Serious
Tornadoes	Medium	Very Low	Serious	Serious
Brush fires	Medium	Medium	Minor	Minor
Earthquakes	Very Low	Very Low	Extensive	Serious
Landslides	Low	Very Low	Minor	Minor

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## Definitions used in the Commonwealth of Massachusetts State Hazard Mitigation Plan

### Frequency

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).

### Severity

Minor: Limited and scattered property damage; no damage to public infrastructure (roads, bridges, trains, airports, public parks, etc.); contained geographic area (i.e. one or two communities); essential services (utilities, hospitals, schools, etc) not interrupted; no injuries or fatalities.

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.

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.

Catastrophic: Property and public infrastructure destroyed; essential services stopped, thousands of injuries and fatalities.

## **Flood Related Hazards**

Flooding was the most prevalent serious natural hazard identified by local officials in Medford. Flooding is generally the rising or overflowing of water onto normally dry land and can be caused by hurricanes, nor'easters, severe rainstorms, and thunderstorms among other causes. Global climate change has the potential to increase the frequency and severity of rainstorms and snowstorms, which would be a continuation of trend observed over the past several decades.

### Regionally Significant Floods

There have been a number of major floods that have affected the Metro Boston region over the last fifty years. Significant historic flood events in Medford have included:

- March 1968
- The blizzard of 1978

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- January 1979
- April 1987
- October 1991 (“The Perfect Storm”)
- October 1996
- June 1998
- March 2001
- April 2004
- May 2006
- April 2007
- March 2010

### Overview of City-Wide Flooding

The City of Medford is subject to inland flooding in the forms of riverine flooding and urban flooding. Riverine flooding occurs when the rate of precipitation and/or amount of stormwater runoff overwhelms the capacity of natural or structured drainage systems causing overflows; urban flooding occurs when precipitation causes the water table to rise and leads to flooding of low-lying areas such as streets and underpasses. These types of flooding are often combined as storm events lead to large amounts of draining stormwater, which can be blocked by elements of the built environment and can be backed up when drainage locations (ponds, streams, etc.) are at or above capacity.

The city is located entirely within the Mystic River Watershed. Flooding was the most prevalent serious natural hazard identified by local officials in Medford. Flooding is caused by hurricanes, nor’easters, severe rainstorms and thunderstorms and is often worsened by coastal storm surges and high tides. The majority of flooding in the City is caused by deficiencies in the drainage system rather than location within the flood plain.

### Overview of Drainage System

The majority of Medford’s flooding problems are associated with the City’s drainage system and the filling or channeling of natural water resource areas.

There are a variety of issues that affect the drainage system in the City. In some cases, the system is served by older infrastructure that has been impacted by additional or increased development and does not have the necessary capacity to accommodate the resulting runoff. There are instances where waterways serve as part of the drainage system, such as along Winter Brook, but these can become restricted or blocked due to siltation in the open channel or connecting pipes. Lastly, debris from roadways or from residents dumping (e.g., lawn clippings and other yard waste) have blocked pipes and culverts which has resulted in flooding of homes and public ways.

A number of water resource areas, especially wetlands, have been filled in over time in Medford to support development or in an attempt to change drainage pattern in a specific area. These filled areas also have occurred along the Mystic River in portions of the flood plain. These areas serve as natural drainage locations and during severe rain storms,

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these areas still have high water levels that can contribute to localized flooding issues and potential inflow and infiltration issues with the piped drainage system.

Information on flood hazard areas was taken from two sources. The first was the National Flood Insurance Rate Maps. The FIRM flood zones are shown on Map 3 in Appendix B and defined below.

### *Flood Insurance Rate Map Zone Definitions*

Zones A1-30 and AE: Special Flood Hazard Areas subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. Base Flood Elevations are shown within these zones.

Zone A (Also known as Unnumbered A Zones): Special Flood Hazard Areas subject to inundation by the 1-percent-annual-chance flood event generally determined using approximate methodologies. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations or depths are shown.

Zone AO: Special Flood Hazard Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet. Average flood depths derived from detailed hydraulic analyses are shown in this zone.

Zone B and X (shaded): Zones where the land elevation has been determined to be above the Base Flood Elevation, but below the 500 year flood elevation. These zones are not Special Flood Hazard Areas.

Zones C and X (unshaded): Zones where the land elevation has been determined to be above both the Base Flood Elevation and the 500 year flood elevation. These zones are not Special Flood Hazard Areas

The second source of flooding information was discussions with local officials. The Locally Identified Areas of Flooding below were identified by City staff as areas where flooding is known to occur or could occur if certain infrastructure failed. These areas do not necessarily coincide with the flood zones from the FIRM maps. They may be areas that flood due to inadequate drainage systems or other local conditions rather than location within a flood zone. The numbers correspond to the numbers on Map 8, “Locally Identified Hazard Areas”.

1. Wright’s Pond – Downstream area that could potentially be inundated in the event of a dam breach.
2. Cranberry Brook Area – Area of chronic flooding due to under drainage pipes downstream of the brook.

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3. Lincoln Road / Meetinghouse Brook Area – Area of chronic flooding that has been exacerbated at times due to releases on the reservoir upstream by the Town of Winchester.
4. Daly Rd / Meetinghouse Brook Area - Area of chronic flooding that has been exacerbated at times due to releases on the reservoir upstream by the Town of Winchester.
5. South Medford Area - Area of chronic flooding due to aging infrastructure and downstream drainage issues in the City of Somerville.
6. Fifth Street Area - Area of chronic flooding due to drainage infrastructure issues.
7. Sydney St. Pump Station – Location of critical storm water pump station.

### Dam Failure

Dam failure can occur as a result of structural failure, independent of a hazard event, or as the result of the impacts of a hazard event such as flooding associated with storms or an earthquake. In the event of a dam failure, the energy of the water stored behind even a small dam can cause loss of life and property damage if there are people or buildings downstream. The number of fatalities from a dam failure depends on the amount of warning provided to the population and the number of people in the area in the path of the dam's floodwaters. Dam failure in general is infrequent but has the potential for severe impacts. An issue for dams in Massachusetts is that many were built in the 19<sup>th</sup> century without the benefits of modern engineering or construction oversight.

Through a review with City staff and information available from the Division of Conservation and Recreation (DCR), six dams were identified in Medford. DCR assess the dams are using the three hazard classifications below:

- **High Hazard:** Dams located where failure or mis-operation will likely cause loss of life and serious damage to home(s), industrial or commercial facilities, important public utilities, main highway(s) or railroad(s).
- **Significant Hazard:** Dams located where failure or mis-operation may cause loss of life and damage home(s), industrial or commercial facilities, secondary highway(s) or railroad(s) or cause interruption of use or service of relatively important facilities.
- **Low Hazard:** Dams located where failure or mis-operation may cause minimal property damage to others. Loss of life is not expected.

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Three of the dams within the City's limits are classified as high hazard dams, and two of the dams have been improved since completion of the previous plan. An overview of the dams is provided below:

*South Reservoir West Dike* – This dam is classified as a high hazard dam. This dam is owned by the Town of Winchester and is managed by the municipal water department.

*South Reservoir Dam* – This dam is classified as a high hazard dam and is owned by the Division of Conservation and Recreation.

*South Reservoir East Dike* - This dam is classified as a high hazard dam and is owned by the Town of Winchester, The dam is managed by the Town's municipal water department.

*Wright's Pond Dam* - Wrights Pond Dam is owned by the City of Medford. It was reconstructed in the 1990s and was improved in 2012, including improvements to the crest and spillway which were designed around the potential for precipitation from a 100 year storm. Wright's Pond has an estimated downstream population of approximately 750 people.

*Mystic Lakes Dam (#20)* – This dam is owned by the Division of Conservation and Recreation and is located between Medford and the City of Arlington. The dam, which separates the upper lake from the lower lake on the Mystic River, had been listed as a significant hazard was rebuilt in 2011 and included the restoration of fish ladders for herring and eel.

*Cradock Bridge* – This bridge is located in Medford Square and serves as an urban flood control structure that constricts water flow in much the way that a dam does. The bridge is under the jurisdiction of the Department of Conservation and Recreation (DCR). The Massachusetts Department of Transportation will be reconstructing the bridge over the next 3 years, including replacement of the concrete barriers beneath the bridge that were needed previously for locks under the bridge.

Although not located in Medford, another significant dam is the Amelia Earhart Dam, which is located south of the City on the Mystic River between the Cities of Everett and Somerville. The dam is listed as a low hazard, but is estimated to need \$5 million dollars in repairs, such as repairs to the current third pump and the possible installation of a fourth pump. The dam separates the tidal and the non-tidal parts of the Mystic River, and is currently able to pump 4,000 cubic feet per second of flow from the Mystic and Malden Rivers against high tide into Boston Harbor. The pump improvements would increase the rate that flood water can travel out of the cities and towns along the Mystic River.

### Repetitive Loss Structures

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There are two (2) repetitive loss structures in Medford, which is the same number of structures identified in the 2008 plan. 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/txt/rebuild/repetitive\\_loss\\_faqs.txt](http://www.fema.gov/txt/rebuild/repetitive_loss_faqs.txt).

### Wind Related Hazards

Wind-related hazards include hurricanes and tornadoes as well as high winds during severe rainstorms and thunderstorms. The typical wind speed in the Boston area ranges from around 11 miles per hour to 14 over the course of the year, but independent of storm events, gusts of up to 40 mph can occur. As with many communities, falling trees that result in downed power lines and power outages are an issue in Medford. Information on wind related hazards can be found on Map 5 in Appendix B

### Hurricanes

Between 1858 and 2013, Massachusetts has experienced approximately 35 tropical storms, eleven Category 1 hurricanes, five Category 2 hurricanes and one Category 3 hurricane. This equates to a frequency of once every six years. A hurricane or storm track is the line that delineates the path of the eye of a hurricane or tropical storm. There has been one recorded storm tracks through Medford, a Category 1 Hurricane in 1944. The storm passed roughly through the southeastern part of the City. The City experiences the impacts of the wind and rain of hurricanes and tropical storms regardless of whether the storm track passed through the City. The hazard mapping indicates that the 100 year wind speed is 110 miles per hour.

Hurricanes typically have regional impacts beyond their immediate tracks, and numerous hurricanes have affected the communities of eastern Massachusetts (Table 8). A hurricane or tropical storm track is the line that delineates the path of the eye of the hurricane or storm. Falling trees and branches are a significant problem because they can result in power outages when they fall on power lines or block traffic and emergency routes.

**Table 8. Hurricane Records for Massachusetts**

<b>Hurricane Event</b>	<b>Date</b>
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 Diane	August 17-19, 1955
Hurricane Donna	September 12, 1960
Hurricane Gloria	September 27, 1985
Hurricane Bob	August 19, 1991

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Hurricane Earl	September 4, 2010
Tropical Storm Irene	August 28, 2011
Hurricane Sandy	October 29-30, 2012

\*Category 3. Source: National Oceanic and Atmospheric Administration (NOAA)

Hurricane intensity is measured according to the Saffir/Simpson scale, which categorizes hurricane intensity linearly based upon maximum sustained winds, barometric pressure, and storm surge potential. These are combined to estimate potential damage. The following gives an overview of the wind speeds, surges, and range of damage caused by different hurricane categories:

Scale No. (Category)	Winds(mph) Storm	Surge (ft)	Potential Damage
	74 – 95	4 - 5	Minimal
2	96 – 110	6 - 8	Moderate
3	111 – 130	9 - 12	Extensive
4	131 – 155	13 - 18	Extreme
5	> 155	>18	Catastrophic

Source: NOAA

### Tornados

On average, there are six tornados that touchdown somewhere in the northeast region every year. Tornados are most common in the summer, June through August and most form in the afternoon or evening. Tornados are associated with strong thunderstorms. The strongest tornado in Massachusetts history was the Worcester Tornado in 1953 (NESEC). The most recent tornado event in Massachusetts caused significant damage in the Springfield area and resulted in 4 deaths in June of 2011. There have been no recorded tornados within the Medford City limits.

### Nor'easters

Featuring strong northeasterly winds blowing in from the ocean over coastal areas, nor'easters are relatively common in the winter months in New England occurring one to two times a year and frequently lead to coastal flooding and erosion. The storm radius of a nor'easter can be as much as 1,000 miles and these storms feature sustained winds of 10 to 40 mph with gusts of up to 70 mph. These storms are accompanied by heavy rains or snows, depending on temperatures.

Many of the historic flood events identified in the previous section were precipitated by nor'easters, including the "Perfect Storm" event in 1991. More recently, blizzards in December 2010, October 2011 and February 2013 were both large nor'easters that caused significant snowfall amounts.

### Severe Thunderstorms

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While less severe than the other types of storms discussed, thunderstorms can lead to localized damage and represent a hazard risk for communities. Generally defined as a storm that includes thunder, which always accompanies lightning, a thunderstorm is a storm event featuring lightning, strong winds, and rain and/or hail. Thunderstorms sometime give rise to tornados. On average, these storms are only around 15 miles in diameter and last for about 30 minutes. A severe thunderstorm can include winds of close to 60 mph and rain sufficient to produce flooding.

### Winter Storms

Winter storms are the most common and most familiar of the region’s hazards that affect large geographic areas. The majority of blizzards and ice storms in the region cause more inconvenience than they do serious property damage, injuries, or deaths. However, periodically, a storm will occur which is a true disaster, and necessitates intense large-scale emergency response. Occasionally winter storms can also hinder the tidal exchange in tidally restricted watersheds and result in localized flooding within these areas. Ice build-up at gate structures can also damage tide gates and increase the hazard potential as a result of malfunctioning tide gates. Coastal storms also cause flooding because of tidal surges. The average annual snowfall for the majority of the city is 36.1-48.0 inches. There is a small band in the northwestern part of the City where the average snowfall is 48.1-72.0 inches.

The Northeast Snowfall Impact Scale (NESIS) developed by Paul Kocin of The Weather Channel and Louis Uccellini of the National Weather Service (Kocin and Uccellini, 2004) characterizes and ranks high impact northeast snowstorms. These storms have large areas of 10 inch snowfall accumulations and greater. NESIS has five categories: Extreme, Crippling, Major, Significant, and Notable. NESIS scores are a function of the area affected by the snowstorm, the amount of snow, and the number of people living in the path of the storm. The largest NESIS values result from storms producing heavy snowfall over large areas that include major metropolitan centers. The NESIS categories are summarized below:

Category	NESIS	Value Description
1	1–2.499	Notable
2	2.5–3.99	Significant
3	4–5.99	Major
4	6–9.99	Crippling
5	10.0+	Extreme

Source: Massachusetts State Hazard Mitigation Plan, 2010

Since 1958 Massachusetts has experienced two Category 5 Extreme snow storms, nine Category 4 (Crippling) storms, and 13 Category 3 (Major) snow storms. The most significant winter storm in recent history was the “Blizzard of 1978,” which resulted in

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over 3 feet of snowfall and multiple day closures of roadways, businesses, and schools. Historically, severe winter storms have occurred in the following years:

**Table 9. Severe Winter Storm Records for Massachusetts**

Blizzard of 1978	February 1978
Blizzard	March 1993
Blizzard	January 1996
Severe Snow Storm	March 2001
Severe Snow Storm	December 2003
Severe Snow Storm	January 2004
Severe Snow Storm	January 2005
Severe Snow Storm	April, 2007
Severe Snow Storm	December 2010
Blizzard of 2013	February 2013

Because a major feature of winter storms is heavy precipitation, the same mitigation measures in place for flooding are all important for mitigating the impacts of winter storms. However, the rapid melting of snow after major storms, combined with rainfall, is more of a common flooding threat.

### **Geologic Hazards**

Geologic hazards include earthquakes, landslides, sinkhole, subsidence, and unstable soils such as fill, peat, and clay. Although new construction under the most recent building codes generally will be built to seismic standards, there are still many structures which pre-date the most recent building code. Information on geologic hazards can be found on Map 4 in Appendix B.

#### Earthquakes

Damage in an earthquake stems from ground motion, surface faulting, and ground failure in which weak or unstable soils, such as those composed primarily of saturated sand or silts, liquefy. The effects of an earthquake are mitigated by distance and ground materials between the epicenter and a given location. An earthquake in New England affects a much wider area than a similar earthquake in California due to New England's solid bedrock geology (NESEC).

Earthquakes are a hazard with multiple impacts beyond the obvious building collapse. Buildings may suffer structural damage which may or may not be readily apparent. Earthquakes can cause major damage to roadways, making emergency response difficult. Water lines and gas lines can break, causing flooding and fires. Another potential vulnerability is equipment within structures. For example, a hospital may be structurally engineered to withstand an earthquake, but if the equipment inside the building is not

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properly secured, the operations at the hospital could be severely impacted during an earthquake. Earthquakes can also trigger landslides.

According to the State Hazard Mitigation Plan, New England experiences an average of five earthquakes per year. From 1668 to 2007, 355 earthquakes were recorded in Massachusetts (NESEC) and a sample of these is included in Table 10 below.

**Table 10. Historical Earthquakes in Massachusetts or Surrounding Area, 1727-2013**

<b>Location</b>	<b>Date</b>	<b>Magnitude*</b>
MA - Cape Ann	11/10/1727	5
MA - Cape Ann	12/29/1727	NA
MA - Cape Ann	2/10/1728	NA
MA - Cape Ann	3/30/1729	NA
MA - Cape Ann	12/9/1729	NA
MA - Cape Ann	2/20/1730	NA
MA - Cape Ann	3/9/1730	NA
MA - Boston	6/24/1741	NA
MA - Cape Ann	6/14/1744	4.7
MA - Salem	7/1/1744	NA
MA - Off Cape Ann	11/18/1755	6
MA - Off Cape Cod	11/23/1755	NA
MA - Boston	3/12/1761	4.6
MA - Off Cape Cod	2/2/1766	NA
MA - Offshore	1/2/1785	5.4
MA - Wareham/Taunton	12/25/1800	NA
MA - Woburn	10/5/1817	4.3
MA - Marblehead	8/25/1846	4.3
MA - Brewster	8/8/1847	4.2
MA - Boxford	5/12/1880	NA
MA - Newbury	11/7/1907	NA
MA - Wareham	4/25/1924	NA
MA - Cape Ann	1/7/1925	4
MA - Nantucket	10/25/1965	NA
MA - Boston	12/27/74	2.3
VA - Mineral	8/23/11	5.8
MA - Nantucket	4/12/12	4.5
ME - Hollis	10/17/12	4.0

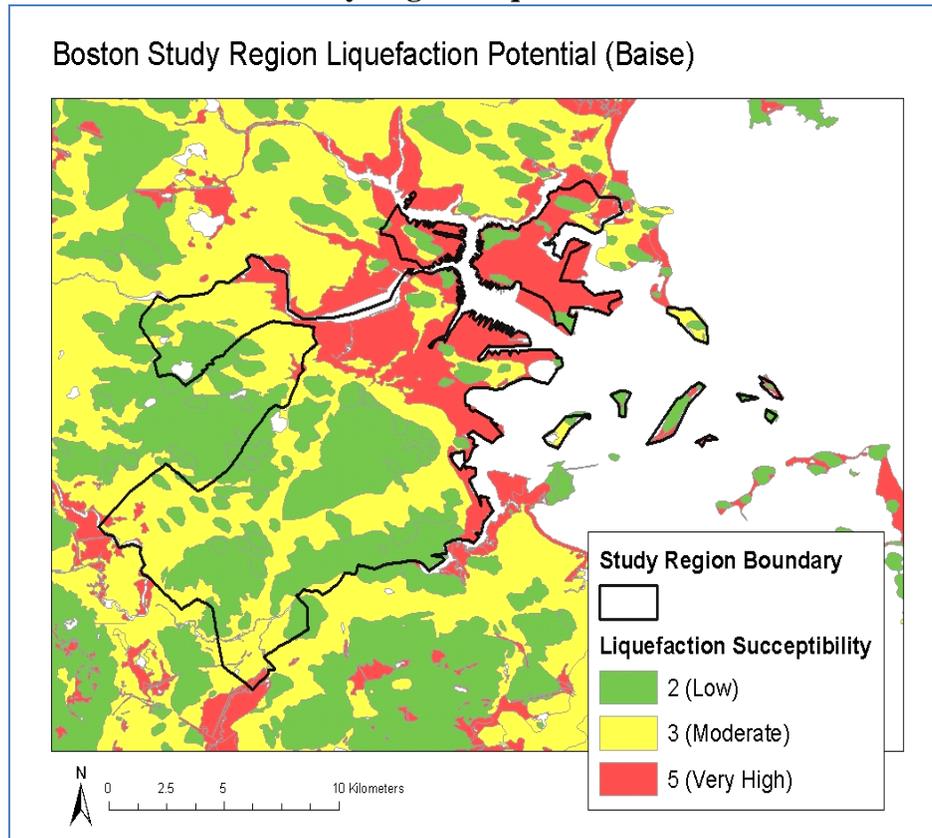
There have been no recorded earthquake epicenters within Medford.

*Liquefaction* - One additional impact that is of particular concern in the Boston metropolitan area is liquefaction (see figure below). This is due to the prevalence of filled land. Liquefaction means that loosely packed, water-logged sediments lose strength and therefore move in large masses or lose bearing strength. Soil units susceptible to

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liquefaction include: non-engineered artificial fill, alluvial deposits, beach deposits, fluvial deposits and flood plain deposits. Non-engineered artificial fill is what is typically known locally as filled land. An earthquake with a magnitude of 5.5 or greater can trigger liquefaction. In the Boston region, these areas of filled land are densely developed with structures that pre-date the seismic provisions of the current Massachusetts State Building Code.

### Boston Study Region Liquefaction Potential



Source: Baise, Laurie G., Rebecca B. Higgins ; and Charles M. Brankman, Tufts University

### 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 majority of the city is classified as having a low risk for landslides. The southeastern portion of the city, primarily in the vicinity of Wellington Circle, has a moderate risk for landslides.

### **Other Natural Hazards**

#### Brush Fires

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For the purposes of this plan, a brush fire is an uncontrolled fire occurring in a forested or grassland area. In the Boston region these fires rarely grow to the size of a wildfire as seen more typically in the western U.S. As their name implies, these fires typically burn no more than the underbrush of a forested area. These fires present a hazard where there is the potential for them to spread into developed or inhabited areas, particularly residential areas where sufficient fuel materials might exist to allow the fire the spread into homes.

The Fire Department responds to a number of brush fires of varying sizes annually. Within the past year, there were no brush fires that resulted in significant property damage. These fires occur most commonly in the Middlesex Fells Reservation, due to dry and dead vegetation, and in the Mystic River Reservation, due to phragmites growth.

The following areas of City were identified as having the highest potential for brush fires. The numbers correspond to the numbers on Map 8, “Hazard Areas”:

- 8. Middlesex Fells Reservation
- 9. Shepherd Brooks Estate/Oak Grove Cemetery
- 10. Mystic River Reservation
- 11. Fellsway Plaza Area

### Land Use and Development Trends

#### Existing Land Use

The most recent land use statistics available from the state are from aerial photography done in 2005. Table 11 shows the acreage and percentage of land in 10 categories. If the three residential categories are aggregated, residential uses make up nearly 45% of the area of the City (approx. 2,350 acres). Approximately 30% of the land in the City is identified as undeveloped, and a majority of this land consists of the Middlesex Fells (1156 acres).

**Table 11. 2005 Land Use**

Land Use Type	Acres	Percent
High Density Residential	2303.79	43.43%
Medium Density Residential	47.22	0.89%
Low Density Residential	1.38	0.04%
Non-Residential, Developed	498.92	9.40%
Commercial	385.37	7.26%
Industrial	167.82	3.16%
Transportation	314.34	5.92%
Agriculture	0	0%
Undeveloped	1343.16	25.32%
Undeveloped Wetland	242.97	4.58%

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**Table 11. 2005 Land Use**

<b>Land Use Type</b>	<b>Acres</b>	<b>Percent</b>
<b>Total</b>	<b>5304.97</b>	<b>100%</b>

Source: Massachusetts Geographic Information System (MassGIS) Land Use 2005 data

## Economic Elements

Medford has economic assets throughout the City, but the most prominent economic centers are in the south and eastern area of the municipality. These centers consist of historic structures and businesses as well as more recent developments that include retail, office, and residential uses. The City also has the potential for additional mixed use growth around existing and proposed transit nodes.

## Historic, Cultural, and Natural Resource Areas

There are several locations and areas of historical and cultural importance to the City, some of which are listed on the State and National historic registers. In addition, there are sites that are of importance locally even if not listed on historic registers. There are two historic districts in the City, the Mary Simonds Historic District and the Hillside Avenue Historic District, which are both located adjacent to Medford Square. The sites of importance to Medford include the Isaac Royall House in South Medford, the Peter Tufts House in the Wellington neighborhood and the Brooks Estate, which is located in the western section of City near the border with the Town of Winchester.

## Development Trends

Under current zoning, the City of Medford is largely built out. Much of the land area is occupied by existing residential neighborhoods, commercial or industrial areas, recreation and conservations land, and undevelopable wetlands and floodplain areas. The development that is occurring in the City is largely redevelopment, mostly consisting of mixed use and transit-oriented development projects.

## Potential Future Development

MAPC consulted with the local team to determine areas that may experience development or redevelopment in the future, defined for the purposes of this plan as a ten year time horizon. These areas are shown on Map 8, “Potential Future Development Areas” and are described below. The letter for each site corresponds to the letters on Map 8.

- A. Wellington Circle – This area has been under development over the past five years to include new retail and residential uses. The development is centered around the Wellington Station on the MBTA Orange Line, and is located by the intersection of Routes 16 and 28. This area also includes the River’s Edge project, which is a mixed use project that includes office and residential developments.

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- B. Riverside Industrial Area – The Riverside area is the existing location of industrial and commercial developments to the west of the Wellington Circle Area.
- C. Medford Square – A historic commercial, cultural and institutional center of the City, Medford Square is located by State Routes 38 and 60, and just to the east of Interstate 93. The City continues to focus on revitalizing the area according to the Master Plan for the area, and exploring opportunities for commercial revitalization and redevelopment and additional residential development.
- D. Mystic Avenue – This area is located along Route 38 to the South of the Mystic River, and is a commercial corridor. Due to some underutilized sites along the corridor, it provides the opportunity for revitalization and could experience redevelopment in the future.
- E. Green Line Transit Development – College Avenue – This area at the intersection of College Avenue and Boston Avenue is the planned location of a new station along the MBTA Green Line Extension to Medford. Potential development and redevelopment could occur in this area as a result of the new transit service.
- F. Green Line Transit Development – Boston Avenue - This area at the intersection of Boston Avenue and Route 16 (Mystic Valley Parkway) is the planned location of a new station along the MBTA Green Line Extension to Medford. Potential development and redevelopment, including redevelopment of nearby commercial and residential uses, could occur in this area as a result of the new transit service.
- G. Green Line Transit Development – Boston Avenue - This area in the vicinity of Ball Square (Boston Avenue and Broadway) and along the municipal border with Somerville is the planned location of a new station along the MBTA Green Line Extension to Medford. Potential redevelopment, including redevelopment of nearby commercial and industrial uses, could occur in this area as a result of the new transit service.
- H. Tufts University – The Tufts University campus is located in both Medford and the City of Somerville. There could be potential for future development and growth related to the campus.

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### Vulnerability Assessment

The purpose of the vulnerability assessment is to estimate the extent of potential damages from natural hazards of varying types and intensities.

#### Future Development in Hazard Areas

Table 12 shows the relationship of these parcels to two of the mapped hazards. This information is provided so that planners can ensure that development proposals comply with flood plain zoning and that careful attention is paid to drainage issues.

**Table 12. Relationship of Potential Future Development Areas to Hazard Areas**

Parcel	Landslide risk	Flood Zone	Brush Fire
Riverside Industrial Area	Moderate Susceptibility	No	No
Wellington Circle	Moderate Susceptibility	2.52% in AE	Yes Mystic River Reservation
Medford Square	Low	3.9713% in AE	No
Mystic Avenue	Moderate Susceptibility	No	No
Green Line Transit Development - College Avenue	Low	No	No
Green Line Transit Development - Boston Avenue	Low	No	No
Green Line Transit Development - Ball Square	Low	No	No
Tufts University	Low	No	No

#### Critical Infrastructure in Hazard Areas

Critical infrastructure includes facilities that are important for disaster response and evacuation (such as emergency operations centers, fire stations, water pump stations, etc.) and facilities where additional assistance might be needed during an emergency (such as nursing homes, elderly housing, day care centers, etc.). These facilities are listed in Table 13 and are shown on all of the maps in Appendix B.

The purpose of mapping the natural hazards and critical infrastructure is to present an overview of hazards in the community and how they relate to critical infrastructure, to better understand which facilities may be vulnerable to particular natural hazards.

# CITY OF MEDFORD HAZARD MITIGATION PLAN

## Explanation of Columns in Table 13

*Column 1: ID #:* The first column in Table 10 is an ID number which appears on the maps that are part of this plan. See Appendix B.

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

*Column 3: Type:* The third column indicates what type of site it is.

*Column 4: Landslide Risk:* The fourth column indicates the degree of landslide risk for that site. This information came from NESEC. 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>.

*Column 5: FEMA Flood Zone:* The fifth column addresses the risk of flooding. A "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 maps). If there is an entry in this column, it indicates the type of flood zone as follows:

**Zone A (1% annual chance)** - 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 (1% annual chance)** - 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 X500 (.2% annual chance)** - Zone X500 is the flood insurance rate zone that correspond to the 500-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.

**Zone VE (1% annual chance)** - 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: Locally-Identified Flood Area:* The locally identified areas of flooding were identified by City staff as areas where flooding occurs. These areas do not necessarily coincide with the flood zones from the FIRM maps. They may be areas that flood due to inadequate drainage systems or other local conditions rather than location within a flood zone. The numbers correspond to the numbers on Map 8, "Hazard Areas".

*Column 7: Hurricane Surge Category:* The seventh column indicates whether or not the site is located within a hurricane surge area and the category of hurricane estimated to be necessary to cause inundation of the area. The following explanation of hurricane surge areas was taken from the US 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.

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." See <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 8: Brushfire Risk:* The fourth column indicates whether the site falls within an area identified by municipal staff as posing a brushfire risk.

**CITY OF MEDFORD HAZARD MITIGATION PLAN**

**Table 13: Relationship of Critical Infrastructure to Hazard Areas**

<b>ID</b>	<b>NAME</b>	<b>TYPE</b>	<b>Landslide Risk</b>	<b>FEMA Flood Zone</b>	<b>Locally-Identified Flood Area</b>	<b>Hurricane Surge Category</b>	<b>Brushfire Risk</b>
1	Post Office	Post Office	Moderate Susceptibility	No	No	0	No
1	Mass Electric	Power Substation	Low Susceptibility	No	Wrights Pond	High	No
2	Saltenstall Building	Elderly Housing	Low Susceptibility	No	Wrights Pond	High	No
3	Senior Citizen Center	Elderly Housing	Low Susceptibility	No	Wrights Pond	High	No
4	McGlynn Middle School	School	Moderate Susceptibility	No	No	High	No
5	Andrews Middle School	School	Low Susceptibility	No	No	High	No
6	Winchester Hospital - Hyperbaric Chambers	Medical Facility	Low Susceptibility	0.2 PCT ANNUAL CHANCE FLOOD HAZARD	Wrights Pond	High	No
8	Six Acres Day Care	Child Care	Low Susceptibility	No	No	High	No
9	Tempone Manor	Elderly Housing	Low Susceptibility	0.2 PCT ANNUAL CHANCE FLOOD HAZARD	No	High	No
12	Medford Public Library	Library	Low Susceptibility	No	No	High	No
13	West Medford Train Station	Transportation Facility	Low Susceptibility	No	No	High	No
14	Algonquin Gas	Gas Distribution	Low Susceptibility	No	No	High	No
15	Tufts University Campus	School	Low Susceptibility	No	No	High	No
16	Wellington Station	Transportation Facility	Moderate Susceptibility	No	No	High	No

**CITY OF MEDFORD HAZARD MITIGATION PLAN**

**Table 13: Relationship of Critical Infrastructure to Hazard Areas**

<b>ID</b>	<b>NAME</b>	<b>TYPE</b>	<b>Landslide Risk</b>	<b>FEMA Flood Zone</b>	<b>Locally-Identified Flood Area</b>	<b>Hurricane Surge Category</b>	<b>Brushfire Risk</b>
17	Kiss 108 Radio Station	Broadcast Facility	Moderate Susceptibility	No	No	Low	No
19	Fire Station	Fire Station	Low Susceptibility	No	South Medford	High	No
20	Key Span	Gas Line	Moderate Susceptibility	0.2 PCT ANNUAL CHANCE FLOOD HAZARD	No	High	No
21	Glenridge Nursing Care	Elderly Housing	Low Susceptibility	No	No	High	No
22	Little Red School House	Child Care	Moderate Susceptibility	No	No	High	No
23	Mass Electric Sub Station	Power Substation	Moderate Susceptibility	No	No	High	No
24	Wrights Pond Dam	Dam	Low Susceptibility	A	No	High	Middlesex Fells Reservation
25	Mystic Lakes Dam	Dam	Low Susceptibility	0.2 PCT ANNUAL CHANCE FLOOD HAZARD	No	High	No
26	Walden Manor	Elderly Housing	Low Susceptibility	No	No	High	No
27	Magoun Manor	Elderly Housing	Low Susceptibility	No	No	High	No
28	Winthrop House	Elderly Housing	Low Susceptibility	No	No	High	No
29	Courtyard Nursing Care Center	Elderly Housing	Low Susceptibility	No	No	High	No
30	Kennedy School	School	Low Susceptibility	No	No	High	No

**CITY OF MEDFORD HAZARD MITIGATION PLAN**

**Table 13: Relationship of Critical Infrastructure to Hazard Areas**

<b>ID</b>	<b>NAME</b>	<b>TYPE</b>	<b>Landslide Risk</b>	<b>FEMA Flood Zone</b>	<b>Locally-Identified Flood Area</b>	<b>Hurricane Surge Category</b>	<b>Brushfire Risk</b>
31	Office of Emergency Management	Emergency Operations Center	Low Susceptibility	0.2 PCT ANNUAL CHANCE FLOOD HAZARD	No	High	No
32	Walkling Court	Elderly Housing	Low Susceptibility	No	No	High	No
33	Lawrence Memorial Hospital of Medford	Hospital	Low Susceptibility	No	No	High	No
34	State Police Barracks	Police Station	Moderate Susceptibility	0.2 PCT ANNUAL CHANCE FLOOD HAZARD	No	High	Mystic River Reservation
35	Police Headquarters	Police Station	Low Susceptibility	0.2 PCT ANNUAL CHANCE FLOOD HAZARD	No	High	No
36	Fire Headquarters	Fire Station	Low Susceptibility	0.2 PCT ANNUAL CHANCE FLOOD HAZARD	No	High	No
37	Fire Station	Fire Station	Low Susceptibility	No	No	High	No
38	Fire Station	Fire Station	Moderate Susceptibility	0.2 PCT ANNUAL CHANCE FLOOD HAZARD	No	High	No
40	Water and Sewer Plant	Public Works Facility	Low Susceptibility	0.2 PCT ANNUAL CHANCE FLOOD HAZARD	No	High	No
41	City Hall	Municipal Office	Low Susceptibility	No	Wrights Pond	High	No

**CITY OF MEDFORD HAZARD MITIGATION PLAN**

**Table 13: Relationship of Critical Infrastructure to Hazard Areas**

<b>ID</b>	<b>NAME</b>	<b>TYPE</b>	<b>Landslide Risk</b>	<b>FEMA Flood Zone</b>	<b>Locally-Identified Flood Area</b>	<b>Hurricane Surge Category</b>	<b>Brushfire Risk</b>
42	Fire Station	Fire Station	Low Susceptibility	No	No	High	No
43	Fire Station	Fire Station	Low Susceptibility	No	No	High	No
44	Columbus School	School	Moderate Susceptibility	No	No	High	No
45	St. Clement's High School	School	Low Susceptibility	No	No	High	No
46	Curtis Tufts School	School	Low Susceptibility	No	South Medford Area	High	No
47	St. Clement's Elementary School	School	Low Susceptibility	No	No	High	No
48	St. Joseph School	School	Low Susceptibility	No	No	High	No
49	Brooks School	School	Low Susceptibility	No	No	High	No
50	St. Raphael School	School	Low Susceptibility	No	No	High	No
51	Roberts Middle School	School	Low Susceptibility	No	No	High	No
52	St. Francis School	School	Low Susceptibility	No	No	High	No
53	Medford High School	School	Low Susceptibility	No	No	High	No
54	Mass. Water Resources Authority	MWRA	Low Susceptibility	No	No	High	No
55	Mass. Water Resources Authority	MWRA	No	AE	No	High	No
56	Carr Park - Data Collection Units for gas, electric and water	Public Works Facility	Low Susceptibility	No	No	High	No

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**Table 13: Relationship of Critical Infrastructure to Hazard Areas**

<b>ID</b>	<b>NAME</b>	<b>TYPE</b>	<b>Landslide Risk</b>	<b>FEMA Flood Zone</b>	<b>Locally-Identified Flood Area</b>	<b>Hurricane Surge Category</b>	<b>Brushfire Risk</b>
57	Tufts College Parking Garage - DCU	Public Works Facility	Low Susceptibility	No	No	High	No
58	Collings Circle - DCU	Public Works Facility	Low Susceptibility	No	No	High	No
59	Department of Public Works	Public Works Facility	Low Susceptibility	0.2 PCT ANNUAL CHANCE FLOOD HAZARD	No	High	No

## CITY OF MEDFORD HAZARD MITIGATION PLAN

### Damage Assessments

An 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 (multiple-hazards) is a computer program developed by FEMA to estimate losses due to a variety of natural hazards. The following overview of HAZUS-MH is taken from the FEMA website. For more information on the HAZUS-MH software, go to <http://www.fema.gov/plan/prevent/hazus/index.shtm>

“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 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 City of Medford, 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 to allow for a comparison between different types of disasters. Therefore, this analysis should be considered to be a starting point for understanding potential

## CITY OF MEDFORD HAZARD MITIGATION PLAN

damages from the hazards. If interested, communities can build a more accurate database and further test disaster scenarios.

### *Estimated Damages from Hurricanes*

The HAZUS software was used to model potential damages to the community from a 100 year and 500 year hurricane event; storms that are .01% and .005% likely to happen in a given year and roughly equivalent to a Category 2 and Category 4 hurricane. The damages caused by these hypothetical storms were modeled as if the storm track passed directly through the City, bringing the strongest winds and greatest damage potential.

Though there are no recorded instances of a hurricane equivalent to a 500 year storm passing through Massachusetts, this model was included in order to present a reasonable “worst case scenario” that would 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 14. Estimated Damages from Hurricanes**

	<b>100 Year</b>	<b>500 Year</b>
<b>Building Characteristics</b>		
Estimated total number of buildings	15,914	15,914
Estimated total building replacement value (Year 2006 \$) (Millions of Dollars)	4,755	4,755
<b>Building Damages</b>		
# of buildings sustaining minor damage	1,562	5,324
# of buildings sustaining moderate damage	252	2,352
# of buildings sustaining severe damage	15	348
# of buildings destroyed	2	127
<b>Population Needs</b>		
# of households displaced	116	1,010
# of people seeking public shelter	30	239
<b>Debris</b>		
Building debris generated (tons)	9,119.16	44,756.4
Tree debris generated (tons)	3,355.83	12,623.6
# of truckloads to clear building debris	363	1,801
<b>Value of Damages (Thousands of dollars)</b>		
Total property damage	46,238.22	334,977.25
Total losses due to business interruption	6,145.48	50,031.66

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### *Estimated Damages from Earthquakes*

The HAZUS earthquake module allows users to define an earthquake magnitude and model the potential damages caused by that earthquake as if its epicenter had been at the geographic center of the study area. For the purposes of this plan, two earthquakes were selected: magnitude 5.0 and a magnitude 7.0. Historically, major earthquakes are rare in New England, though a magnitude 5 event occurred in 1963.

**Table 15. Estimated Damages from Earthquakes**

	<b>Magnitude 5.0</b>	<b>Magnitude 7.0</b>
<b>Building Characteristics</b>		
Estimated total number of buildings	15,914	15,914
Estimated total building replacement value (Year 2006 \$)(Millions of dollars)	4,754	4,754
<b>Building Damages</b>		
# of buildings sustaining slight damage	2,656	1,265
# of buildings sustaining moderate damage	927	4,686
# of buildings sustaining extensive damage	160	4,552
# of buildings completely damaged	22	5,248
<b>Population Needs</b>		
# of households displaced	232	10,895
# of people seeking public shelter	137	6,412
<b>Debris</b>		
Building debris generated (tons)	0.040 million	1.350 million
# of truckloads to clear building debris	1,640	54,080
<b>Value of Damages (Millions of dollars)</b>		
Total property damage	251.38	3,560.43
Total losses due to business interruption	26.21	706.14

### *Estimated Damages from Flooding*

MAPC did not use HAZUS-MH to estimate flood damages in Medford. 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 lieu of using HAZUS, MAPC developed a methodology to give a rough approximation of flood damages.

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Medford is 8.29 square miles or 5304.97 acres. Approximately 478.74 acres have been identified by local officials as areas of flooding. This amounts to 9.02% of the land area in Medford. The number of structures in each flood area was estimated by applying the percentage of the total land area to the number of structures (15,914) in Medford; the same number of structures used by HAZUS for the hurricane and earthquake calculations. HAZUS uses a value of \$298,730.68 per structure for the building replacement value. This was used to calculate the total building replacement value in each of the flood areas. The calculations were done for a low estimate of 10% building damages and a high estimate of 50% as suggested in the FEMA September 2002 publication, "State and Local Mitigation Planning how-to guides" (Page 4-13). The range of estimates for flood damages is \$42,901,748.09 to \$214,508,740.47 (Table 16). These calculations are not based solely on location within the floodplain or a particular type of storm (i.e. 100 year flood).

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**Table 16. Estimated Damages from Flooding**

<b>ID</b>	<b>Flood Hazard Area</b>	<b>Approximate Area in Acres</b>	<b>% of Total Land Area in Medford</b>	<b>Estimated Number of Structures</b>	<b>Replacement Value</b>	<b>Low Estimate of Damages</b>	<b>High Estimate of Damages</b>
1	Wrights Pond	216.04	407.24%	648	\$193,602,313	\$19,360,231	\$96,801,156
2	Cranberry Brook Area	59.55	112.25%	179	\$53,363,397	\$5,336,340	\$26,681,699
3	Lincoln Road / Meetinghouse Brook Area	74.86	141.11%	225	\$67,084,150	\$6,708,415	\$33,542,075
4	Daly Rd / Meetinghouse Brook Area	11.84	22.31%	36	\$10,608,431	\$1,060,843	\$5,304,215
5	South Medford Area	110.51	208.31%	332	\$99,029,263	\$9,902,926	\$49,514,632
6	Fifth Street Area	5.72	10.79%	17	\$5,129,513	\$512,951	\$2,564,756

**CITY OF MEDFORD HAZARD MITIGATION PLAN**

**Table 16. Estimated Damages from Flooding**

<b>ID</b>	<b>Flood Hazard Area</b>	<b>Approximate Area in Acres</b>	<b>% of Total Land Area in Medford</b>	<b>Estimated Number of Structures</b>	<b>Replacement Value</b>	<b>Low Estimate of Damages</b>	<b>High Estimate of Damages</b>
7	Sydney St Pump Station	0.22	0.42%	1	\$200,415	\$20,041	\$100,207
<b>Totals</b>		<b>478.74</b>	<b>9.02%</b>	<b>1436</b>	<b>\$429,017,480.94</b>	<b>\$42,901,748.09</b>	<b>\$214,508,740.47</b>

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## **CITY OF MEDFORD HAZARD MITIGATION PLAN**

### **V. HAZARD MITIGATION GOALS**

The Medford Local Multiple Hazard Community Planning Team met on March 27, 2013. At that meeting, the team reviewed and discussed the goals from the 2008 Hazard Mitigation Plan for the City of Medford. After some discussion, the existing goals were found to still be reflective of the City's objectives with regard to addressing hazard mitigation in the community.

The following ten goals were endorsed by the Committee for the 2013 update of the Medford Hazard Mitigation Plan:

1. Prevent and reduce the loss of life, injury 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 City 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 all applicable standards for preventing and reducing the impacts of natural hazards.
8. Take maximum advantage of resources from FEMA, MEMA and other agencies to educate City staff and the public about hazard mitigation.

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# CITY OF MEDFORD HAZARD MITIGATION PLAN

## VI. HAZARD MITIGATION STRATEGY

The central component of a hazard mitigation plan is the strategy for reducing the community's vulnerabilities to natural hazard events. Responding to the analysis of risk, vulnerabilities, potential impacts, and anticipated future development, the process for developing this strategy is one of setting goals, understanding what actions the community is already taking that contribute to mitigating the effects of natural hazards and assessing where more action is needed to complement or modify existing measures. The following sections include descriptions of existing mitigation measures, a status update on mitigation measures identified in previous plans, and descriptions of proposed new mitigation measures. All mitigation measures are evaluated by their benefits and potential costs to arrive at a prioritized list of action items.

### What is Hazard Mitigation?

Hazard mitigation means to permanently reduce or alleviate the losses of life, injuries and property resulting from natural hazards through long-term strategies. These long-term strategies include planning, policy changes, education programs, infrastructure 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. The three links below provide additional information on these programs.

<http://www.fema.gov/government/grant/hmgp/index.shtm>

<http://www.fema.gov/government/grant/pdm/index.shtm>

<http://www.fema.gov/government/grant/fma/index.shtm>

Hazard Mitigation Measures can generally be sorted into the following groups:

- **Prevention:** Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and stormwater management regulations.
- **Property Protection:** Actions that involve the modification of existing buildings or infrastructure to protect them from a hazard or removal from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, flood proofing, storm shutters, and shatter resistant glass.
- **Public Education & Awareness:** Actions to inform and educate citizens, elected officials, and property owners about the potential risks from hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.

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- Natural Resource Protection: Actions that, in addition to minimizing hazard losses also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
- Structural Projects: Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include storm water controls (e.g., culverts), floodwalls, seawalls, retaining walls, and safe rooms.
- Emergency Services Protection: Actions that will protect emergency services before, during, and immediately after an occurrence. Examples of these actions include protection of warning system capability, protection of critical facilities, and protection of emergency response infrastructure.

(Source: FEMA Local Multi-Hazard Mitigation Planning Guidance)

### Existing Mitigation Measures

#### Existing Multi-Hazard Mitigation Measures

There are several mitigation measures that impact more than one hazard. These include the Comprehensive Emergency Management Plan (CEMP), the Massachusetts State Building Code and participation in a local Emergency Planning Committee.

*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.

*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. The building code can be viewed in its entirety at <http://www.mass.gov/bbrs/newcode.htm>.

It was noted that the Massachusetts State Building Code does a good job overall of protecting against the impacts of natural hazards. For example, for areas in Medford that contain filled land and are of concern regarding liquefaction, construction is required to be built on piles or various types of spread footings to account for the sub-standard soil conditions. Also, the flood area construction areas are classified as A-Zone areas in the building code and any recent construction in these areas, which has been limited, has been performed in accordance with the State Building Code requirements.

*Participation in the Mystic Regional Emergency Planning Committee (REPC)* - The Mystic REPC serves as the emergency planning committee for 19 cities and towns. These include: Arlington, Burlington, Chelsea, Everett, Lynn, Lynnfield, Malden, Medford, Melrose, North Reading, Reading, Revere, Saugus, Somerville, Stoneham, Wakefield,

## CITY OF MEDFORD HAZARD MITIGATION PLAN

Winchester, Winthrop, and Woburn. The Mystic REPC's 19 member cities and towns work together to develop plans to educate, communicate, and protect their communities in case of natural and man-made emergencies. The Mystic REPC is the first regional planning committee to be certified by State of Massachusetts.

*Participation in Additional Regional Emergency Preparedness and Response Organizations* - Medford also participates in additional regional organizations that address emergency preparedness and response including:

- Northeast Homeland Security Planning Councils, which includes 85 municipalities and is responsible to develop a regional Homeland Security Plan and oversees related grant program expenditures.
- METROFIRE, which is an association of Fire Departments in the Metropolitan Boston area to coordinate Mutual Aid and act as a common entity for improving the overall effectiveness of their Fire and Emergency Medical Services
- Mystic Valley Public Health Coalition – MDPH Region 3E (Medford, Malden, Melrose, Wakefield, Stoneham and Reading (2011)) has been working as a preparedness coalition since 2004. Medford has been the host agent since the inception of the program.
- Mystic Valley Medical Reserve Corps (2005) – The corps is a volunteer organization of pre-credentialed volunteers to assist the Public Health Departments in the event of an emergency or a public health initiative. The Public Health Director in Medford is the Director, but the MRC serves the same six (6) cities and towns of the Public Health Coalition.

*Medford Health Department Emergency Response Plan* – Per Massachusetts Department of Public Health (MPDH) guidelines, the all hazards plan incorporates response and recovery in the management of all hazards. The plan is revised as needed per guidance of the Centers for Disease Control and Prevention (CDC) and MDPH.

### Existing Flood Hazard Mitigation Measures

*Section 46 of the Medford City Code – Development in the Flood Zone* – This section of the general code deals with development in the flood zones. Section 46.31 lists the purposes of this section. Section 46-33 lists five approaches to reducing flood losses. The areas subject to this ordinance are the areas of special flood hazard identified on the 1985 Flood Insurance Rate Map (FIRM) maps. Section 46-39 acknowledges that land outside the special flood hazard areas may also flood. Section 46-75 regulates the alteration of watercourses.

FEMA updated FIRMs since the 2008 plan. The City approved an amendment to Section 46 in June 2010 to incorporate the updated FEMA FIRMs and bring the City into compliance with federal regulations.

*Wetlands Ordinance* - Adopted after 2008 plan, the purpose of the ordinance (Sec. 87) is to preserve and protect the wetlands, water resources, and adjacent upland areas by controlling activities deemed by the Conservation Commission likely to have a

## CITY OF MEDFORD HAZARD MITIGATION PLAN

significant individual and/or cumulative effect upon resource area values, such as public or private water supply, groundwater, flood control, erosion and sedimentation control, and storm damage prevention, deemed important to the community. The City continues to review and explore opportunities to update.

*Site Plan Review* – Section 94-221 2.e sets forth requirements for site plans in the Mixed Use zoning district. It requires that a preliminary site plan in the Mixed Use zoning district must include a description of any problems of drainage or topography. The site plan must also show the location of wetlands, water bodies and the 100 year flood plain elevations as well as the location of existing and proposed drainage facilities. The site plan must also include “the applicant’s calculation of requirements and evaluation of the availability and adequacy of off-site public facilities including ... and drainage”. Adequate drainage is also listed as one of the criteria for reviewing and approving a site plan. Section 94-331 sets forth the same requirements for site plan reviews in other districts.

*Linkage Fees* – Section 94:441 sets up a fund for roads and traffic facility capital improvements through a linkage fee for development projects of a certain size. Section 94-471 does the same for water and sewer facilities and Section 94-411 does this for police and fire facilities. The funds can be used for capital improvements related to accommodating new development.

*Participation in the Upper Mystic River Watershed Project Impact Initiative* – Medford, along with Arlington, Burlington, Lexington, Reading, Stoneham, Wilmington, Winchester and Woburn, came together to form the Upper Mystic Watershed Board (UMWB). The UMWB is a collaborative, inter-governmental entity created to draft and implement a regional flood mitigation strategy. The City continues to participate as needed in coordination efforts for the UMWB, although the Board has not met in recent years.

*Street sweeping* – The City has an annual street sweeping program. In the spring, sand is removed from the streets and in the fall, the focus is on leaf removal. The program is conducted using City employees. Additionally, the City also sweeps nightly on major roadway corridors.

*Catch basin cleaning* – All catch basins in the City are cleaned once a year. This task is performed by outside contractors. Approximately 3400 catch basins are cleaned annually.

*Debris removal* – When heavy rains are forecast, the Department of Public Works (DPW) goes out to watch for and remove trash that has accumulated in the brooks, catch basins and trash racks.

*Subdivision regulations regarding runoff* - The city engineering department continues to be aggressive in working with developers to ensure that there is not net increase in runoff from new development projects.

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*Participation in the National Flood Insurance Program* - FEMA maintains a database on flood insurance policies and claims. This database can be found on the FEMA website at <http://www.fema.gov/nfip/pcstat.shtm>. The reporting period covers January 1, 1978 through March 31, 2013. The following information is provided for the City of Medford.

Flood insurance policies in force (As of March 31, 2013)	71
Coverage amount of flood insurance policies	\$20,704,400
Premiums paid	\$57,073
Total losses (All losses submitted regardless of the status)	35
Closed losses (Losses that have been paid)	30
Open losses (Losses that have not been paid in full)	0
CWOP losses (Losses that have been closed without payment)	5
Total payments (Total amount paid on losses)	\$184,267.70

### Existing Dam Failure Mitigation Measures

*The Comprehensive Emergency Management Plan* - The CEMP addresses dam safety.

*Permits required for construction* – State law requires a permit for the construction of any dam.

*DCR dam safety regulations* – All dams are subject to the Division of Conservation and Recreation’s dam safety regulations.

*Wetlands Ordinance* - Adopted after 2008 plan, the ordinance would apply if activities were deemed by the Conservation Commission likely to have a significant individual and/or cumulative effect upon water resource areas of value.

### Existing Wind Hazard Mitigation Measures

*Forestry Division*– The City has a forestry department responsible for maintaining and trimming trees. The Division, under the supervision of the Tree Warden, maintains all public shade trees in the City of Medford. Shade trees are governed under MGL Chpt. 87 Section 3 and cannot be removed unless the Tree Warden or Deputy deems the tree unhealthy and/or dead or approved through a Public Hearing. Also, during and after wind-storm emergencies, crews from the division will work in dangerous situations in the interest of public safety.

### Existing Winter Storm Hazard Mitigation Measures

*Snow disposal sites* - Snow disposal is currently accomplished by piling snow in the playgrounds and on a municipal lot in Medford Square.

### Existing Geologic Hazard Mitigation Measures

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*Massachusetts State Building Code* – The State Building Code contains a section on designing for earthquake loads (780 CMR 1612.0). Section 1612.1 states that the purpose of these provisions is “to minimize the hazard to life to occupants of all buildings and non-building structures, to increase the expected performance of higher occupancy structures as compared to ordinary structures, and to improve the capability of essential facilities to function during and after an earthquake”. This section goes on to state that due to the complexity of seismic design, the criteria presented are the minimum considered to be “prudent and economically justified” for the protection of life safety. The code also states that absolute safety and prevention of damage, even in an earthquake event with a reasonable probability of occurrence, cannot be achieved economically for most buildings.

Section 1612.2.5 sets up seismic hazard exposure groups and assigns all buildings to one of these groups according to a Table 1612.2.5. Group II includes buildings which have a substantial public hazard due to occupancy or use and Group III are those buildings having essential facilities which are required for post-earthquake recovery, including fire, rescue and police stations, emergency rooms, power-generating facilities, and communications facilities.

### Existing Other Hazard Mitigation Measures

*Prohibition on outdoor burning* – The City does not allow outdoor burning.

*Subdivision review* – The Fire Department reviews subdivision plans to ensure adequate access for fire trucks and an adequate water supply.

**Table 17. Medford Existing Mitigation Measures**

<b>Type of Existing Mitigation Measures</b>	<b>Area Covered</b>	<b>Effectiveness/ Enforcement</b>	<b>Improvements/ Changes Needed</b>
<b>MULTIPLE HAZARDS</b>			
Comprehensive Emergency Management Plan (CEMP)	City-wide	Emphasis is on emergency response.	None.
Massachusetts State Building Code	City-wide.	Most effective for new construction. Many buildings in the City pre-date the most recent, more stringent requirements.	None.
Participation in the Mystic Region Emergency Planning Committee	Regional.	Provides a forum for regional cooperation on issues related to natural and man-	None.

**CITY OF MEDFORD HAZARD MITIGATION PLAN**

**Table 17. Medford Existing Mitigation Measures**

<b>Type of Existing Mitigation Measures</b>	<b>Area Covered</b>	<b>Effectiveness/ Enforcement</b>	<b>Improvements/ Changes Needed</b>
		made disasters.	
Participation in Additional Regional Emergency Preparedness and Response Organizations	Regional.	Provides a added opportunities for regional review, planning and coordination for emergency preparedness and response	None.
Medford Health Department Emergency Response Plan	City-wide.	Emphasis is on to preparedness for emergencies at public health departments.	None.
<b>FLOOD HAZARDS</b>			
Section 46 of the Medford City Code – Development in the Flood Zone	Areas designated as special flood hazard zones on the 1985 FIRM maps.	Effective for areas designated as special flood hazard areas. Section 46-39 acknowledges that land outside the flood hazard zones may also flood.	Amended in June 2010 to incorporate updated FEMA FIRMs.
Wetlands Ordinance	Areas containing wetlands, water resources, and adjacent uplands.	Effective.	Update as needed to reflect local planning goals and changes to state wetland regulations.
Site Plan Review Provisions of the Zoning Code	Any for projects that require site plan review.	Effective.	None.
Linkage fees	City-wide but only applies to projects of a certain size.	Effective.	None.
Upper Mystic River Watershed Project Impact Initiative	The Upper Mystic River watershed.	Effective as a regional planning tool.	None.

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**Table 17. Medford Existing Mitigation Measures**

<b>Type of Existing Mitigation Measures</b>	<b>Area Covered</b>	<b>Effectiveness/ Enforcement</b>	<b>Improvements/ Changes Needed</b>
Street sweeping	City-wide.	Effective.	None.
Catch basin cleaning/debris removal.	City-wide.	Generally effective. When heavy rains are forecast, the DPW does additional cleaning as needed to remove trash that has accumulated.	None.
Participation in the National Flood Insurance Program	Areas identified on the FIRM maps.	There are 71 policies in force.	Encourage all eligible homeowners to obtain insurance.
Subdivision regulations	City-wide.	Effective.	None.
<b>DAM FAILURE</b>			
Comprehensive Emergency Management Plan (CEMP)	All dams in the City.	Emphasis is on emergency response.	None.
State permits required for dam construction	State-wide.	Most effective for ensuring initial construction meets the code.	Improvements needed to the statewide system for dam inspections.
DCR dam safety regulations	State-wide.	Enforcement is an issue.	Staffing and budgeting needs to be addressed.
Wetlands Ordinance	Activities likely to have a significant individual and/or cumulative effect on water resource areas of value.	Effective.	Update as needed to reflect local planning goals and changes to state wetland regulations.
<b>WIND HAZARDS</b>			
Forestry Division	City-wide.	Effective.	None.

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**Table 17. Medford Existing Mitigation Measures**

<b>Type of Existing Mitigation Measures</b>	<b>Area Covered</b>	<b>Effectiveness/ Enforcement</b>	<b>Improvements/ Changes Needed</b>
<b>WINTER HAZARDS</b>			
Snow disposal	City-wide.	Effective.	None.
<b>GEOLOGIC HAZARDS</b>			
Massachusetts State Building Code	City-wide.	Effective for most situations.	None.
<b>BRUSH FIRE HAZARDS</b>			
Prohibition on outdoor burning	City-wide.	Effective.	None.
Subdivision review	City-wide.	Effective.	None.

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### Implementation Progress on Previous Plans

At a meeting of the Medford Hazard Mitigation Committee, City staff reviewed the mitigation measures identified in the 2008 Metro Boston Regional Pre-Disaster Mitigation Plan Medford Annex determined whether measures identified in the plan had been implemented or deferred. For implemented projects, they were categorized as either complete or ongoing, with the latter referring to projects were still under development or had begun but not yet completed. Ongoing measures are carried forward into the 2013 Medford Hazard Mitigation Plan. Of those measures that had been deferred, the committee evaluated whether the measure should be deleted or carried forward into the plan update. The decision on whether to delete or retain a particular measure was based on the committee’s assessment of the continued relevance or effectiveness of the measure and whether the deferral of action on the measure was due to the inability of the City to take action on the measure.

**Table 18. Mitigation Measures from the 2008 Plan**

Mitigation Measures	Priority	Implementation Responsibility	2012 Status
Sydney St. drainage improvements	High	DPW	Complete
Sydney Street Connector	High	DPW	Complete
Cradock Ave. drainage improvements	High	DPW	Deferred/Complete (Maintenance activities performed along lines which addressed drainage issues)
South Medford drainage improvements	High	DPW	Ongoing (Continuing to be under study with potential refinement of geography where drainage issues are located)
Winter Brook Drainage Improvements	High	DPW	Complete/Ongoing (Small scale project performed to clear section of Winter Brook where it is in an open channel/no piping to enclose brook. Area continues to be under study for potential drainage improvement project)
Study the drainage impacts of the Green Line extension.	High	DPW	Ongoing (Included as part of mitigation work of MBTA Green Line extension project which is underway)
Cranberry Brook drainage improvements	Medium	DPW	Ongoing (Project continues to be under study)
Park Street drainage	Low	DPW	Ongoing/Deferred (Project continues to be under study although area has

**CITY OF MEDFORD HAZARD MITIGATION PLAN**

**Table 18. Mitigation Measures from the 2008 Plan**

<b>Mitigation Measures</b>	<b>Priority</b>	<b>Implementation Responsibility</b>	<b>2012 Status</b>
improvements			not experienced flooding in recent years)
Prepare a study of the Wrights Pond Dam for the 100 year flood	High	City	Complete (Dam Improvement Safety Study was completed and crest on dam was raised and spillway improved to address elevation and volumes needs to meet height of potential maximum flood)
Repair the Mystic Lakes Dam	High	DCR	Complete (DCR reconstructed dam and included fish ladder)
Restore wetlands by removing phragmites and replanting with native species	Medium	DCR	Ongoing (Follow up underway with DCR)
Purchase a brush truck.	Medium.	City	Complete (New truck purchased in 2010)
Purchase additional equipment as identified by the Fire Dept.	Medium	City	Ongoing (New equipment identified and acquired as needed and as funding allows)
Distribute map of areas susceptible to liquefaction to City departments.	Low	Building	Ongoing (Under study and still collecting data to show potential at risk areas at a more local scale)
Dig test pits at the high school to determine the cause of the sinkholes	Medium	DPW	Complete (Broken pipe was identified under parking lot and fixed)

Medford’s staff continually demonstrates commitment and a high level of professionalism with regard to addressing natural hazard mitigation needs in order to protect the lives and property of the residents and businesses located in the City. As has been previously stated, flooding represents the greatest hazard for the community and staff diligently maintain the structures and enforces regulations that contribute to minimizing the potential impacts of this hazard, within the resources available. The action items identified above represent a list of activities that the City aimed to target since 2008, and they have brought many to completion.

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## CITY OF MEDFORD HAZARD MITIGATION PLAN

### 2013 Hazard Mitigation Strategy

What is Hazard Mitigation?

Hazard mitigation means to permanently reduce or alleviate the losses of life, injuries and property resulting from natural hazards through long-term strategies. These long-term strategies include planning, policy changes, education programs, infrastructure 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. The three links below provide additional information on these programs.

<http://www.fema.gov/government/grant/hmgp/index.shtm>

<http://www.fema.gov/government/grant/pdm/index.shtm>

<http://www.fema.gov/government/grant/fma/index.shtm>

Hazard Mitigation Measures can generally be sorted into the following groups:

- **Prevention**: Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and stormwater management regulations.
- **Property Protection**: Actions that involve the modification of existing buildings or infrastructure to protect them from a hazard or removal from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, flood proofing, storm shutters, and shatter resistant glass.
- **Public Education & Awareness**: Actions to inform and educate citizens, elected officials, and property owners about the potential risks from hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.
- **Natural Resource Protection**: Actions that, in addition to minimizing hazard losses also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.
- **Structural Projects**: Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include storm water controls (e.g., culverts), floodwalls, seawalls, retaining walls, and safe rooms.
- **Emergency Services Protection**: Actions that will protect emergency services before, during, and immediately after an occurrence. Examples of these actions include protection of warning system capability, protection of critical facilities, and protection of emergency response infrastructure.

(Source: *FEMA Local Multi-Hazard Mitigation Planning Guidance*)

## CITY OF MEDFORD HAZARD MITIGATION PLAN

### Proposed Hazard Mitigation Measures

#### Flood Hazard Mitigation Measures

- A) Main Street to Mystic Avenue drainage improvements (Refinement of South Medford improvement as proposed in 2008 plan): Work to address potential infiltration and inflow issues, and downstream constraints/limits that reduce the ability of the system to drain during intense rainfall events.
- B) Meetinghouse Brook Drainage Improvements: Develop, design and construct drainage improvements at the lower end of Meetinghouse Brook where it drains to the Mystic River.
- C) Infiltration and Inflow Study in the area of the Lawrence Estates: Investigate potential points of infiltration and inflow to reduce additional water entering the system in order to maintain, and where possible, recapture drainage capacity in the area of the Lawrence Estates.
- D) Cradock Bridge/Cradock Locks Project: Coordinate and work with MassDOT on the bridge reconstruction project so that the locks are removed and improvements are made for water flow on the Mystic River.
- E) Coordinate with Green Line extension project: Coordinate project design and construction activities with MassDOT and MBTA so that any identified drainage issues along the corridor and at planned stations are resolved by the project.
- F) Winter Brook Drainage Improvements: Continue to study system for additional drainage improvement project(s), such as increasing capacity of pipes in system and removing siltation and debris in open channel.
- G) Wetland Ordinance: Maintain ordinance by identifying new findings and models that could be used to update to current ordinance.
- H) Cranberry Brook drainage improvements: Continue to study system for additional drainage improvement project(s), such as replacing undersized pipes and potentially piping sections that are still open channels.
- I) South Medford to River/Winter Brook Drainage Improvements: Work back from outlet locations to determine drainage volume needs and replace or increase capacity of upstream pipes accordingly.
- J) Coordination with Private Property Owners on Catch basin Maintenance: Coordinate with private land owners to develop best practices for cleaning catch basins on private property in order to prevent drainage issues on and off the properties.

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- K) Park Street drainage improvements: Continue to study system for additional drainage improvement project(s), such as increasing capacity of drainage system in order to handle additional runoff from increased development in area.

### *Measures to Ensure Compliance with NFIP*

- L) Floodplain Management: Continue to enforce the Floodplain Zoning District (Section 470) and associated building regulations for floodplain areas. Update this district to remain consistent with FEMA guidelines and floodplain mapping.
- M) Floodplain Mapping: Maintain up to date maps of local FEMA identified floodplains.

### Wind Hazard Mitigation Measures

- N) Tree Warden Coordination with Utility Companies: Have the Tree Warden coordinate with utility companies on tree trimming to reduce potential for the downing of overhead lines during storm events.

### Winter Storm Hazard Mitigation Measures

- O) Tree Warden Coordination with Utility Companies: Snow loading on trees has led to falling branches and the downing of electrical and other overhead utility lines. The Tree Warden should investigate where these impacts have occurred and coordinate with utility companies on tree trimming to reduce potential for the downing of overhead lines during storm events.

### Geologic Hazard Mitigation Measures

- P) Distribute Map of Areas Susceptible to Liquefaction to City Departments: The City should provide a copy of the map of areas susceptible to liquefaction to all relevant City departments to assist in planning and evaluating development proposals and for disaster response.

### Other Natural Hazards

- Q) Reduce Phragmites in Wetlands: Restore wetlands, especially in the Mystic Valley Parkway region, by removing phragmites and restoring native species to cut down on fires and would help to beautify the wetlands.
- R) Purchase Additional Equipment: Continue to identify and, as funding allows, acquire new equipment for the Fire Department in order to respond to and address brush fires.

# CITY OF MEDFORD HAZARD MITIGATION PLAN

## Prioritization of Mitigation Activities

The last step in developing the City’s mitigation strategy is to assign a level of priority to each mitigation measure so as to guide the focus of the City’s limited resources towards those actions with the greatest potential benefit. At this stage in the process, the Local Hazard Mitigation Committee has limited access to detailed analyses of the cost and benefits of any given measure, so prioritization is based on the committee member’s knowledge of the existing and potential hazard impacts and an approximate sense of the costs associated with pursuing any given measure.

Prioritization occurred through discussion at the third meeting of the local committee and through subsequent review by committee members and public comment. Priority setting was based on local knowledge of the hazard areas, including impacts of hazard events and the extent of the area impacted and the relation of a given mitigation measure to the City’s identified goals. In addition, through the discussion, the local committee also took into consideration factors such as the number of homes and businesses affected, whether or not road closures occurred and what impact closures had on delivery of emergency services and the local economy, anticipated project costs, whether the City currently had the technical and administrative capability to carry out the mitigation measures, whether any environmental constraints existed, and whether the City would be able to justify the costs relative to the anticipated benefits.

The table below demonstrates the prioritization. For each mitigation measure, the geographic extent of the potential benefiting area is identified as is an estimate of the overall benefit and cost of the measures. The benefits and costs were evaluated in terms of:

### Benefits

High	Action will result in a significant reduction of hazard risk to people and/or property from a hazard event
Medium	Action will likely result in a moderate reduction of hazard risk to people and/or property from a hazard event
Low	Action will result in a low reduction of hazard risk to people and/or property from a hazard event

### Costs

High	Estimated costs greater than \$50,000
Medium	Estimated costs between \$10,000 to \$50,000
Low	Estimated costs less than \$10,000 or staff time

With this assessment, an approximate timeframe has been identified in which the municipality would attempt to achieve the mitigation measure.

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**Table 19. Mitigation Measure Prioritization**

<b>Mitigation Action</b>	<b>Geographic Area</b>	<b>Benefit</b>	<b>Estimated Cost</b>	<b>Priority</b>	<b>Time Frame</b>
<b>Flood Hazard Mitigation Measures</b>					
a) Main Street to Mystic Avenue drainage improvements	South Medford	High	High	High	2013 - 2018
b) Meetinghouse Brook Drainage Improvements	Lawrence Estates	High	High	High	2013-2016
c) Infiltration and Inflow Study in the area of the Lawrence Estates	Lawrence Estates	High	High	High	2013-2016
d) Cradock Bridge/ Cradock Locks Project	Medford Square	High	High	High	2013-2017
e) Coordinate with Green Line extension project	Medford Hillside	Medium	High	High	2013-2017
f) Winter Brook Drainage Improvements	Wellington/Glenwood	Medium	High	Medium	2013-2017
g) Wetlands Ordinance	City Wide	Medium	Low	Medium	2013-2017
h) Cranberry Brook Drainage Improvements	North Medford	Medium	High	Medium	2013-2017

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**Table 19. Mitigation Measure Prioritization**

<b>Mitigation Action</b>	<b>Geographic Area</b>	<b>Benefit</b>	<b>Estimated Cost</b>	<b>Priority</b>	<b>Time Frame</b>
i) South Medford to River/Winter Brook Drainage Improvements	South Medford	Medium	High	Medium	2014-2016
j) Coordination with Private Property Owners on Catch basin Maintenance	City Wide	Medium	Low	Low	2014-2016
k) Park Street drainage improvements	Wellington/Glenwood	Low	High	Low	2013-2017
l) Floodplain Management	Floodplains	High	Low	Low	2013-2017
m) Floodplain Mapping	Floodplains	High	Low	Low	2013-2017
<b>Wind Hazard Mitigation Measures</b>					
n) Tree Warden Coordination with Utility Companies	City wide	High	Medium	Medium	2013-2017
<b>Snow Hazard Mitigation Measures</b>					
o) Tree Warden Coordination with Utility Companies	City wide	High	Medium	Medium	2013-2017
<b>Geologic Hazard Mitigation Measures</b>					

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**Table 19. Mitigation Measure Prioritization**

<b>Mitigation Action</b>	<b>Geographic Area</b>	<b>Benefit</b>	<b>Estimated Cost</b>	<b>Priority</b>	<b>Time Frame</b>
p) Distribute Map of Areas Susceptible to Liquefaction to City Departments	City wide	Low	Low	Low	2013-2017
<b>Other Hazard Mitigation Measures</b>					
q) Reduce Phragmites in Wetlands	Wetlands	Medium	Low	Medium	2013-2017
r) Purchase Additional Equipment	Brush Fire Hazard Areas	Medium	High	Medium	2013-2017

## CITY OF MEDFORD HAZARD MITIGATION PLAN

### Introduction to Potential Mitigation Measures (Table 20)

Description of the Mitigation Measure – The description of each mitigation measure is brief and cost information is given only if cost data were already available from the community. 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.

Priority – The designation of high, medium, or low priority was done at the meeting of the Local Multiple Hazard Community Planning Team meeting. The designations reflect discussion and a general consensus developed at the meeting but could change as conditions in the community change. In determining project priorities, the local team considered potential benefits and project costs.

Implementation Responsibility – The designation of implementation responsibility was done by MAPC based on a general knowledge of what each municipal department is responsible for. 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.

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. Because the time frame for this plan is five years, the timing for all mitigation measures has been kept within this framework. The identification of a likely time frame is not meant to constrain a community from taking advantage of funding opportunities as they arise.

Potential Funding Sources – This column attempts to identify the most likely sources of funding for a specific measure. The information on potential funding sources in this table is preliminary and varies depending on a number of factors. These factors include whether or not a mitigation measure has been studied, evaluated or designed, or if it is still in the conceptual stages. MEMA and DCR assisted MAPC in reviewing the potential eligibility for hazard mitigation funding. 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.

Additional information on funding sources – The best way to determine eligibility for a particular funding source is to review the project with a staff person at the funding agency. The following websites provide an overview of programs and funding sources.

Army Corps of Engineers (ACOE) – The website for the North Atlantic district office is <http://www.nae.usace.army.mil/>. The ACOE provides assistance in a

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number of types of projects including shoreline/streambank protection, flood damage reduction, flood plain management services and planning services.

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 firefighting needs. See the link below for some example.

<http://www.rurdev.usda.gov/rd/newsroom/2002/cfg.html>

### Abbreviations Used in Table 17

FEMA Mitigation Grants includes:

FMA = Flood Mitigation Assistance Program.

HMGP = Hazard Mitigation Grant Program.

PDM = Pre-Disaster Mitigation Program

ACOE = Army Corps of Engineers.

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

Mass DOT = Massachusetts Department of Transportation

MBTA = Massachusetts Bay Transportation Authority

DCR = MA Department of Conservation and Recreation

DHCD = MA Department of Housing and Community Development

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**Table 20. Medford Potential Mitigation Measures**

<b>Mitigation Measure</b>	<b>Measure Type</b>	<b>Implementation Responsibility</b>	<b>Priority</b>	<b>Time Frame</b>	<b>Potential Funding Sources</b>
<b>Flood Hazard Mitigation Measures</b>					
a) Main Street to Mystic Avenue Drainage improvements*	Structural Projects	Engineering/ DPW	High	2013 - 2017	Medford/FEMA
b) Meetinghouse Brook Drainage Improvements	Structural Projects	Engineering/ DPW	High	2013-2016	Medford/FEMA
c) Infiltration and Inflow Study in the area of the Lawrence Estates	Structural Projects	Engineering/ DPW	High	2013-2016	Medford
d) Cradock Bridge/ Cradock Locks Project	Structural Projects	City/ MassDOT	High	2013-2017	MassDOT
e) Coordinate with Green Line extension project*	Structural Projects	City/ MassDOT/ MBTA	High	2013-2017	MassDOT/MBTA
f) Winter Brook Drainage Improvements*	Structural Projects	City/ Private Property Owners	Medium	2013-2017	Medford/FEMA
g) Wetlands Ordinance	Natural Resource Protection/ Prevention	Energy and Environment/ Conservation Commission	Medium	2013-2017	Medford
h) Cranberry Brook Drainage Improvements*	Structural Projects	DPW/ Engineering	Medium	2013-2017	Medford/FEMA

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**Table 20. Medford Potential Mitigation Measures**

<b>Mitigation Measure</b>	<b>Measure Type</b>	<b>Implementation Responsibility</b>	<b>Priority</b>	<b>Time Frame</b>	<b>Potential Funding Sources</b>
i) South Medford to River/Winter Brook Drainage Improvements*	Structural Projects	DPW/ Engineering	Medium	2014-2016	Medford/FEMA
j) Coordination with Private Property Owners on Catch basin Maintenance	Prevention	Engineering/ DPW/Building Department	Low	2014-2016	Private Property Owners
k) Park Street Drainage Improvements*	Structural Projects	DPW/ Engineering	Low	2013-2017	Medford/FEMA
l) Floodplain Management	Prevention	Office of Community Development/ Conservation Commission	Low	2012-2014	Medford
m) Floodplain Mapping	Prevention	Office of Community Development/ Conservation Commission	Low	2012-2017	Medford
<b>Wind Hazard Mitigation Measures</b>					
n) Tree Warden Coordination with Utility Companies	Prevention	Forestry Division	Medium	2013-2017	Medford/Utility Companies
<b>Winter Storm Hazard Mitigation Measures</b>					
o) Tree Warden Coordination with Utility Companies	Prevention	Forestry Division	Medium	2013-2017	Medford/Utility Companies
<b>Geologic Hazard Mitigation Measures</b>					

**CITY OF MEDFORD HAZARD MITIGATION PLAN**

**Table 20. Medford Potential Mitigation Measures**

<b>Mitigation Measure</b>	<b>Measure Type</b>	<b>Implementation Responsibility</b>	<b>Priority</b>	<b>Time Frame</b>	<b>Potential Funding Sources</b>
p) Distribute Map of Areas Susceptible to Liquefaction to City Departments*	Prevention	Building Department/ Engineering	Low	2013-2017	Medford
<b>Other Hazard Mitigation Measures</b>					
q) Reduce Phragmites in Wetlands	Prevention	Conservation Commission/Fire Department/ DCR	Low	2013- 2017	Medford/ DCR
r) Purchase Additional Equipment	Emergency Services Protection	Fire Department	Medium	2013-2017	Medford

\* Mitigation measures carried forward from the 2008 Medford Hazard Mitigation Plan.

# CITY OF MEDFORD HAZARD MITIGATION PLAN

## **Regional and Inter-Community Considerations**

### Regional Issues

Some hazard mitigation issues are strictly local. The problem originates primarily within the municipality and can be solved at the municipal level (e.g., capacity issues in local drainage system). Other issues are inter-community issues that involve cooperation between two or more municipalities (e.g., downstream issues related to upstream flooding on the Mystic River). There is a third level of mitigation which is regional; involving a state, regional or federal agency or an issue that involves three or more municipalities (e.g., any potential issues related to the Amelia Earhart Dam, which is owned by the DCR).

### Regional Partners and Hazard Mitigation Coordination

In the densely developed communities of the study area, mitigating natural hazards, particularly flooding, is more than a local issue. The drainage systems that serve these communities are a complex system of storm drains, tide gates, roadway drainage structures, pump stations and other facilities owned and operated by a wide array of agencies including but not limited to the City of Medford, the Department of Conservation and Recreation (DCR), the Massachusetts Water Resources Authority (MWRA), Massachusetts Department of Transportation (MassDOT) and the Massachusetts Bay Transportation Authority (MBTA).

The planning, construction, operations and maintenance of these structures are integral to the flood 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. The following is a list of recommendations from the 2008 plan that had planned to be undertaken in coordination with or by regional agencies.

Cradock Bridge - The City of Medford identified the rehabilitation of the Cradock Bridge, which is on a state roadway facility, as a high priority regional issue and the bridge is now under redesign and planning for reconstruction over the next couple of years.

Green Line Extension – The City of Medford believes that the MBTA Green Line extension need continued studies so that it does not negatively impact drainage in Medford. Drainage issues are now being considered as part of the Green Line extension design and construction project. The project currently extends as far as the planned College Avenue station, and may be extended to Mystic Valley Parkway in the future.

Maintenance of Land along the Mystic River – The City is still interested in the possibility of taking ownership of the land owned by DCR along the Mystic River so that

## CITY OF MEDFORD HAZARD MITIGATION PLAN

the City has control over maintenance of the land. To support this desire, the City and DCR should begin to work together to ensure better maintenance of the open space along the river.

Somerville Combined Sewer Overflows – The combined sewer overflows in Somerville affect flooding in South Medford. The City and Somerville should coordinate around drainage improvements project (e.g., CSO separation) to reduce flooding issues and improve drainage infrastructure across the municipal borders.

Meetinghouse Brook – Although there are local issues that affect flooding from Meetinghouse Brook, there has been past flooding along the waterway when Winchester opened up a dam on the reservoir. The City will continue to reach out to Winchester in an effort to coordinate and reduce the potential for flooding from releases for the reservoir.

River's Edge Development – This development parcel is located in Medford, Malden and Everett. It is important that all three communities continue to work together to implement the master plan for this site and take steps to prevent impacts to the site from natural hazards.

Flooding on the Aberjona River – The City of Medford continues to raise the issue of the importance of undertaking flood mitigation measures on a watershed-wide basis.

### **Climate Change**

The entirety of Massachusetts, and in particular the Commonwealth's coastal cities and towns, faces potential risk from Climate Change. Many of the natural hazards that cities like Medford have historically experienced are likely to be exacerbated by climate change in future years. This is particularly true for flooding caused by extreme precipitation, flooding, and extreme heat. For example, according to the 2012 report *When It Rains It Pours – Global Warming and the Increase in Extreme Precipitation from 1948 to 2011*, intense rainstorms and snowstorms have become more frequent and more severe over the last half century in the northeastern United States. Extreme downpours are now happening 30 percent more often nationwide than in 1948. In other words, large rain or snow storms that happened once every 12 months, on average, in the middle of the 20th century, now happen every nine months.

Attempts to mitigate climate change or adapt to its potential impacts are largely outside the scope of this Hazard Mitigation Plan, which relies primarily on historic trends to assess risk and vulnerability. The potential changes to the State's storm damage profile caused by Climate Change will be well outside of historic trends, making those trends uncertain predictors of future risk and vulnerability at best. Cities, towns, Regional Planning Agencies and other regional and state agencies will need to advocate for a statewide response that includes using the best available information to map and model climate change data related to natural hazards and disseminate this information for use in hazard mitigation planning and land use policy development.

## CITY OF MEDFORD HAZARD MITIGATION PLAN

Lastly, in addition to understanding how the physical infrastructure will be impacted, it is important to identify how vulnerable populations may suffer greater impacts under future Climate Change scenarios. These populations could include the elderly, the very young, low-income groups, immigrants and the homeless, among others, and could disproportionately suffer the effects of extreme events, like flooding and heat waves, be least-equipped to adapt. Efforts should be undertaken to identify the locations of possible vulnerable populations. This could include coordination with updates to the City's demographic data (e.g., Census data for where those 65 and over, low-income and/or are linguistically isolated are located) and collaboration with other boards that serve communities that include Commission for Persons with Disabilities, the Council on Aging and the Human Rights Commission.

After identifying these locations, strategies should be developed and implemented to educate, engage and include these populations in hazard and emergency response planning efforts.

## CITY OF MEDFORD HAZARD MITIGATION PLAN

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# CITY OF MEDFORD HAZARD MITIGATION PLAN

## VII. PLAN ADOPTION AND MAINTENANCE

### Plan Adoption

The Medford Hazard Mitigation Plan was adopted by the City Council on [ADD DATE]. See Appendix D for documentation. The plan was approved by FEMA on [ADD DATE] for a five-year period that will expire on [ADD DATE].

### Plan Maintenance

MAPC worked with the Medford Hazard Mitigation Planning Team to prepare this plan. This group will continue to meet on an as-needed basis to function as the Local Hazard Mitigation Implementation Group, with one City official designated as the coordinator. Additional members could be added to the local implementation group from businesses, non-profits and institutions.

### Implementation Schedule

Bi-Annual Survey on Progress– The coordinator of the Hazard Mitigation Implementation Team will prepare and distribute a biannual survey in years two and four of the plan. The survey will be distributed to all of the local implementation group members and other interested local stakeholders. The survey will poll the members on any changes or revisions to the plan that may be needed, progress and accomplishments for implementation, and any new hazards or problem areas that have been identified.

This information will be used to prepare a report or addendum to the local hazard mitigation plan. The Hazard Mitigation Implementation Team will have primary responsibility for tracking progress and updating the plan.

Develop a Year Four Update – During the fourth year after initial plan adoption, the coordinator of the Hazard Mitigation Implementation Team will convene the team to begin to prepare for an update of the plan, which will be required by the end of year five in order to maintain approved plan status with FEMA. The team will use the information from the year four biannual review to identify the needs and priorities for the plan update.

Prepare and Adopt an Updated Local Hazard Mitigation Plan – FEMA’s approval of this plan is valid for five years, by which time an updated plan must be approved by FEMA in order to maintain the City’s approved plan status and its eligibility for FEMA mitigation grants. Because of the time required to secure a planning grant, prepare an updated plan, and complete the approval and adoption of an updated plan, the local Hazard Mitigation Planning Team should begin the process by the end of Year 3. This will help the City avoid a lapse in its approved plan status and grant eligibility when the current plan expires.

At this point, the Hazard Mitigation Implementation Team may decide to undertake the update themselves, contract with the Metropolitan Area Planning Council to update the plan or to hire another consultant. However the Hazard Mitigation Implementation Team

## **CITY OF MEDFORD HAZARD MITIGATION PLAN**

decides to update the plan, the group will need to review the current FEMA hazard mitigation plan guidelines for any changes. The update of the Medford Hazard Mitigation Plan will be forwarded to MEMA and DCR for review and to FEMA for approval.

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

Upon approval of the Medford Hazard Mitigation Plan by FEMA, the coordinator of the Hazard Mitigation Implementation Team with support from other members of the team 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 during the first six (6) months following plan adoption:

- Fire
- Civil Defense/ Emergency Management
- Police
- Public Works
- Engineering
- Planning and Community Development
- Energy and Environment
- Forestry
- Health
- Building

Other groups that will be coordinated with include large institutions, Chambers of Commerce, land conservation organizations and watershed groups. The plans will also be posted on a community's website with the caveat that local team coordinator 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.

# CITY OF MEDFORD HAZARD MITIGATION PLAN

## VIII. LIST OF REFERENCES

In addition to the specific reports listed below, much of the technical information for this plan came from meetings with City department heads and staff.

City of Medford Zoning Ordinance.

City of Medford Open Space and Recreation Plan Update, 2011

City of Medford CPMP Annual Action Plan, 2012.

City of Medford Community Development Plan, 2004.

Medford Square Master Plan, 2005.

Metro-Boston Multi-Hazard Mitigation Plan, Medford Annex, 2008.

Metropolitan Area Planning Council, Geographic Information Systems data.

Metropolitan Area Planning Council, Regional Plans and Data.

Commonwealth of Massachusetts State Hazard Mitigation Plan, 2010.

FEMA, Local Multi-Hazard Mitigation Planning Guidance, 2008.

FEMA, Flood Insurance Rate Maps for Medford, MA, 2010.

New England Seismic Network, Boston College Weston Observatory, website:  
<http://aki.bc.edu/index.htm>

Northeast States Emergency Consortium, website: <http://www.nesec.org/>

## **CITY OF MEDFORD HAZARD MITIGATION PLAN**

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**CITY OF MEDFORD HAZARD MITIGATION PLAN**

**APPENDIX A  
MEETING AGENDAS**

## CITY OF MEDFORD HAZARD MITIGATION PLAN

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# CITY OF MEDFORD HAZARD MITIGATION PLAN



*Don Boyce*  
DIRECTOR



*Edward M. Lambert Jr.*  
COMMISSIONER



*Marc D. Draisin*  
EXECUTIVE DIRECTOR

## THE COMMONWEALTH OF MASSACHUSETTS

*Deval Patrick, Governor*

**MASSACHUSETTS EMERGENCY MANAGEMENT AGENCY**  
400 WORCESTER ROAD, FRAMINGHAM, MA 01702-5399 508-820-2000 FAX 508-820-1404

**DEPARTMENT OF CONSERVATION AND RECREATION**  
251 CAUSEWAY STREET, SUITE 600-900, BOSTON, MA 02114-2104 617-626-1250 FAX 617-626-1351

**METROPOLITAN AREA PLANNING COUNCIL**  
60 TEMPLE PLACE, 6<sup>TH</sup> FLOOR, BOSTON, MA 02111 617-451-2770 FAX 617-482-7185

## Metro Boston Hazard Mitigation Planning Team

### First Meeting

**Wednesday, April 13, 10:00 AM**

**Everett City Hall, Keverian Room (3<sup>rd</sup> floor)  
484 Broadway (Route 99), Everett**

### AGENDA

#### METRO BOSTON HAZARD MITIGATION PLANNING TEAM

Boston  
Brookline  
Cambridge  
Chelsea  
Everett  
Malden  
Medford  
Somerville

#### 10:00 WELCOME & INTRODUCTIONS

#### 10:10 OVERVIEW OF HAZARD MITIGATION PLANNING & GRANTS

- State Hazard Mitigation Plan & FEMA Grants—Sarah White, MEMA
- FEMA Hazard Mitigation Program and Grants – Nan Johnson, FEMA
- Regional & Local Mitigation Plans - Martin Pillsbury, MAPC

#### 10:30 UPDATING THE METRO BOSTON HAZARD MITIGATION PLAN

- FEMA Requirements & Grant Eligibility
- Review of Scope of Work & Schedule –MAPC
- Questions & Discussion – Local issues & Priorities

#### 11:00 GETTING STARTED: MAPPING AND CRITICAL FACILITIES DATABASE FOR THE METRO BOSTON PLAN UPDATE

- Susan Brunton, GIS Analyst, MAPC

#### 11:20 NEXT STEPS

#### 11:30 ADJOURN

If you have any questions please contact Martin Pillsbury at MAPC:  
617-451-2770, ext. 2012 or [mpillsbury@mapc.org](mailto:mpillsbury@mapc.org)

# CITY OF MEDFORD HAZARD MITIGATION PLAN

## Meeting Agenda Local Multiple Hazard Community Planning Team City of Medford March 27, 2013

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- 1) Overview of Project Scope and Status
- 2) Introduce City of Medford Hazard Mitigation Planning Map Series and Digitized Ortho Photo Map.
- 3) Identify:
  - a) Flood Hazard Areas (incl. areas with concentration of repetitive loss properties)
  - b) Fire Hazard Areas (incl. approximate number of annual wildfires and recent incidences that resulted in property damage)
  - c) Future Potential Development Areas
  - d) Historical, Cultural or Natural Resource Areas
  - e) Dams (incl. type and ownership)
- 4) Review and Assess Plan Goals (see over)
- 5) Discuss Public Involvement and Outreach (see over)
- 6) Set Date for First Public Meeting and Discuss Public Outreach
- 7) Set Tentative Date Second Staff Meeting to:
  - a) Review Existing Mitigation Measures
  - b) Review Mitigation Measures from the 2008 Plan
  - c) Discuss Potential Mitigation Measures
  - d) Prioritize Mitigation Measures

---

**Project Overview** - MAPC received a grant to prepare natural hazards *Pre-Disaster Mitigation Plan* for the communities of Boston, Brookline, Cambridge, Chelsea, Everett, Malden, Medford and Somerville. MAPC is working with the eight communities to update their plans to mitigate potential damages of natural hazards such as floods, winter storms, hurricanes, earthquakes and wild fires, before such hazards occur. The federal *Disaster Mitigation Act of 2000* requires that all municipalities adopt a *Pre-Disaster Mitigation Plan* for natural hazards in order to remain eligible for FEMA Disaster Mitigation Grants.

This FEMA planning program is separate from new or ongoing homeland security initiatives, and is focused solely on addressing natural hazards, although some of the data collected for this plan may be useful for other aspects of emergency planning as well.

## CITY OF MEDFORD HAZARD MITIGATION PLAN

### Public Participation

1. MAPC presents at 2 public meeting
2. Coordinate public outreach and information for meetings
3. Post on City website with a set public review period
4. Distribute to specified organizations or boards/commissions for their review
5. Distribute announcement to adjacent municipalities about Draft Plan Update
6. Other opportunities for local involvement and participation in process

### 2008 Plan - Goals

1. Prevent and reduce the loss of life, injury 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 City 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 all applicable standards for preventing and reducing the impacts of natural hazards.
8. Take maximum advantage of resources from FEMA, MEMA and other agencies to educate City staff and the public about hazard mitigation.

# CITY OF MEDFORD HAZARD MITIGATION PLAN

## Meeting Agenda Local Multiple Hazard Community Planning Team Medford, MA

May 3, 2013

10:00 AM - 12:00 PM

Medford City Hall

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1. Confirm Goals
2. Review Existing Mitigation Measures
3. Review Mitigation Measures from the 2008 Plan
4. Discuss Potential Mitigation Measures
5. Prioritize Mitigation Measures
6. Set Date for Final Review Team
7. Prepare for final public meeting

---

**Project Overview** - MAPC received a grant to prepare natural hazards *Pre-Disaster Mitigation Plan* for the communities of Boston, Brookline, Cambridge, Chelsea, Everett, Malden, Medford and Somerville. MAPC is working with the eight communities to update their plans to mitigate potential damages of natural hazards such as floods, winter storms, hurricanes, earthquakes and wild fires, before such hazards occur. The federal *Disaster Mitigation Act of 2000* requires that all municipalities adopt a *Pre-Disaster Mitigation Plan* for natural hazards in order to remain eligible for FEMA Disaster Mitigation Grants.

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## CITY OF MEDFORD HAZARD MITIGATION PLAN

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# CITY OF MEDFORD HAZARD MITIGATION PLAN

## APPENDIX B HAZARD MAPPING

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: Development** – This map shows potential future developments, and critical infrastructure sites. MAPC consulted with City staff to determine areas that were likely to be developed or redeveloped in the future. The map also depicts current land use.

**Map 3: Flood Zones** – The map of flood zones used the FEMA NFIP Flood Zones as depicted on the FIRMs (Federal Insurance Rate Maps) as its source. At the time this plan was developed, these flood zones had not yet been officially adopted and were therefore considered draft. This map is not intended for use in determining whether or not a specific property is located within a FEMA NFIP flood zone. The currently adopted FIRMs for Medford are kept by the City. For more information, refer to the FEMA Map Service Center website <http://www.msc.fema.gov>. The definitions of the flood zones are described in detail on this site as well. The flood zone map for each community also shows critical infrastructure and repetitive loss areas.

## CITY OF MEDFORD HAZARD MITIGATION PLAN

**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 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. The critical infrastructure sites are also shown. The source of the aerial photograph is Mass GIS.

# CITY OF MEDFORD HAZARD MITIGATION PLAN



## FEMA Pre-Disaster Mitigation Planning Grant MEDFORD, MA

Map 1: Population Density  
**DRAFT**

**Sites**

- Critical Infrastructure Sites\* (Green circle)
- Repetitive Loss Sites (Red circle)
- Water Bodies (Blue area)

\* See details in separate table

**Train Stations** (Circle with 'T')

**Commuter Rail Lines** (Purple line)

**Trains** (Black line with cross-ticks)

**Subway Lines**

- Blue
- Green
- Orange
- Red
- Silver

**All Roads**

- Interstate (Thick grey line)
- U.S. Highway (Thin grey line)
- State Route (Thin grey line)
- Street (Thin black line)

**Population Density 2010 Census Blocks People Per Acre**

- 0 or No Data (Lightest yellow)
- 0.1 - 5.0 (Light yellow)
- 5.1 - 15.0 (Orange)
- 15.1 - 30.0 (Dark orange)
- More than 30 (Darkest orange/brown)

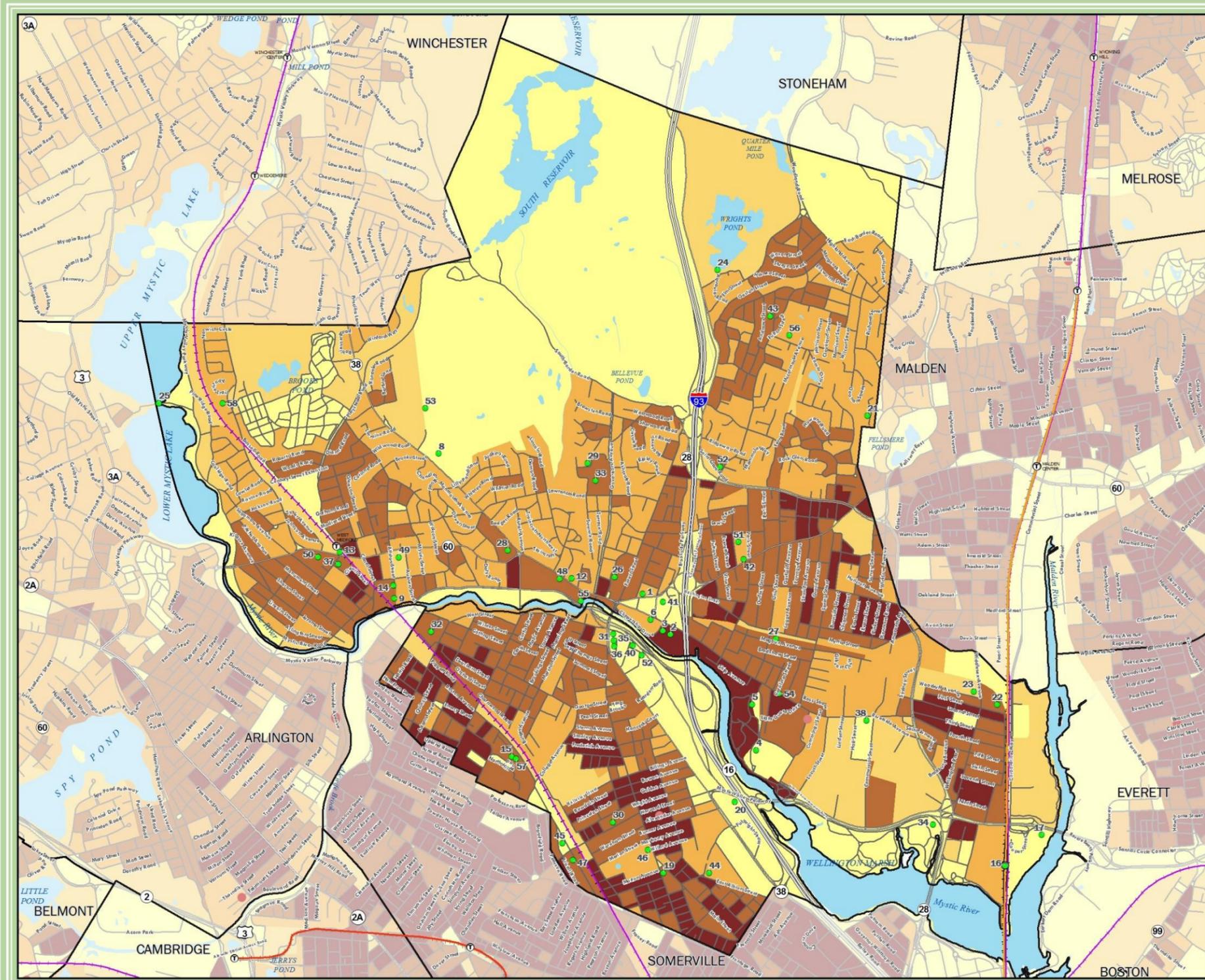


The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analyses.

Produced by MAPC Data Services  
60 Temple Place, Boston, MA 02111 (617) 451-2770

Data Sources:  
Metropolitan Area Planning Council (MAPC)  
Massachusetts Geographic Information System (MassGIS)  
Northeast States Emergency Consortium (NESEC)  
Massachusetts Emergency Management Agency (MEMA)  
Federal Emergency Management Agency (FEMA)  
MEDFORD, MA

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Date: 5/30/2013



CITY OF MEDFORD HAZARD MITIGATION PLAN



FEMA Pre-Disaster Mitigation Planning Grant  
**MEDFORD, MA**  
 Map 2: Developable Land  
**DRAFT**

**Sites**

- Critical Infrastructure Sites\*
- Repetitive Loss Sites
- \* See details in separate table

**Development Areas**

- Development Areas (Red outline)

**Land Use**

- High Density Residential (Dark Orange)
- Medium Density Residential (Light Orange)
- Low Density Residential (Yellow-Orange)
- Non-Residential Developed (Light Yellow)
- Commercial (Dark Red)
- Industrial (Purple)
- Transportation (Grey)
- Agriculture (Light Green)
- Undeveloped (Light Green)
- Undeveloped Wetlands (Teal)

**Train Stations**

- Commuter Rail Lines (Purple line)
- Trains (Black line)

**Subway Lines**

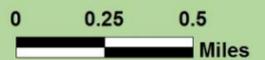
- Blue (Blue line)
- Green (Green line)
- Orange (Orange line)
- Red (Red line)
- Silver (Silver line)

**All Roads**

- Interstate (Thick grey line)
- U.S. Highway (Thin grey line)
- State Route (Thin grey line)
- Street (Thin grey line)

**Water Bodies**

- Water Bodies (Blue area)

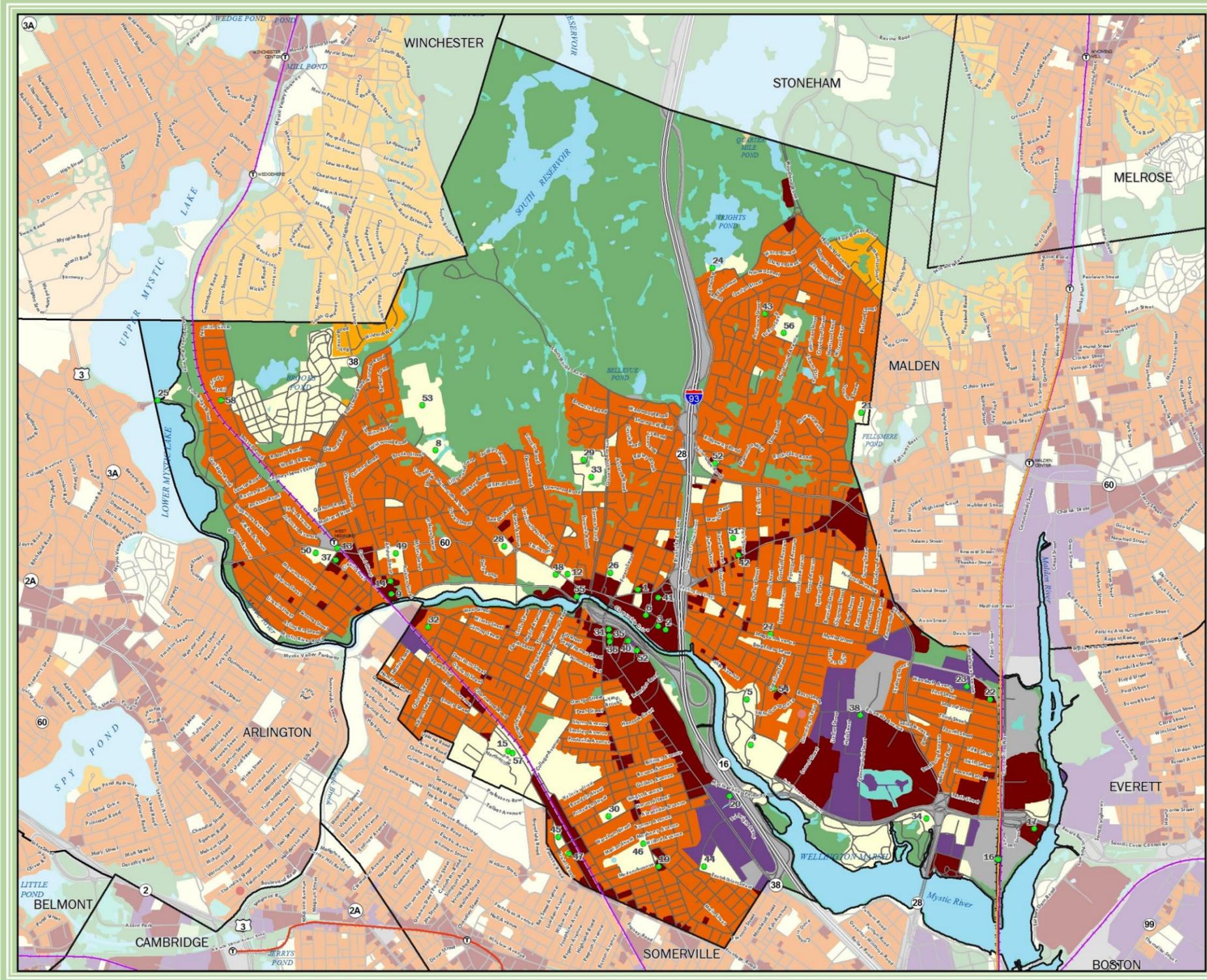


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 60 Temple Place, Boston, MA 02111 (617) 451-2770

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 Northeast States Emergency Consortium (NESEC)  
 Massachusetts Emergency Management Agency (MEMA)  
 Federal Emergency Management Agency (FEMA)  
 MEDFORD, MA

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# CITY OF MEDFORD HAZARD MITIGATION PLAN



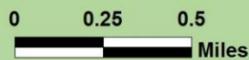
FEMA Pre-Disaster Mitigation Planning Grant

## MEDFORD, MA

Map 3: Flood Zones

DRAFT

<p><b>Sites</b></p> <ul style="list-style-type: none"> <li><span style="color: green;">●</span> Critical Infrastructure Sites*</li> <li><span style="color: red;">●</span> Repetitive Loss Sites</li> </ul> <p>* See details in separate table</p>	<ul style="list-style-type: none"> <li> Train Stations</li> <li> Commuter Rail Lines</li> <li> Trains</li> </ul>
<ul style="list-style-type: none"> <li> Water Bodies</li> </ul>	<p><b>Subway Lines</b></p> <ul style="list-style-type: none"> <li> Blue</li> <li> Green</li> <li> Orange</li> <li> Red</li> <li> Silver</li> </ul>
<p><b>Flood Zones (Annual Chance)</b></p> <ul style="list-style-type: none"> <li> Zone A : 1%</li> <li> Zone AE : 1%</li> <li> Zone AH : 1%</li> <li> Zone AO : 1%</li> <li> Zone V : 1% with Velocity Hazard</li> <li> Zone VE : 1% with Velocity Hazard</li> <li> 0.2% Annual Chance</li> </ul>	<p><b>All Roads</b></p> <ul style="list-style-type: none"> <li> Interstate</li> <li> U.S. Highway</li> <li> State Route</li> <li> Street</li> </ul>

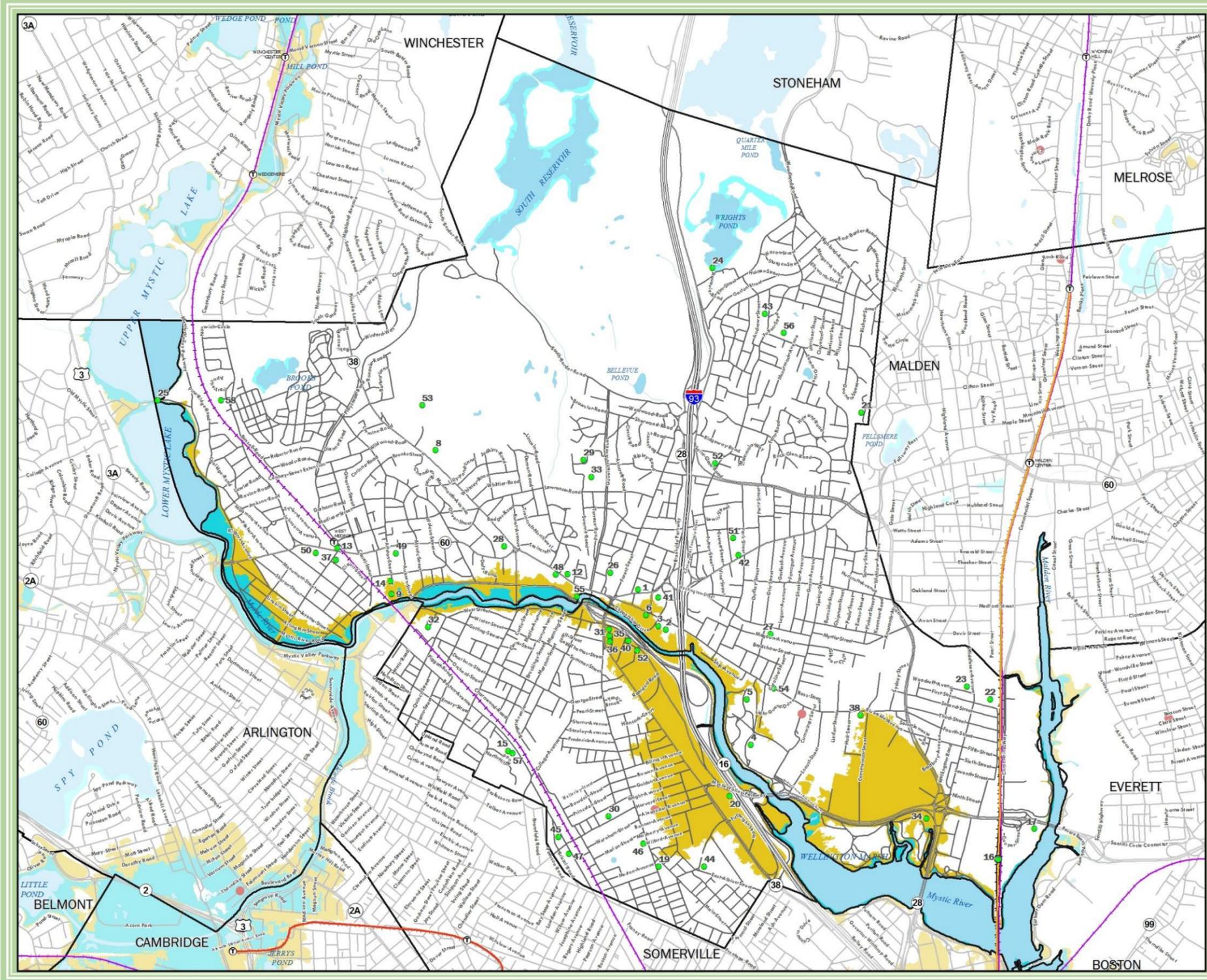


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60 Temple Place, Boston, MA 02111 (617) 451-2770

Data Sources:  
Metropolitan Area Planning Council (MAPC)  
Massachusetts Geographic Information System (MassGIS)  
Northeast States Emergency Consortium (NESEC)  
Massachusetts Emergency Management Agency (MEMA)  
Federal Emergency Management Agency (FEMA)  
MEDFORD, MA

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Date: 5/30/2013



# CITY OF MEDFORD HAZARD MITIGATION PLAN



## FEMA Pre-Disaster Mitigation Planning Grant **MEDFORD, MA** Map 4: Earthquakes / Landslides **DRAFT**

<b>Sites</b>	Water Bodies
Critical Infrastructure Sites*	Train Stations
Repetitive Loss Sites	Commuter Rail Lines
<small>* See details in separate table</small>	Trains
<b>Earthquakes</b>	<b>Subway Lines</b>
Epicenters	Blue
<b>All Roads</b>	Green
Interstate	Orange
U.S. Highway	Red
State Route	Silver
Street	
<b>Landslides</b>	
High landslide incidence (greater than 15% of the area is involved in landsliding)	
High susceptibility to landsliding and moderate incidence	
High susceptibility to landsliding and low incidence	
Moderate susceptibility to landsliding and low incidence	
Low landslide incidence (less than 1.5 % of the area is involved in landsliding)	

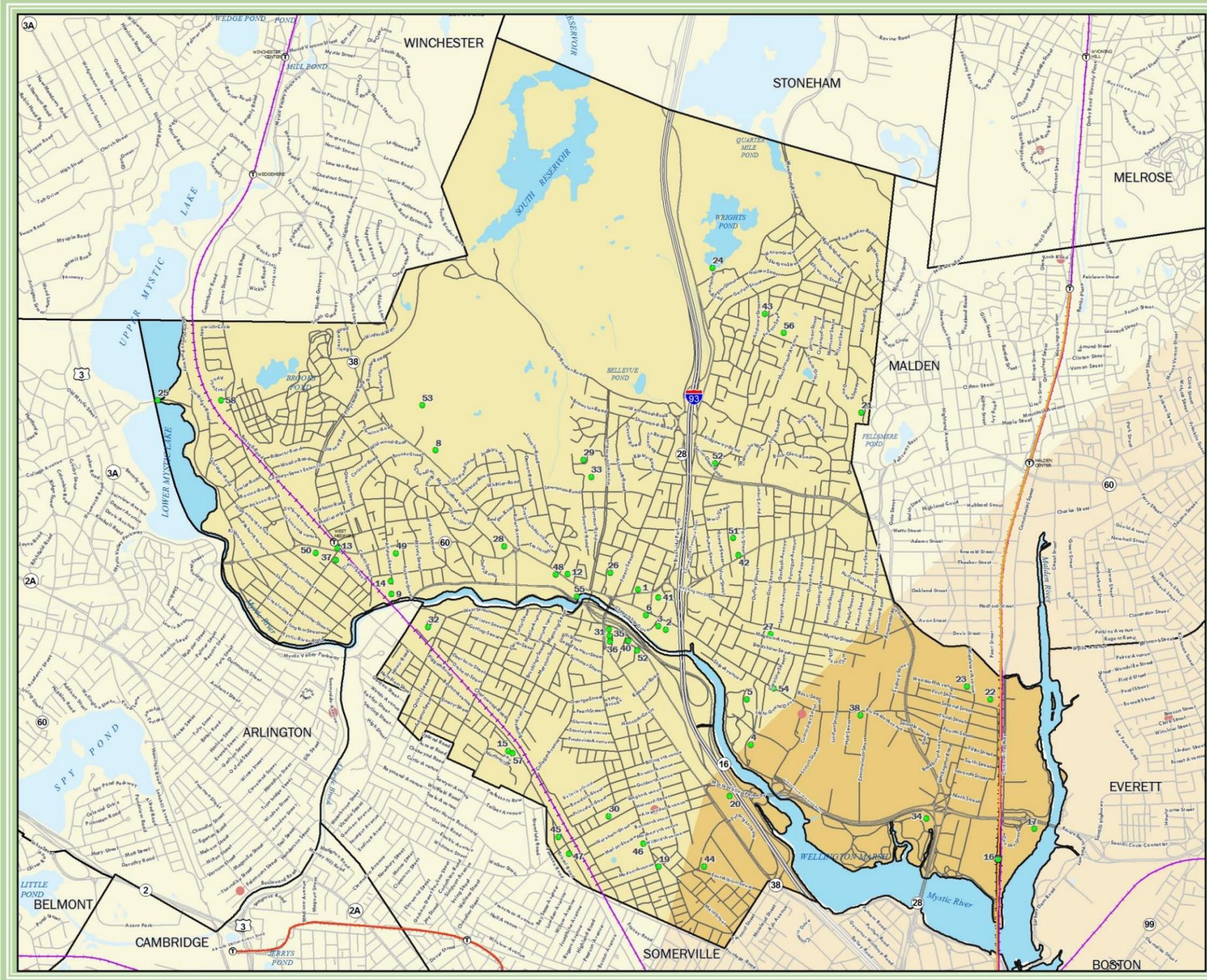


The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analyses.

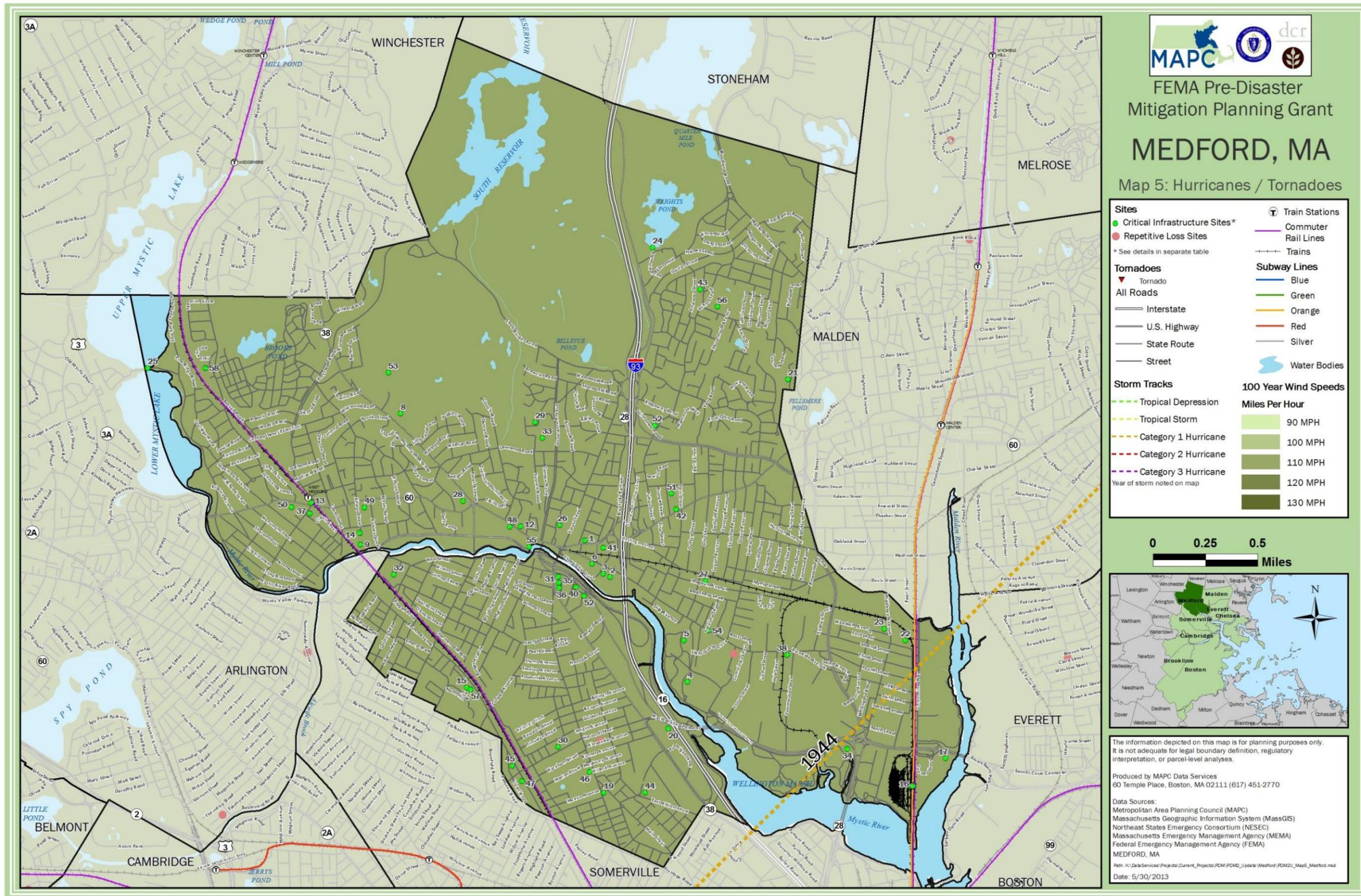
Produced by MAPC Data Services  
60 Temple Place, Boston, MA 02111 (617) 451-2770

Data Sources:  
Metropolitan Area Planning Council (MAPC)  
Massachusetts Geographic Information System (MassGIS)  
Northeast States Emergency Consortium (NESEC)  
Massachusetts Emergency Management Agency (MEMA)  
Federal Emergency Management Agency (FEMA)  
MEDFORD, MA

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Date: 5/30/2013



CITY OF MEDFORD HAZARD MITIGATION PLAN



CITY OF MEDFORD HAZARD MITIGATION PLAN



FEMA Pre-Disaster Mitigation Planning Grant  
**MEDFORD, MA**  
 Map 6: Average Snowfall

**DRAFT**

**Sites**

- Critical Infrastructure Sites\*
- Repetitive Loss Sites

\* See details in separate table

**Average Annual Snowfall**

- 36.1 to 48.0 inches
- 48.1 to 72.0 inches

**All Roads**

- Interstate
- U.S. Highway
- State Route
- Street

**Water Bodies**

- Water Bodies

**Train Stations**

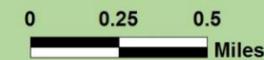
- Train Stations

**Rail Lines**

- Commuter Rail Lines
- Trains

**Subway Lines**

- Blue
- Green
- Orange
- Red
- Silver

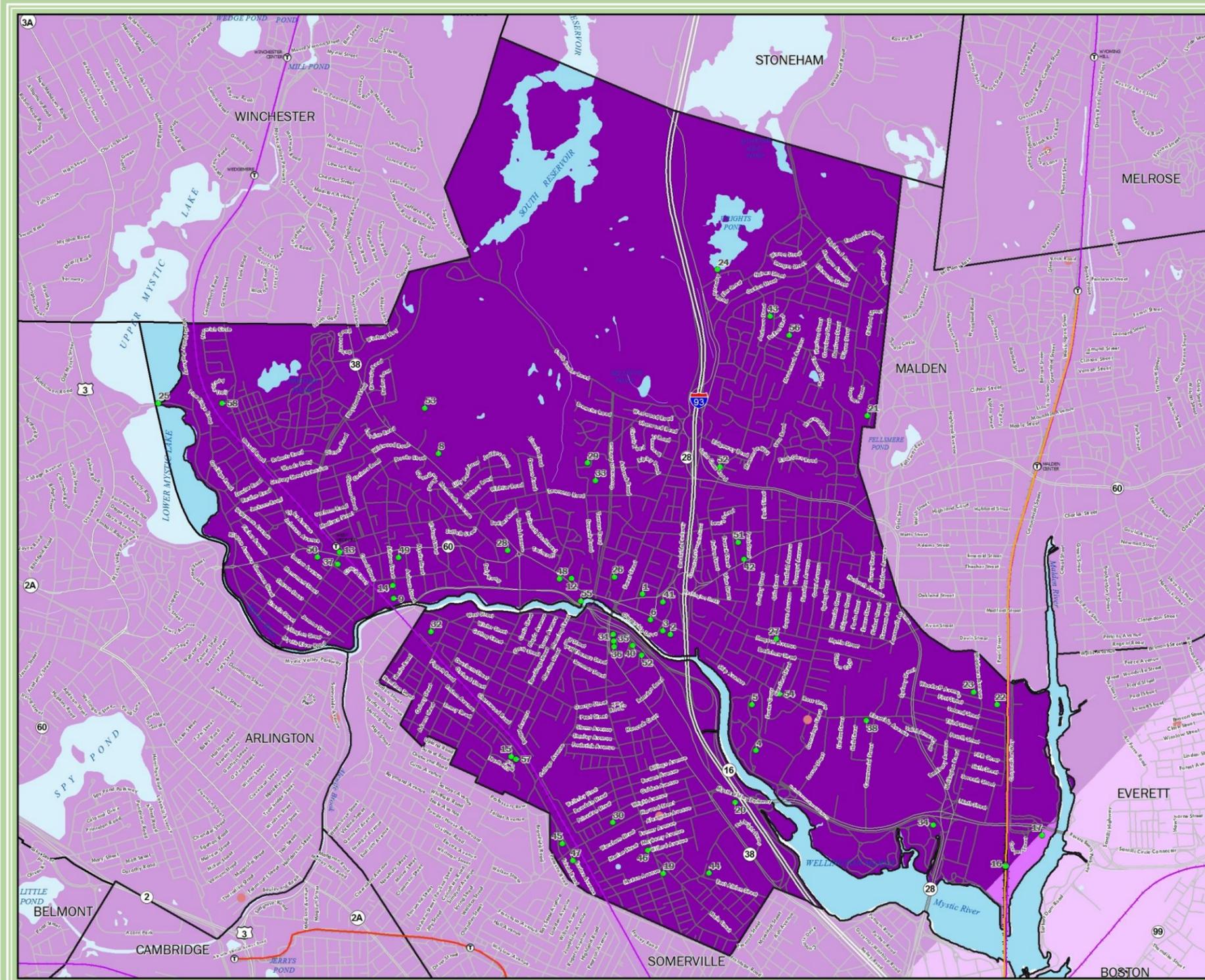


The information depicted on this map is for planning purposes only. It is not adequate for legal boundary definition, regulatory interpretation, or parcel-level analyses.

Produced by MAPC Data Services  
 60 Temple Place, Boston, MA 02111 (617) 451-2770

Data Sources:  
 Metropolitan Area Planning Council (MAPC)  
 Massachusetts Geographic Information System (MassGIS)  
 Northeast States Emergency Consortium (NESEC)  
 Massachusetts Emergency Management Agency (MEMA)  
 Federal Emergency Management Agency (FEMA)  
 MEDFORD, MA

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 Date: 5/30/2013



CITY OF MEDFORD HAZARD MITIGATION PLAN



FEMA Pre-Disaster Mitigation Planning Grant  
**MEDFORD, MA**  
 Map 7: Composite Natural Hazards  
**DRAFT**

**Sites**

- Critical Infrastructure Sites\*
- Repetitive Loss Sites

\* See details in separate table

**Composite Natural Hazards**

- Low (2 Hazards)
- Moderate (3 Hazards)
- High (4 Hazards)
- Very High (5 Hazards)

Composite natural hazards shown for areas of existing development. Hazards include:

- 100 year wind speed of 110 MPH or higher
- Moderate landslide risk
- FEMA Q3 flood zones (100 year and 500 year)
- Average snowfall of 36.1" or more
- Hurricane surge inundation areas

**Water Bodies**

**All Roads**

- Interstate
- U.S. Highway
- State Route
- Street

**Train Stations**

- Commuter Rail Lines
- Trains

**Subway Lines**

- Blue
- Green
- Orange
- Red
- Silver

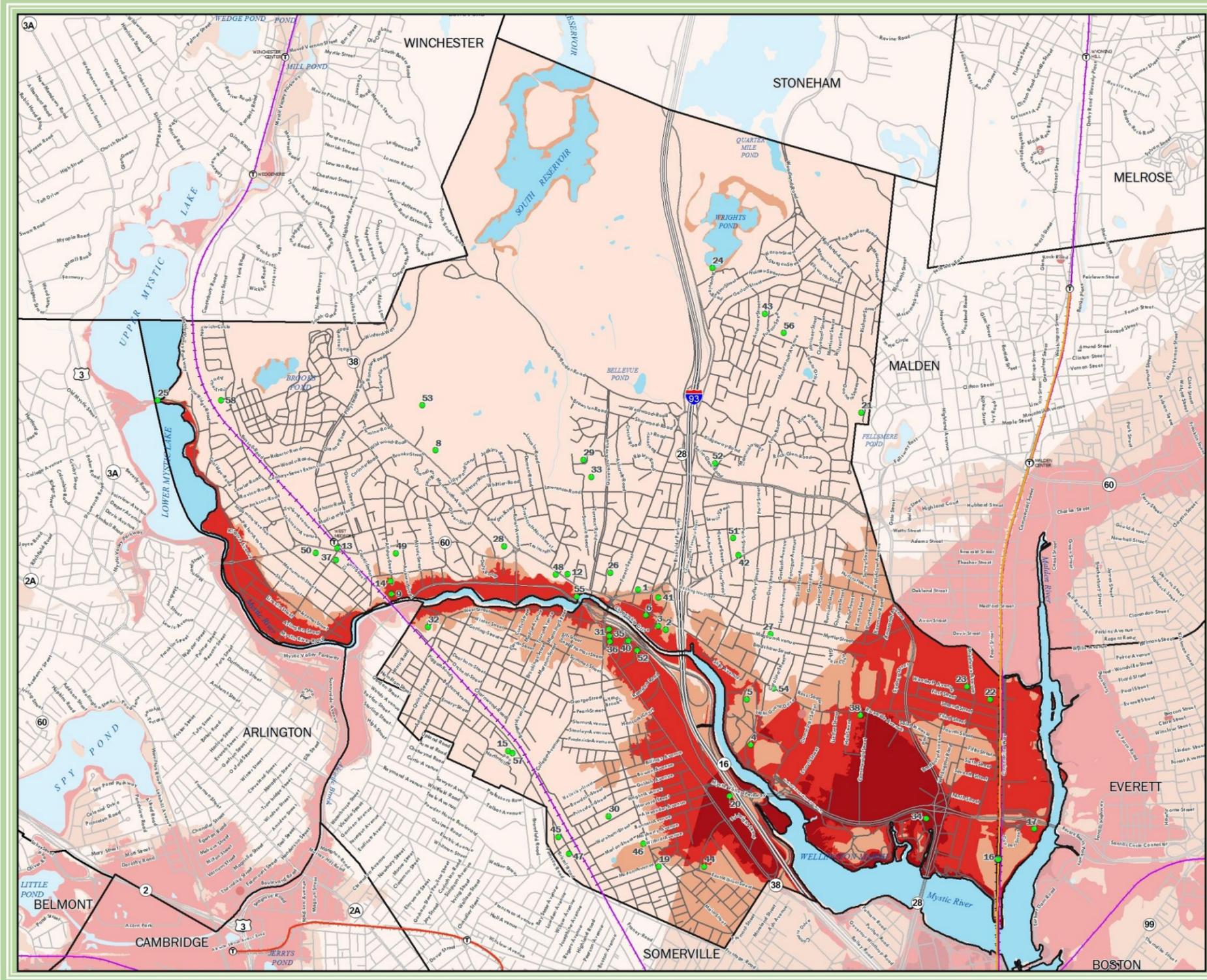


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 Federal Emergency Management Agency (FEMA)  
 MEDFORD, MA

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 Date: 5/30/2013



# CITY OF MEDFORD HAZARD MITIGATION PLAN



## FEMA Pre-Disaster Mitigation Planning Grant MEDFORD, MA

Map 8: Local Hazard Areas

DRAFT

<span style="color: green;">●</span> Critical Infrastructure Sites*	Train Stations
<span style="color: red;">●</span> Repetitive Loss Sites	Commuter Rail Lines
* See details in separate table	
Locally Identified Hazard Areas	Trains
Potential Future Development Area	<b>Subway Lines</b>
Interstate	Blue
U.S. Highway	Green
State Route	Orange
Street	Red
	Silver

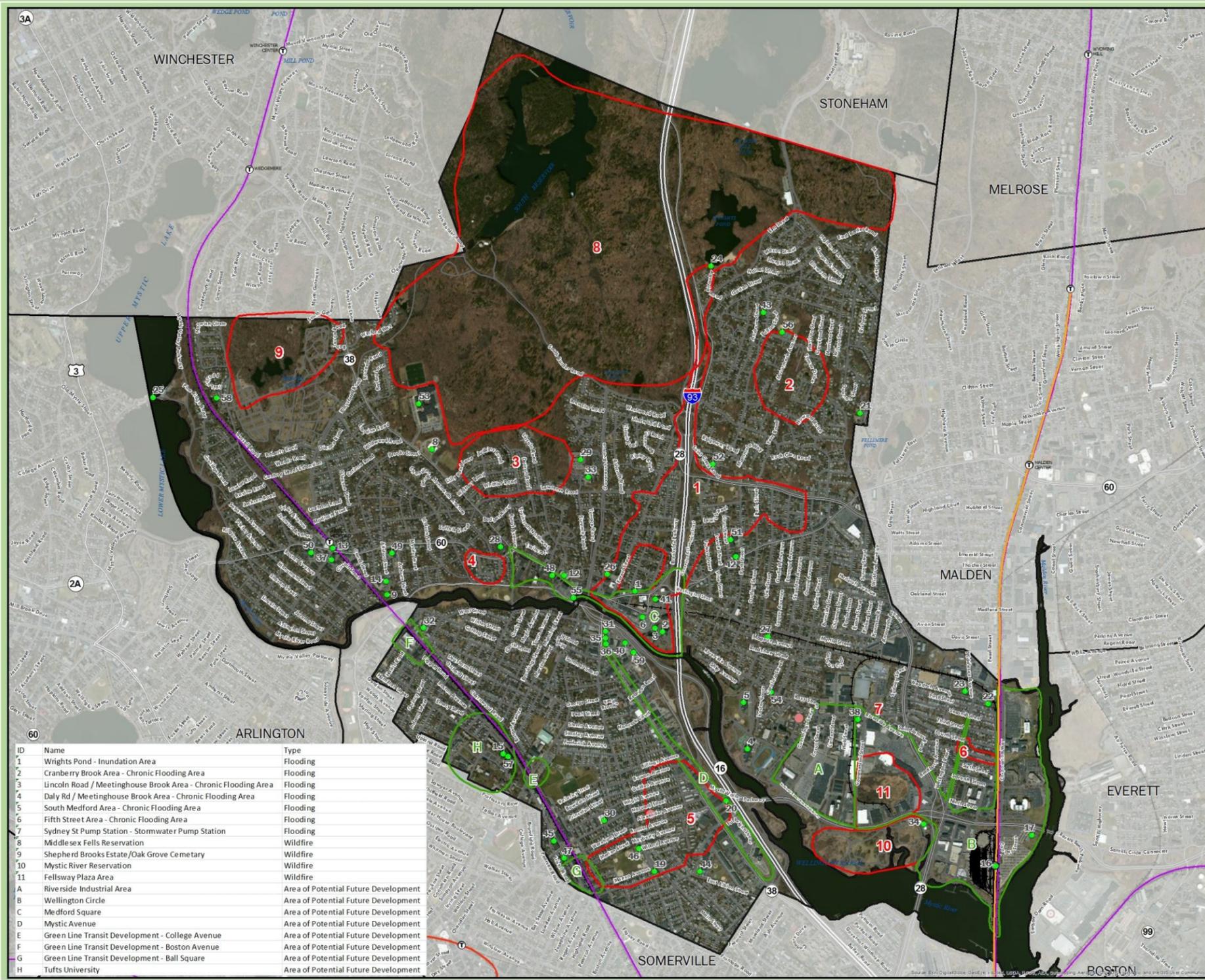


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Massachusetts Emergency Management Agency (MEMA)  
Federal Emergency Management Agency (FEMA)  
MEDFORD, MA

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Date: 6/12/2013



ID	Name	Type
1	Wrights Pond - Inundation Area	Flooding
2	Cranberry Brook Area - Chronic Flooding Area	Flooding
3	Lincoln Road / Meetinghouse Brook Area - Chronic Flooding Area	Flooding
4	Daly Rd / Meetinghouse Brook Area - Chronic Flooding Area	Flooding
5	South Medford Area - Chronic Flooding Area	Flooding
6	Fifth Street Area - Chronic Flooding Area	Flooding
7	Sydney St Pump Station - Stormwater Pump Station	Flooding
8	Middlesex Fells Reservation	Wildfire
9	Shepherd Brooks Estate / Oak Grove Cemetery	Wildfire
10	Mystic River Reservation	Wildfire
11	Fellsway Plaza Area	Wildfire
A	Riverside Industrial Area	Area of Potential Future Development
B	Wellington Circle	Area of Potential Future Development
C	Medford Square	Area of Potential Future Development
D	Mystic Avenue	Area of Potential Future Development
E	Green Line Transit Development - College Avenue	Area of Potential Future Development
F	Green Line Transit Development - Boston Avenue	Area of Potential Future Development
G	Green Line Transit Development - Ball Square	Area of Potential Future Development
H	Tufts University	Area of Potential Future Development

## **CITY OF MEDFORD HAZARD MITIGATION PLAN**

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**CITY OF MEDFORD HAZARD MITIGATION PLAN**

**APPENDIX C  
DOCUMENTATION OF PUBLIC PARTICIPATION**

# CITY OF MEDFORD HAZARD MITIGATION PLAN

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# HAZARD MITIGATION PLAN PUBLIC MEETING

***Natural hazards can have serious impacts on the City of Medford and its residents***



The Medford Hazard Mitigation Plan presents a strategy for reducing the City's vulnerability to the impacts of natural hazard events such as flooding, hurricanes and winter storms.

Join the City in discussion about the update to the Medford Hazard Mitigation Plan

**Date: Thursday, May 2, 2013**

**Time: 6:00PM – 7:00PM**

*(5:30 – 6:00PM Open House to preview maps and speak with planners and staff)*

**Location: Medford City Hall, Council Chambers**

For more information, please contact Barry Keppard via phone at (617) 933-0750 or email [bkeppard@mapc.org](mailto:bkeppard@mapc.org)



*If you need any special accommodations, such as language interpretation, assistive listening devices or meeting materials in alternate formats, please use the contact information above to notify us in advance. We would appreciate notice as soon as possible, but at least one week prior to the event would be appreciated.*

**CITY OF MEDFORD HAZARD MITIGATION PLAN**



*City of Medford*

MASSACHUSETTS

COUNCIL PRESIDENT  
ROBERT A. MAIOCCO  
89 NORWICH CIRCLE  
MEDFORD, MASSACHUSETTS 02155  
396-3640

**COMMITTEE OF THE WHOLE  
MEETING NOTICE  
TUESDAY, JUNE 11, 2013 @ 6:00 PM  
IN ROOM 207, COUNCIL OFFICE  
MEDFORD CITY HALL**

There will be a Meeting of the Committee of the Whole on Tuesday, June 11, 2013 at 6:00 PM, in Room 207, Council Office, Medford City Hall

The purpose of the Meeting is to request for input on a presentation by MAPC on revising the City of Medford's Hazard Mitigation Plan which in return will be forwarded to MEMA/FEMA for their approval then back to the City Council for final approval

The committee has requested representatives from the MAPC and the City Engineer to be in attendance

For further information, aids and accommodations contact the City Clerk at 781-393-2425

Yours truly,  
*Robert A. Maiocco* (EF)  
Robert A. Maiocco  
Council President

March 29, 2013

Cc: Mayor Council S. Burke City Engineer

RECEIVED  
Mar 29 10 32 AM '13  
CITY CLERK  
MEDFORD, MASS.

# HAZARD MITIGATION PLAN PUBLIC MEETING

***Natural hazards can have serious impacts on the City of Medford and its residents***



The Medford Hazard Mitigation Plan presents a strategy for reducing the City's vulnerability to the impacts of natural hazard events such as flooding, hurricanes and winter storms.

Join the City for a presentation and discussion about the update to the Medford Hazard Mitigation Plan at a Committee of the Whole Meeting

**Date: Tuesday, June 11, 2013**

**Time: 6:00PM**

**Location: Room 207, Council Office  
Medford City Hall**

For more information, please contact Barry Keppard via phone at (617) 933-0750 or email [bkeppard@mapc.org](mailto:bkeppard@mapc.org)



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**CITY OF MEDFORD HAZARD MITIGATION PLAN**

**APPENDIX D  
DOCUMENTATION OF PLAN ADOPTION**

# **CITY OF MEDFORD HAZARD MITIGATION PLAN**

## **DOCUMENTATION OF PLAN ADOPTION**

[To be added to final plan after adoption by the City]