

# City of Boston Natural Hazard Mitigation Plan

*A Component Plan of Boston's Comprehensive Emergency Management Program*



**Final 2014 Plan Update  
Approved by FEMA  
January 8, 2016**

**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**

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**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
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**ACKNOWLEDGEMENTS AND CREDITS**

This Hazard Mitigation Plan update was prepared by the City of Boston with the assistance of 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 update was funded in part by the Federal Emergency Management Agency's (FEMA) Hazard Mitigation Grant Program (HMGP) and by the City of Boston.

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# CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN 2014 UPDATE

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**OFFERED BY COUNCILOR STEPHEN J. MURPHY**

**Flaherty, Ciommo, McCarthy, O'Malley, Pressley, Wu, Linehan, Jackson and Baker**

**CERTIFICATE OF ADOPTION  
CITY COUNCIL  
CITY OF BOSTON, MASSACHUSETTS**

**RESOLUTION FOR THE ADOPTION OF THE CITY OF BOSTON  
NATURAL HAZARD MITIGATION PLAN 2014 UPDATE**

WHEREAS, the City of Boston, MA established an Executive Steering Committee to prepare the *City of Boston Natural Hazard Mitigation Plan 2014 Update*;

WHEREAS, the *City of Boston Natural Hazard Mitigation Plan 2014 Update* contains recommendations for several potential projects to mitigate impacts from natural hazards in the City of Boston;

WHEREAS, FEMA has issued a conditional approval of the *City of Boston Natural Hazard Mitigation Plan 2014 Update*;

WHEREAS, MEMA requires localities to adopt formally their respective Natural Hazard Plans; and

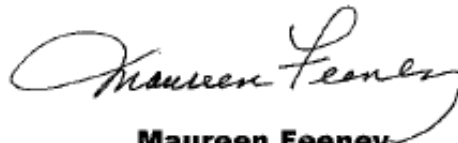
WHEREAS, adoption of the *City of Boston Natural Hazard Mitigation Plan 2014 Update* by the Boston City Council will make the City of Boston eligible for FEMA grant programs including Pre-Disaster Mitigation Assistance, Flood Mitigation Assistance, and the Hazard Mitigation Grant Program.

THEREFORE, BE IT RESOLVED that the Boston City Council adopts the *City of Boston Natural Hazard Mitigation Plan 2014 Update*.

ADOPTED AND SIGNED this Date. **September 16, 2015**

**In City Council September 16, 2015: Adopted**

**Attest:**



**Maureen Feeney  
City Clerk**

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## **I. EXECUTIVE SUMMARY**

Hazard mitigation planning is a process that identifies actions to reduce the dangers to life and property from natural hazard events. This plan is a framework for the City of Boston's wide range of hazard mitigation efforts. This plan meets the guidelines for the hazard mitigation planning program administered by the Federal Emergency Management Agency (FEMA) in partnership with the Massachusetts Emergency Management Agency (MEMA) and the Department of Conservation and Recreation (DCR).

While cities are not required by FEMA to adopt hazard mitigation plans, the Federal Disaster Mitigation Act of 2000 requires all municipalities that wish to be eligible to receive FEMA hazard mitigation grants to adopt a local multi-hazard mitigation plan, and to update the plan every five years. Boston's first hazard mitigation plan was approved by FEMA in March 2008, and this 2014 Plan Update provides the first five-year update. An approved Hazard Mitigation Plan makes the City eligible for FEMA's Hazard Mitigation Grant Program, Flood Assistance Mitigation grants, and Pre-Disaster Mitigation Grants.

### **Planning Process**

Planning for the Boston Hazard Mitigation Plan 2014 Update was led by the Boston Hazard Mitigation Executive Steering Committee, comprised of representatives of key City departments and commissions with responsibility for various aspects of hazard mitigation. The Executive Steering Committee was the main vehicle for coordinating input on all hazards to be addressed in this plan. The committee reviewed the types of impacts and the areas where natural hazards most affect the City, based on both historic trends and expected future impacts of climate change. The committee coordinated internal consultations between several City agencies, and organized a series of five workshops that were facilitated by the Social and Environmental Research Institute (SERI). The committee also established the City's goals for addressing these natural hazard impacts, and developed a list of proposed hazard mitigation measures.

Public participation in this planning process is important for improving awareness of the potential impacts of natural hazards, building support for the mitigation actions the City plans to take, and identifying additional potential impacts and actions. The City's public participation process included two public meetings hosted by the Boston Conservation Commission, the first on April 18, 2012, before the plan update was drafted, and the second on September 18, 2013, to provide an opportunity for comments on the draft plan update. In addition, the draft plan update was posted on the City's website for public review prior to the second public meeting. Direct outreach was also conducted with key institutions and state agencies. Any comments received were reviewed and incorporated by the local hazard mitigation team. Revisions to the draft plan included the addition of recommendations for multi-language public education, updating several city projects, and revising the priorities for mitigation for invasive insects, trees, and green infrastructure.

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## Risk Assessment

This 2014 Plan Update assesses the potential impacts to the City from multiple natural hazards, including flooding, high winds, winter storms, extreme heat, brush fire, and geologic hazards. Of these hazards, flooding presents the most historically widespread hazard to the City, but coastal storm damage and record breaking extreme heat events are of increasing concern given the recent and projected trends in changes to the climate. The Executive Steering Committee, with members from all of the City's relevant departments and commissions, was the main vehicle for gathering local data on past and current trends for all natural hazards for the risk assessment. While historic trends in natural hazards are fully incorporated into this plan update, the City has taken steps to also take into consideration the potential future impacts of climate change. While not (yet) required by federal plan guidelines, given the City's commitment to addressing climate change through its *Boston Climate Action Plan* (2011), the Hazard Mitigation Executive Steering Committee established a strong priority for incorporating climate change considerations into this Hazard Mitigation Plan 2014 Update. The need for this approach is also reinforced at the state level by the recent adoption of the *Massachusetts Climate Adaptation Report* (2011). In assessing climate change issues for this plan update, the City drew upon the latest available scientific research, and made many relevant reports available on its web site (see Section VIII).

In order to assist Boston in the task of bringing climate change issues into its hazard mitigation plan update, the City and MAPC partnered with the Social and Environmental Research Institute (SERI). The City of Boston Office of Emergency Management organized a series of four collaborative stakeholder planning sessions on infrastructure, regulations, buildings and facilities, and public safety. The sessions used a unique methodology known as *Vulnerability-Consequence Adaptation Planning Scenarios* (VCAPS). Many of the insights gleaned from this process informed the plan update, and the details of these sessions are summarized in the document.

One of the key tools the City used to assess vulnerability was FEMA's HAZUS-MH program. The Mayor's Office of Emergency Management (OEM) asked MEMA for the Northeast States Emergency Consortium (NESEC) to conduct a HAZUS-MH Level II analysis of the City of Boston. The City collaborated with NESEC to implement HAZUS-MH with more locally specific data. The analyses provide a quantified estimate of the damages that would result from key natural hazard events in the City, although these analyses did not take climate projections into account.

The City of Boston invited the academic, scientific, and technical community to contribute ongoing research studies to the natural hazard mitigation planning process. The City took advantage of academic and research studies, such as the flood hydrology studies of Dr. Ellen Marie Douglas at UMASS Boston and earthquake studies by Dr. Laurie Baise, Tufts University and Dr. James Kaklamanos, Merrimack College. In addition the City has partnered with the US Army Corps of Engineers, which is conducting a Hurricane Evacuation Study that will delineate areas impacted by several hurricane scenarios.

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## **Hazard Mitigation Goals**

The Boston Hazard Mitigation Executive Committee established the following Hazard Mitigation Goals for the 2014 Plan Update:

### **Goal 1 Protect the health and safety of the public.**

- Encourage people to be prepared before, during and after a hazard event.
- Ensure that services related to public health can function during and after a hazard, e.g., sanitation, water, debris removal, hospitals and emergency services.
- Ensure that evacuation can happen in an organized and efficient manner.
- Minimize secondary impacts from hazards, such as the release of pollutants. e.g., by covering salt piles.
- Promote public communications
- Establish a multi-cultural and multi-language public awareness program

### **Goal 2: Protect existing properties and structures.**

- Provide resources for residents and businesses to make their buildings and properties more disaster resistant.
- Educate the public on measures they can take to protect their property.
- Maintain existing mitigation structures.
- Ensure that future development / redevelopment does not make existing properties more vulnerable to hazards.
- Ensure that critical facilities are protected from hazards.
- Protect natural areas to ensure that they buffer impacts to built areas during a natural disaster.
- Preserve and restore the functions of natural resource systems.

### **Goal 3: Ensure that essential services can function during and after a hazard event.**

- Ensure that critical infrastructure is protected from natural hazards.
- Ensure that people (key service providers and employees) can get into the City to provide services.
- Ensure that interdepartmental communication is seamless.
- Maintain the Emergency Operations Plan (EOP) and supporting annexes.

### **Goal 4: Work regionally to mitigate impacts from natural hazards and to respond and recover from hazard events.**

- Continue to participate in regional efforts.
- Cooperate with other agencies, communities, and private entities.
- Understand priorities and capabilities of other entities to allow for resource-sharing, mutual aid, and entering into memoranda of understanding (MOU).

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### **Goal 5: Determine priorities for directing resources for hazard mitigation and response.**

- Prioritize mitigation projects.
- Continue to program mitigation projects in the Capital Investment Plan.
- Pursue various funding sources.
- Encourage private property-owners to implement measures to protect their own property.

### **Goal 6: Maintain Hazard Awareness.**

- Track and compile hazard related data.
- Understand the potential implications of climate change on the frequency and extent of natural hazard events and incorporate that knowledge into hazard mitigation efforts.
- Maintain publicly available information on natural hazard risks in the City.
- Integrate hazard mitigation into other City initiatives and plans.

### **Hazard Mitigation Strategy**

The Boston Hazard Mitigation Executive Steering Committee identified a number of mitigation measures that would serve to reduce the City's vulnerability to natural hazard events. Many of these are related to improving and maintaining the integrity of the drainage system through addressing maintenance and reconstruction issues. In keeping with the City's priorities for climate preparedness, there is also a strong emphasis on coastal damages and extreme heat. Efforts to increase public awareness are also an important component of the plan update.

The hazard mitigation strategy recognizes that our understanding of natural hazards and the steps that can be taken to mitigate their damages will change over time. Global climate change and the accompanying changes to sea level, average temperatures, and extreme events will increase the City's vulnerability in the future, and local officials will work together across municipal lines and with state and federal agencies, institutions, and the business community in order to understand and address these challenges.

To support this work in October 2013 the City of Boston released *Climate Ready Boston: Municipal Vulnerability to Climate Change*, the report of the Mayor's Climate Preparedness Task Force examining the preparedness of municipal facilities, operations, services, and policies for the effects of climate change. Individual departments identified vulnerabilities, established priorities, and planned next steps. The appendices to this report contain prioritized actions targeted to the City's agencies, including: Administration and Finance, Boston Centers for Youth & Families, Boston Housing Authority, Boston Public Health Commission, Department of Innovation and Technology, Property Management, Public Works Department, Boston Police Department, Boston Public Schools, Boston Redevelopment Authority, Boston Transportation Department, Housing and Neighborhood Development, Environment Department, Office of Food Initiatives, Inspectional Services Department, Office of

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Emergency Management, and the Parks & Recreation Department. The report with appendices is attached to this Hazard Mitigation Plan Update as Attachment H.

**Plan Review and Update Process**

The major components of the plan review and update process are summarized in Table 1:

Boston has made progress on implementing mitigation measures identified in its 2008 Hazard Mitigation Plan. While some of the measures identified in that plan are complete, others still require the identification of funding source to support construction, equipment, and additional manpower. Moving forward into the next five year implementation period, there will be additional opportunities to incorporate hazard mitigation into the City’s decision making processes.

**Table 1 Plan Review and Update**

| <b>Chapter</b>                      | <b>Reviews and Updates</b>  |
|-------------------------------------|---|
| III – Public Participation          | The Boston Hazard Mitigation Executive Steering Committee placed an emphasis on public participation for the update of the Hazard Mitigation Plan, discussing strategies to enhance participation opportunities at its first meeting and identifying key stakeholders. During plan development, the plan was discussed at two public meetings hosted by the Conservation Commission. The draft plan update was also available on the City’s website for public comment.   |
| IV – Risk Assessment                | MAPC gathered the most recently available hazard data and met with City staff to identify changes in local hazards. City department heads and staff reviewed critical infrastructure in order to create an up-to-date list. The City used the most recently available version of HAZUS and implemented it with enhanced local data with the help of NESEC. The impacts of climate change and potential mitigation were explored in a series of stakeholder workshops organized by the Social and Environmental Research Institute.  |
| V - Goals                           | The Hazard Mitigation Goals were reviewed and endorsed by the Boston Hazard Mitigation Executive Steering Committee.  |
| VI – Hazard Mitigation Strategy     | The list of existing mitigation measures was updated to reflect their current status as well as to add new mitigation activities in the City since adoption of the previous plan. Recommended mitigation measures from the 2008 plan were reviewed and assessed as to whether they were completed, on-going, or deferred. The Boston Hazard Mitigation Executive Steering Committee determined whether to carry forward measures, modify them, or delete them for the 2014 plan update. The 2014 Hazard Mitigation Plan update also adds new mitigation measures. The Committee re-prioritized all of these measures based on current conditions. |
| VII – Plan Adoption and Maintenance | This section of the plan includes a process for on-going plan implementation that will assist the City in incorporating hazard mitigation into other municipal planning, budgeting, and regulatory programs. It also includes a five year update process that will better prepare the City to update the plan again in 2018.  |

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**II. INTRODUCTION**

**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 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.

**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 to hazard mitigation planning and has engaged the regional planning agencies to provide technical assistance to help cities and towns prepare their plans. Under this program, the City of Boston prepared this plan with the technical assistance of the Metropolitan Area Planning Council (MAPC). MAPC is also providing assistance to seven other Inner Core communities 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.

**Federal/State Disaster Declarations**

The City of Boston has experienced 21 natural hazard incidents that triggered federal or state disaster declarations since 1991. These are listed in Table 2 below. The majority of these events involved flooding.

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

| <b>DISASTER NAME<br/>(DATE OF EVENT)</b>  | <b>TYPE OF FEDERAL<br/>ASSISTANCE PROVIDED</b>  | <b>DECLARED AREAS IN MA</b>  |
|---|---|--|
| Hurricane Bob<br>(August 1991)            | FEMA Public Assistance<br>Project Grants<br>Hazard Mitigation Grant Program   | Counties of Barnstable, Bristol, Dukes,<br>Essex, Hampden, Middlesex, Plymouth,<br>Nantucket, Norfolk, Suffolk |
| No-Name Storm<br>(October 1991)           | FEMA Public Assistance<br>Project Grants<br>FEMA Individual Household<br>Program<br>Hazard Mitigation Grant Program | Counties of Barnstable, Bristol, Dukes,<br>Essex, Middlesex, Plymouth, Nantucket,<br>Norfolk, Suffolk          |
| March Blizzard<br>(March 1993)            | FEMA Public Assistance Project<br>Grants  | Statewide  |
| January Blizzard<br>(January 1996)        | FEMA Public Assistance Project<br>Grants  | Statewide  |
| October Flood<br>(October 1996)           | FEMA Public Assistance<br>Project Grants<br>FEMA Individual Household<br>Program<br>Hazard Mitigation Grant Program | Counties of Essex, Middlesex, Norfolk,<br>Plymouth, Suffolk  |
| June Flood<br>(June 1998)                 | FEMA Individual Household<br>Program<br>Hazard Mitigation Grant Program<br>Community Development Block<br>Grant-HUD | Counties of Bristol, Essex, Middlesex,<br>Norfolk, Suffolk, Plymouth, Worcester                                |
| South Boston Fire<br>(Oct 29, 2000)       | Small Business Administration   | City of Boston   |
| March Flood<br>(March 2001)               | FEMA Individual Household<br>Program<br>Hazard Mitigation Grant Program   | Counties of Bristol, Essex, Middlesex,<br>Norfolk, Suffolk, Plymouth, Worcester                                |
| Roxbury Fire<br>(Jun 9, 2002)             | Small Business Administration   | City of Boston   |
| February Snowstorm<br>(Feb 17-18, 2003)   | FEMA Public Assistance Project<br>Grants  | Statewide  |
| January Blizzard<br>(January 22-23, 2005) | FEMA Public Assistance<br>Project Grants  | Statewide  |
| Hurricane Katrina<br>(August 29, 2005)    | FEMA Public Assistance<br>Project Grants  | Statewide  |
| May Rainstorm/Flood<br>(May 12-23, 2006)  | Hazard Mitigation Grant Program   | Statewide  |
| April Nor'easter<br>(April 15-27, 2007)   | azard Mitigation Grant Program  | Statewide  |

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| <b>DISASTER NAME<br/>(DATE OF EVENT)</b>              | <b>TYPE OF FEDERAL<br/>ASSISTANCE PROVIDED</b>                                   | <b>DECLARED AREAS IN MA</b>   |
|---|--|---|
| Hyde Park Fire<br>(Jan 5, 2008)                       | Small Business Administration  | City of Boston  |
| Fenway Business<br>District Fire<br>(January 6, 2009) | Small Business Administration  | City of Boston  |
| Flooding<br>(March, 2010)                             | FEMA Public Assistance<br>FEMA Individuals and<br>Households Program<br>SBA Loan | Bristol, Essex, Middlesex, Suffolk,<br>Norfolk, Plymouth, Worcester |
|   | Hazard Mitigation Grant Program  | Statewide   |
| Tropical Storm Irene<br>(August 27-28, 2011)          | FEMA Public Assistance   | Statewide   |
| Hurricane Sandy<br>(October 27-30, 2012)              | FEMA Public Assistance   | Barnstable, Bristol, Dukes, Nantucket,<br>Plymouth, and Suffolk     |

Source: database provided by MEMA and the City of Boston

**FEMA and HUD Funded Mitigation Projects**

Over the last 20 years the City of Boston has received funding from FEMA and HUD for hazard mitigation projects in the Muddy River. These funds were from the Community Development Block Grant (CDBG) program and the Hazard Mitigation Grant Program (HMGP). This project totaled \$6,101,830 with \$4,342,715 covered by federal grants and \$1,239,547 by City funding. Project funding is summarized in Table 3.

**Table 3 FEMA and HUD-Funded Mitigation Projects**

| <b>Project Title<br/>(Funding Source)</b>  | <b>Scope of Work</b>   | <b>Total Cost</b> | <b>Federal<br/>Funding</b> | <b>City<br/>Funding</b> |
|--|--|-------------------|----------------------------|-------------------------|
| Muddy River<br>Improvements –<br>2 projects<br>(Community<br>Development<br>Block Grant) | Design and construction<br>of improvements to the<br>Muddy River in Boston<br>and Brookline. Reduce<br>future flooding along<br>Muddy River. | \$3,103,643       | \$2,583,643                | \$490,000               |
| Charlesgate<br>Channel<br>Improvements<br>(Hazard Mitigation<br>Grant Program)           | Debris, accumulated<br>sediment and other flow<br>restrictions will be<br>removed from a length<br>of the Muddy River.                       | \$2,998,187       | \$1,759,071                | \$749,547               |

Source: Massachusetts Emergency Management Agency (MEMA)

## **CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN 2014 UPDATE**

### **Community Profile**

Boston was incorporated as a town in 1630 and then a city in 1822. Since its incorporation as a city, Boston has annexed six neighboring cities and towns to reach its current size of 49.55 square miles. The City is located in Suffolk County. The City has a mayor-council form of government. The City's website is at [www.cityofboston.gov](http://www.cityofboston.gov).

With a population in 2010 of 617,594, Boston is the largest city not only in Massachusetts, but in all six New England states, and the 21<sup>st</sup> largest city in the United States.

Boston is an economic focal point for Massachusetts as well as the greater New England Region, serving as a center for financial institutions, higher education and medical health services. A total of 561,126 people are employed in the City. The Boston economy constitutes 24% of the state's economy and 10% for all of New England. The Financial District is home to many nationally significant firms, the Longwood Medical Area has a regionally significant concentration of healthcare industry firms, South Boston is home to the newly established Innovation District with a growing roster of new high tech companies, and the colleges and universities all over the City are significant sources of jobs as well as important bases for the regional economy. The importance of the City's medical and educational facilities is substantial with twenty inpatient hospitals and twenty-five public health clinics providing over 110,000 health service jobs. Boston's thirty-two universities, colleges, graduate schools and community colleges have a combined enrollment of approximately 140,000 students, comprising 31% of the state's college students.

As the seat of state government, critical state and federal facilities are located in Boston. A number of Federal agencies also have offices in the City. These include: FEMA Region 1, Environmental Protection Agency Region 1, the U.S. Coast Guard, the Federal Bureau of Investigation, the Dept. of Housing and Urban Development, and many others.

In addition to the people who live and work in the City, Boston attracts an average of 12 million tourists annually from around the country and around the world. Major attractions include the Museum of Science, Museum of Fine Arts, Quincy Marketplace, Boston Convention and Exhibition Center, Hynes Auditorium, TD Boston Garden, numerous theaters, Fenway Park, and the Harbor Islands.

Boston is one of the oldest cities in the country and many events of historical significance occurred here and are marked by buildings and other features of national significance. These include large and well-known sites and structures such as the USS Constitution, famous burying grounds, the Paul Revere House, the Old State House, and Old North Church. But there are many smaller, lesser-known, but historically important sites scattered around the City.

The City is an at-large member on the Executive Board of a FEMA funded effort directed by the Coordinated Statewide Emergency Preparedness (COSTEP) to develop hazard

## CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN 2014 UPDATE

mitigation strategies for cultural sites, museums, and libraries statewide with considerable potential benefit for the many such institutions in Boston.

Boston also serves as the center of the region's transit system, with subway lines, commuter rail lines, bus service, ports and Logan International Airport. Logan International is the largest transportation center in New England. It handled over 28 million passengers and 600,000 flights in 2011, according to MASSPORT. Major ports operated by MASSPORT in Boston include the Port of Boston, Conley Terminal, Cruiseport and the Boston Autoport. Two interstates (I-90 and I-93) converge in Boston. A number of state routes also pass through Boston, including Routes 1, 2, 3, 9, 20, 28, and 30. The MBTA, MassDOT, Mass. Highway District 6, DCR, MWRA, and MASSPORT Authority participated in the process.

Boston's distinct neighborhoods have strong identities. For the purpose of this plan we refer to city neighborhoods as defined by the Boston Redevelopment Authority (BRA): Allston, Back Bay, Beacon Hill/West End, Brighton, Charlestown, Chinatown/Leather District, Dorchester, Downtown, East Boston, Fenway/Kenmore, Hyde Park, Jamaica Plain, Mattapan, Mission Hill, North End, Roslindale, Roxbury, South Boston, South End/Bay Village, and West Roxbury.

Boston borders 14 communities: Quincy, Milton, Canton, Dedham, Needham, Newton, Brookline, Watertown, Cambridge, Somerville, Everett, Chelsea, Revere, and Winthrop.

### Population and Housing Characteristics

In 2010, the City's population was 617,594 and the number of housing units was 272,481 (see Tables 4A and 4B below). Ten percent of the population is over 65 years, and 22 percent have a disability.

**Table 4A - Boston Characteristics, 2010**

|   |
|---|
| <p><b>Population = 617,594</b></p> <ul style="list-style-type: none"><li>• 5.2% are under age 5</li><li>• 10.1% are over age 65</li><li>• 16.8% speak English less than "very well" (over age 5)</li><li>• 35.9% of households have no vehicle</li><li>• 21.9% have a disability (over age 5)</li><li>• 7.5% live in group quarters</li></ul> <p><b>Number of Housing Units = 272,481</b></p> <ul style="list-style-type: none"><li>• 66.1% are renter-occupied housing units</li><li>• 57.2% of housing units were built before 1940</li></ul> |
|---|

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

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| Neighborhood         | Population | Pop. under age 5 | Pop. over age 65 | Pop. living in group quarters | Number of housing units | Renter-occupied units |
|----------------------|------------|------------------|------------------|-------------------------------|-------------------------|-----------------------|
| Allston/Brighton     | 29,196     | 2.2%             | 3.6%             | 19.1%                         | 11,095                  | 87.1%                 |
| Back Bay             | 18,088     | 3.1%             | 11.3%            | 8.6%                          | 12,266                  | 67.0%                 |
| Bay Village          | 1,312      | 2.1%             | 21.3%            | 2.3%                          |                         |                       |
| Beacon Hill          | 9,023      | 3.2%             | 10.4%            | 0.1%                          | 6,013                   | 66.3%                 |
| Charlestown          | 16,439     | 6.7%             | 10.2%            | 0.8%                          | 8,648                   | 53.7%                 |
| Chinatown            | 4,444      |                  |                  |                               | 2,114                   |                       |
| Dorchester           | 114,235    | 6.9%             | 9.5%             | 1.1%                          | 45,133                  | 65.6%                 |
| Downtown             | 11,215     | 2.1%             | 11.8%            | 40.5%                         | 5,390                   | 62.0%                 |
| East Boston          | 40,508     | 7.6%             | 8.8%             | 0.6%                          | 15,854                  | 72.5%                 |
| Fenway               | 33,796     | 0.9%             | 4.6%             | 41.3%                         | 12,836                  | 90.9%                 |
| Hyde Park            | 30,637     | 5.8%             | 12.9%            | 1.0%                          | 11,816                  | 42.0%                 |
| Jamaica Plain        | 37,468     | 6.0%             | 10.6%            | 3.3%                          | 16,797                  | 55.6%                 |
| Mattapan             | 22,600     | 6.3%             | 11.9%            | 1.7%                          | 9,150                   | 60.2%                 |
| Mission Hill         | 16,305     | 3.2%             | 9.1%             | 9.4%                          | 6,628                   | 88.6%                 |
| North End            | 10,131     | 2.0%             | 12.8%            | 1.7%                          | 6,728                   | 75.1%                 |
| Roslindale           | 28,680     | 6.7%             | 12.1%            | 1.4%                          | 11,927                  | 50.0%                 |
| Roxbury              | 48,454     | 7.0%             | 9.1%             | 6.1%                          | 20,005                  | 80.4%                 |
| South Boston         | 33,311     | 4.4%             | 9.7%             | 5.9%                          | 16,409                  | 59.8%                 |
| S. Boston Waterfront | 1,889      | 2.4%             | 3.2%             | 11.2%                         | 1,214                   | 62.3%                 |
| South End            | 24,577     | 4.9%             | 10.6%            | 3.9%                          | 13,648                  | 60.8%                 |
| West End             | 4,080      | 4.3%             | 16.6%            | 2.8%                          | 2,896                   | 76.2%                 |
| West Roxbury         | 30,446     | 7.0%             | 18.0%            | 2.2%                          | 13,547                  | 36.4%                 |

Source: U.S. Census, 2010, prepared by BRA

**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 5 shows the acreage and percentage of land in 10 categories. If the three residential categories are aggregated, residential uses make up 37.49% of the area of the City (3,192.78 acres).

**Table 5 - Boston 2005 Land Use**

| Land Use Type                              | Acres    | Percent |
|--|----------|---------|
| High Density Residential (>4 DU/acre)      | 1,1786.9 | 37.3%   |
| Medium Density Residential (2 – 4 DU/acre) | 565.33   | 1.79%   |
| Low Density Residential (<2 DU/acre)       | 41.45    | .13%    |
| Non-Residential, Developed                 | 6,350.3  | 20.09%  |
| Commercial                                 | 3,302.61 | 10.45%  |
| Industrial                                 | 1,311.02 | 4.15%   |
| Transportation                             | 3,419.21 | 10.82%  |
| Agriculture                                | 63       | .2%     |
| Undeveloped                                | 3,157.25 | 9.99%   |
| Undeveloped Wetland                        | 1,604.48 | 5.08%   |

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|              |                  |               |
|--------------|------------------|---------------|
| <b>Total</b> | <b>31,601.54</b> | <b>100.00</b> |
|--------------|------------------|---------------|

Source: MacConnell Land Use, 2005, Mass. GIS

### Development Trends

Boston has a history of land reclamation. According to the City's *Open Space Plan*, the City grew from 1,000 acres to 30,000 acres due to land reclamation and annexation. As a result, large areas of Boston are built on fill. As discussed later, the amount of filled land affects the City's vulnerability to certain natural hazards, particularly earthquakes.

While the City is essentially built out, there are a significant number of infill projects, redevelopments, and major renovations occurring citywide (see Figure 1). Boston's development and analysis for proposed future development is coordinated by the Boston Redevelopment Authority. Currently, one of the most active areas of development in the City is the Innovation District in the South Boston waterfront.

Development trends throughout the metropolitan region are tracked by MAPC's Development Database, which provides an inventory of new development over the last decade. The database tracks both completed developments and those currently under construction. The database includes 285 developments in the City of Boston since 2005, of which 189 are completed and 96 were under construction as of March 2015. The geographic distribution of these projects by Boston neighborhoods is summarized in Table 6 (several adjacent neighborhoods have been combined). The neighborhoods with the most new commercial developments are the Fenway/Longwood Medical Area, South Boston/South Boston Waterfront, Chinatown/Downtown/North End/West End, and Back Bay/South End.

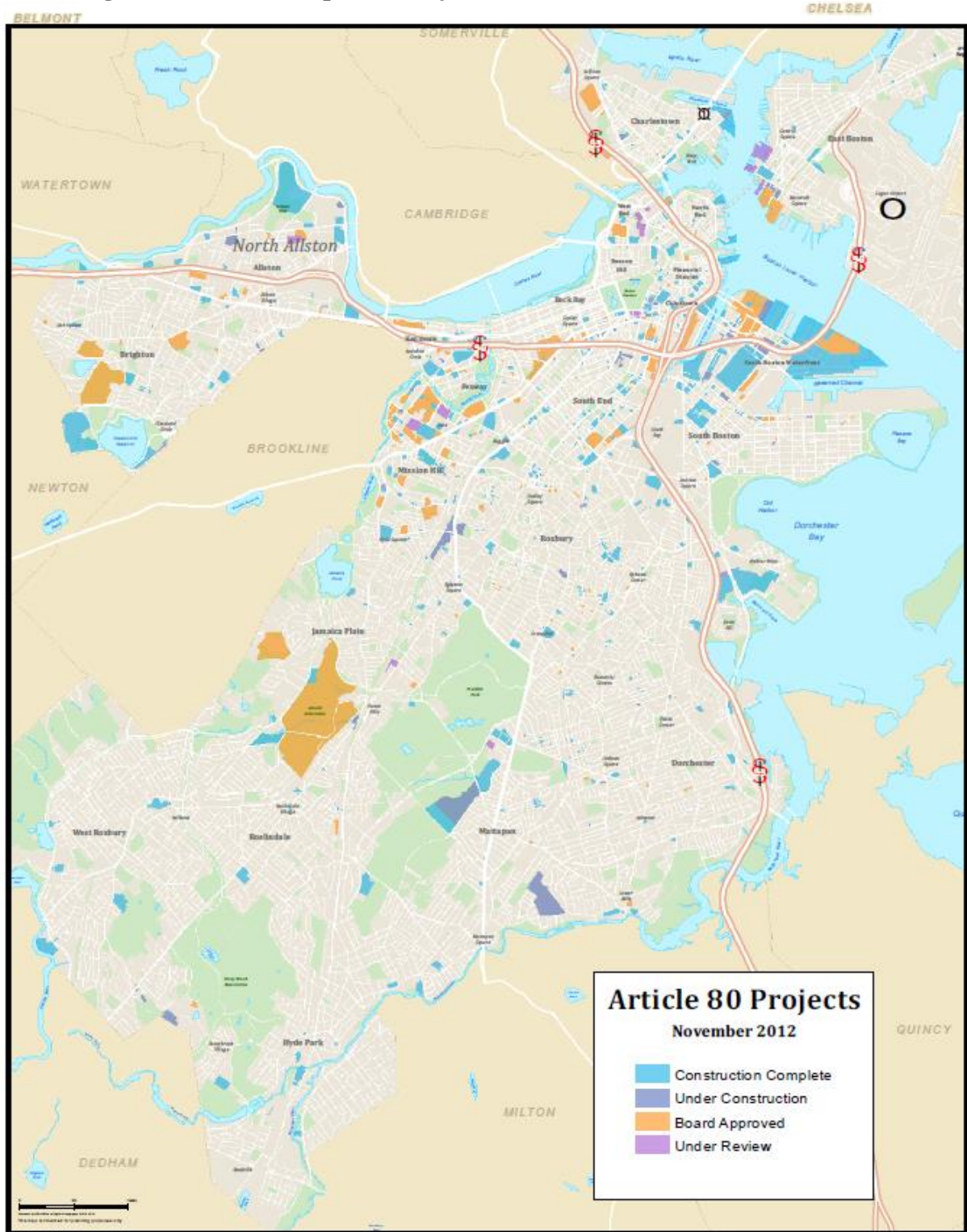
The database also includes several attributes of the new development, including acres, housing units, employment, commercial space, and hotel rooms. The 189 completed developments include a total 9,126 housing units, 9.5 million square feet of commercial space, and 1,458 hotel rooms. The projects currently under construction include 7,008 housing units, 8.3 million square feet of commercial space, and 909 hotel rooms.

Boston faces a number of challenges when addressing natural hazards. These include:

- Boston is an older, dense city with aging infrastructure and narrow streets.
- The City has a high amount of impervious surfaces.
- Boston has a large percentage of populations that may need special assistance during a natural disaster. Vulnerable populations may include those without cars, those that do not speak English well, those with a disability, the very young, and the elderly.
- Boston's housing is old and much was constructed before modern-day building codes.
- Large portions of the City are built on fill.

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Figure 1 - New Development Projects under BRA Article 80 Review



Source: Boston Redevelopment Authority



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**Table 6 Summary of Boston Developments 2005-2015**

| DEVELOPMENTS COMPLETED 2005-2014      | # PROJECTS | ACRES      | HOUSING       |               | COMMERCIAL<br>(SQ FEET) | HOTEL<br>ROOMS |
|---------------------------------------|------------|------------|---------------|---------------|-------------------------|----------------|
|                                       |            |            | UNITS         | EMPLOYMENT    |                         |                |
| Allston/Brighton                      | 9          | 24.0       | 746           | 1003          | 887,496                 | 0              |
| Back Bay/South End                    | 24         | 21.0       | 1531          | 1459          | 1,199,802               | 150            |
| Charlestown                           | 8          | 11.2       | 754           | 42            | 219,932                 | 0              |
| Chinatown/Downtown/North End/West End | 36         | 39.0       | 1872          | 2578          | 1,595,142               | 1308           |
| Dorchester/Mattapan                   | 21         | 59.3       | 1092          | 500           | 344,470                 | 0              |
| East Boston                           | 5          | 37.0       | 276           | 26            | 85,725                  | 0              |
| Fenway/Longwood Medical Area          | 22         | 33.7       | 517           | 9482          | 2,410,390               | 0              |
| Hyde Park/Roslindale/West Roxbury     | 9          | 9.1        | 233           | 100           | 155,000                 | 0              |
| Jamaica Plain                         | 15         | 13.9       | 349           | 295           | 167,381                 | 0              |
| Mission Hill/Roxbury                  | 22         | 21.6       | 804           | 349           | 447,248                 | 0              |
| South Boston/South Boston Waterfront  | 18         | 35.1       | 951           | 1820          | 2,005,304               | 0              |
| <b>SUBTOTAL Construction Complete</b> | <b>189</b> | <b>305</b> | <b>9,126</b>  | <b>17,653</b> | <b>9,517,890</b>        | <b>1,458</b>   |
| <b>UNDER CONSTRUCTION 2015</b>        |            |            |               |               |                         |                |
| Allston/Brighton                      | 7          | 193.9      | 566           | 0             | 622,000                 | 0              |
| Back Bay/South End                    | 8          | 34.8       | 787           | 303           | 1,235,790               | 0              |
| Charlestown                           | 2          | 0.3        | 54            | 563           | 290,790                 | 0              |
| Chinatown/Downtown/North End/West End | 12         | 10.6       | 1208          | 3510          | 2,690,760               | 500            |
| Dorchester/Mattapan                   | 11         | 55.3       | 820           | 323           | 593,000                 | 0              |
| East Boston                           | 2          | 6.3        | 18            | 0             | 0                       | 177            |
| Fenway/Longwood Medical Area          | 10         | 15.7       | 588           | 696           | 1,052,685               | 96             |
| Hyde Park/Roslindale/West Roxbury     | 6          | 4.8        | 210           | 67            | 24,676                  | 0              |
| Jamaica Plain                         | 7          | 15.9       | 722           | 66            | 119,000                 | 0              |
| Mission Hill/Roxbury                  | 18         | 15.2       | 1063.6        | 7             | 412,899                 | 0              |
| South Boston/South Boston Waterfront  | 15         | 30.8       | 971           | 408           | 1,249,593               | 136            |
| <b>SUBTOTAL Under Construction</b>    | <b>96</b>  | <b>383</b> | <b>7,008</b>  | <b>5,943</b>  | <b>8,291,193</b>        | <b>909</b>     |
| <b>TOTAL ALL PROJECTS</b>             | <b>285</b> | <b>689</b> | <b>16,133</b> | <b>23,596</b> | <b>17,809,083</b>       | <b>2,367</b>   |

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In order to characterize any change in the city’s vulnerability associated with new developments, a GIS mapping analysis was conducted which overlaid the development sites with the FEMA Flood Insurance Rate Map (see Table 7). The analysis reveals that of the 196 developments completed since 2005, eight were in a flood zone, and six of those were in a Zone X (0.2% annual chance flood hazard, or “500 year” flood zone). Of the 96 new developments currently under construction, only two are in a flood zone, one of which is in Zone X and one in Zone AE (1% annual chance flood hazard, or “100 year” flood zone). These 10 projects represent 3.5% of the 285 new developments completed or under construction in Boston since 2005. Even those projects that are located within a flood zone must meet the standards of the City’s *Floodplain Overlay Zoning District*, which set floor elevation standards for construction in a flood hazard district and prohibits certain activities and uses (see page 104).

**Table 7 – New Developments in Flood Zones**

| <b>Neighborhood</b>                            | <b>Development</b>                | <b>#</b>  | <b>FLOOD ZONE</b>          |
|--|-----------------------------------|-----------|----------------------------|
| <b>DEVELOPMENTS COMPLETED 2005-2014</b>        |                                   |           |                            |
| Hyde Park                                      | Hyde Park Ave PMDI Artists        |           | AE 1% Annual Chance Flood  |
| North End                                      | Battery Wharf                     |           | AE 1% Annual Chance Flood  |
| Charlestown                                    | CNY-Parcel 4-Harborview Point     |           | X 0.2% Annual Chance Flood |
| Downtown                                       | 500 Atlantic Avenue               |           | X 0.2% Annual Chance Flood |
| East Boston                                    | Portside Pier 1 Shipyard & Marina |           | X 0.2% Annual Chance Flood |
| Hyde Park                                      | The Village At Cleary Square      |           | X 0.2% Annual Chance Flood |
| Hyde Park                                      | Boston Renaissance Charter School |           | X 0.2% Annual Chance Flood |
| S. Bos. Waterfront                             | Channel Center: Phase II          |           | X 0.2% Annual Chance Flood |
| Subtotal Zone AE                               |                                   | 2         |                            |
| Subtotal Zone X                                |                                   | 6         |                            |
| <b>TOTAL ALL FLOOD ZONES</b>                   |                                   | <b>8</b>  |                            |
| <b>DEVELOPMENTS UNDER CONSTRUCTION IN 2015</b> |                                   |           |                            |
| Dorchester                                     | General Academic Building No. 1   |           | AE 1% Annual Chance Flood  |
| Downtown                                       | Russia Wharf                      |           | X 0.2% Annual Chance Flood |
| Subtotal Zone AE                               |                                   | 1         |                            |
| Subtotal Zone X                                |                                   | 1         |                            |
| <b>TOTAL ALL FLOOD ZONES</b>                   |                                   | <b>2</b>  |                            |
| <b>ALL DEVELOPMENTS 2005-2015</b>              |                                   |           |                            |
| Subtotal Zone AE                               |                                   | 3         |                            |
| Subtotal Zone X                                |                                   | 7         |                            |
| <b>TOTAL ALL PROJECTS</b>                      |                                   | <b>10</b> |                            |

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Although the vast majority of Boston's new development is not located within a designated flood hazard zone, some of the waterfront development is located in areas that may be subject to future sea level rise impacts due to climate change (see Risk Assessment section, pages 27-31). To address this concern and reduce future vulnerability in 2013 the Boston Redevelopment Authority adopted [\*Climate Change Preparedness and Resiliency Guidelines\*](#) into the Article 80 development review process (see Figure 2). The guidelines include a detailed checklist will assist project proponents in analyzing project proposals within the framework of climate change, as a step in safeguarding the future of new buildings in Boston in the event of extreme weather conditions (see checklist in Appendix A)..

The guidelines cover sea-level rise, higher average temperatures, more frequent and longer extreme heat events and droughts, more severe freezing rain and heavy rainfall events, and increased wind gusts. In addition, the guidelines will require analysis of secondary weather event impacts such as interruptions to utilities, communications systems, and transportation networks. All development projects subject to Article 80 Small and Large project review, including all Institutional Master Plan amendments will be asked to adhere to the guidelines and complete the climate preparedness checklist, which will be reviewed by the Boston Interagency Green Building Committee.



319 A Street Rear



Boston Public Market



Joslin Diabetes Center



Millennium Tower & Burnham Building

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**Figure 2 - Boston Climate Change Preparedness and Resiliency Guidelines**

Analyze project impacts on the surrounding environment that are attributable to forecasted climate conditions over the full duration of the expected life of the project. Utilizing the best available science, identify changes in the climate and environment and how such changes will affect the project's environmental impacts including the survivability, integrity and safety of the project and its inhabitants.

Climate change conditions may include, but not be limited to, sea-level rise, higher maximum and mean temperatures, more frequent and longer extreme heat events, more frequent and longer droughts, more severe freezing rain and heavy rainfall events, and increased wind gusts. Include analysis of secondary and cascading impacts including more frequent and longer interruptions of utility services including electrical, gas, and telecommunication systems, and disruptions of transportation systems and networks.

A. Complete and submit an initial Climate Change Preparedness and Resiliency Checklist with the Project Notification Form (PNF) filing. The Checklist requires all projects to consider the impacts of future climate conditions, over the expected life of the project, due to Extreme Heat and Weather and, for projects in or near floodplains or areas prone to flooding, due to Rising Sea-Levels. For any environmental impacts due to climate change that are identified, describe planning, design, and / or construction strategies that will be employed to avoid, eliminate or mitigate any adverse impacts. Consideration of environmental impacts due to climate change should not be limited to those listed on the Checklist.

B. Incorporate Climate Change Preparedness and Resiliency strategies into all relevant components of the project such as Transportation, Infrastructure Systems, Environmental Protection, Urban Design, Landscape, Sustainable Development, Historic Resources, and Tidelands.

C. Climate Change Preparedness and Resiliency Checklist and Responses will be reviewed by the Boston Interagency Green Building Committee (IGBC). The Project Proponent will be notified in writing of any comments by the IGBC.

D. The Project Proponent must submit an updated and final Climate Change Preparedness and Resiliency Checklist along with a written Response to the IGBC. The Final Climate Change Preparedness and Resiliency Checklist and Response must be submitted in conjunction with the submittal of the Final Design and Approval package for review by the IGBC. No Final Design Approval/Article 80 documents shall be authorized by the BRA until the final Climate Change Preparedness and Resiliency Checklist and Response have been reviewed by the IGBC for addressing Action Items A, B, and C as set forth above.

See the Climate Change Resiliency and Preparedness Checklist in Appendix A.

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### **III. PLANNING PROCESS AND PUBLIC PARTICIPATION**

The City of Boston employed a six step planning framework based on FEMA’s hazard mitigation planning guidance focusing on local needs and priorities but maintaining a regional perspective on 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. The City of Boston facilitated participation by the general public and other stakeholders through: the City’s Hazard Mitigation Executive Steering Committee, two public meetings hosted by the Boston Conservation Commission, meeting with the Coordinated Statewide Emergency Preparedness committee (COSTEP), posting the plan to the Boston Environment Department’s webpage, and invitations sent to neighborhood groups. The Main Street Business District, municipal boards and commissions, the local chamber of commerce, neighboring communities, and other local or regional entities were also invited to review the plan and provide comment. Regional coordination was facilitated by the Metro Boston Regional Hazard Mitigation Planning Committee.

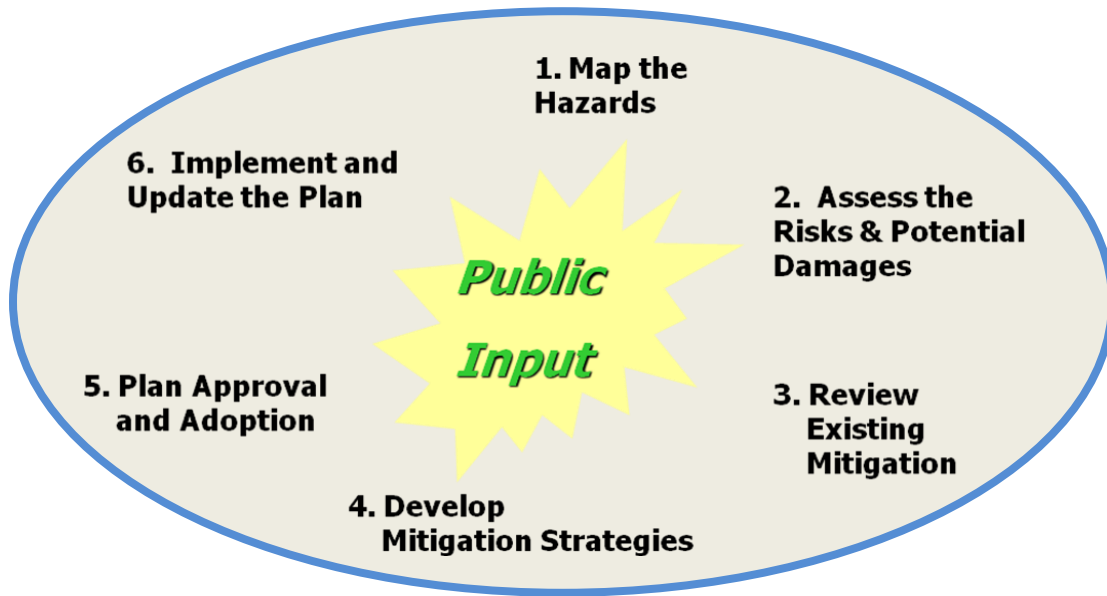
Within the planning framework described above, a number of additional activities were introduced into the planning process for the Boston Hazard Mitigation Plan 2014 Update to address the greater size and complexity presented by the City and its desire to incorporate the potential impacts of climate change into the plan update. The most significant aspects were the utilization of an overall project steering committee representing all relevant City agencies, coupled with four collaborative stakeholder working groups in partnership with SERI, who have developed a methodology for exploring natural hazard impacts and mitigation measures related to climate change.

#### **Planning Process Summary**

The six-step planning framework 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. In a plan update such as this, 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.

1. **Map the Hazards** – The City relied 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. These maps did not include climate change projections.

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2. **Assess the Risks and Potential Damages** – Critical facilities, infrastructure, vulnerable populations, and other features are mapped and compared with the hazard data from the first step to identify those that might be particularly vulnerable to these hazards. Land use data and development trends are also incorporated into this analysis. In addition, the City developed estimates of the potential impacts of certain hazard events on the community.
3. **Review Existing Mitigation** – Boston has an active history in hazard mitigation and has adopted flood plain zoning districts, wetlands protection programs, and other measures as well as enforcing the State Building Code, which has provisions related to hazard resistant building requirements. All current municipal mitigation measures were documented.
4. **Develop Mitigation Strategies** – The City of Boston worked with the municipal staff to identify new mitigation measures, utilizing information gathered from the hazard identification, vulnerability assessments, and the City’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 and 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. Once FEMA approves the plan FEMA issues a conditional approval pending adoption of the plan by the Boston City Council. More information on plan adoption can be found in Chapter IX and documentation of plan adoption can be found in Appendix G.

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**6. Implement and 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 VII includes more detailed information on plan implementation.

### **Boston’s Participation in the Regional Committee**

The Metro Boston Hazard Mitigation Planning Committee served as an opportunity for neighboring communities to discuss hazard mitigation issues of shared concern. The committee includes representatives of Boston, Brookline, Cambridge, Chelsea, Everett, Malden, Medford, and Somerville. The City of Boston’s appointed representative to the regional committee was Elaine M. Sudanowicz from the Mayor’s Office of Emergency Management. The committee met on April 13, 2010 and was attended by representatives from Boston and all the neighboring cities and towns.

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

### **The Boston Hazard Mitigation Executive Steering Committee**

The Boston Hazard Mitigation Executive Steering Committee was central to the planning process as it was the primary body tasked with coordinating multiple City agencies and developing a mitigation strategy for the City. Given this role, it is important that this committee included a diverse representation of knowledgeable municipal staff. The Executive Steering Committee membership can be found in Table 8 below.

The Executive Steering Committee provided overall direction and oversight of the planning process, while smaller working groups provided information on the impacts of hazards on the City, existing mitigation measures, and helped to develop proposed mitigation measures.

The steering committee met on February 8, 2012 and September 6, 2012. The original co-chairs for the first meeting on February 8, 2012 were James Hunt, Mayor’s Office of Environmental and Energy Services, and Don McGough, Mayor’s Office of Emergency Management. During the course of the plan review, they both left their positions with the City of Boston, and were replaced with the current co-chairs, Brian Swett, Mayor’s Office of Environmental and Energy Services and Rene Fielding, Mayor’s Office of Emergency Management.

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| <b>Table 8<br/>Boston Hazard Mitigation Executive Steering Committee</b> |   |
|--|---|
| <b>Name</b>  | <b>Representing</b>                                 |
| Brian Swett, Co-Chair  | Mayor’s Office of Environmental and Energy Services |
| Rene Fielding, Co-Chair  | Mayor’s Office of Emergency Management              |
| Para Jayasinghe  | Public Works Department                             |
| Paul Shoemaker   | Boston Public Health Commission                     |
| Carl Spector   | Environment Department                              |
| John Sullivan  | Boston Water and Sewer Commission                   |
| Aldo Ghirin  | Boston Parks and Recreation                         |
| Chris Busch  | Boston Redevelopment Authority                      |
| John Hanlon  | Office of Budget Management, Capital Planning       |
| <i>Staff Support</i>   |   |
| Elaine M. Sudanowicz   | Mayor’s Office of Emergency Management              |
| James Freas  | MAPC  |
| Martin Pillsbury   | MAPC  |

**Collaborative Working Meetings with the Social and Environmental Research Institute**

The City of Boston invited the Social and Environmental Research Institute (SERI) to assist in the development of the Boston Hazard Mitigation plan because of their experience with bringing the potential consequences of climate change on natural hazards explicitly into the planning process.

SERI began the process with a meeting on stormwater issues at the Boston Water and Sewer Commission on January 30, 2012. The City then held four collaborative working meetings from March through May 2012 that brought together City staff, state agency staff, and other stakeholders to identify hazards and vulnerabilities, consider the potential impacts of climate change, and discuss the hazard mitigation strategy. Each group focused on a different area as follows:

- **Infrastructure** – roads, transit, water and sewer, parks, airport, dam, utilities, groundwater NGO
- **Buildings and Facilities** – publicly owned buildings, libraries, universities, historic and cultural institutions
- **Regulations** – zoning and other ordinances or regulations, social services, insurance, landmarks
- **Public Safety** – police, fire, emergency management, public health, emergency medical services, public housing, environmental protection

SERI’s approach, known as *Vulnerability-Consequence Adaptation Planning Scenarios* (VCAPS), is based on a logic model framework, in which each hazard is discussed through a sequence of primary and secondary impacts that lead to particular consequences of concern. The results of the VCAPS working group sessions are summarized in Appendix B.



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Attendance at the working meetings included representatives of key City, State, and regional agencies. A complete list of participants of all four working meetings is provided in Appendix E.

### **Participation with COSTEP MA**

COSTEP MA (Coordinated Statewide Emergency Preparedness in Massachusetts) is a collaborative of representatives of cultural and historical institutions and agencies as well as first responder and emergency management professionals from federal, state, and municipal governments. The purpose of COSTEP MA is to develop hazard mitigation strategies for cultural sites, museums, and libraries statewide, with considerable potential benefit for the many such institutions in Boston. Participating institutions in Boston include the Museum of Fine Arts, the Bostonian Society (the Old State House), Historic New England (the Otis House), the Massachusetts Historic Society, and UMASS Boston. The City of Boston is an at-large member on the Executive Board of COSTEP.

### **Public Meetings**

The public had an opportunity to provide input to the Boston hazard mitigation planning process at two public meetings hosted by the City of Boston, one early in the planning process, and one after a draft plan was available for review. The first public meeting was held on April 18, 2012, and the second was held on September 18, 2013; both meetings were held in the Boston City Hall.

Both meetings were publicized as regular meetings of the Boston Conservation Commission in accordance with the Massachusetts Open Meeting Law. In addition, both meetings were extensively advertised through the City website, the Mayor's Office of Neighborhood Services (ONS) e-mail lists reaching a wide range of residents and other stakeholders, notification to City Main Street Program neighborhood organizations, and direct invitations to specific stakeholder groups. A number of neighborhood organizations posted the meeting notices on their websites as a result of receiving one or more of these notifications. Additionally, the City produced and circulated a flyer advertising both of the public meetings. The City of Boston encouraged citizen participation through email and followed up on inquiries. The attendance list for each meeting can be found in Appendix F.

Notice was sent to numerous agencies organizations, inviting them to review and submit comments on this Boston Hazard Mitigation Plan 2014 Update. Many of these organizations were also invited to participate in the collaborative working group meetings. A list of the invitees is provided in Appendix F. The following neighboring municipalities were also notified of the draft plan update and invited to comment on it: Quincy, Milton, Canton, Dedham, Needham, Brookline, Newton, Watertown, Cambridge, Somerville, Everett, Chelsea, Revere, and Winthrop.

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A City website with a description of the planning process and information on hazard mitigation, copies of reports on hazards in the City, a schedule of public meetings, and, when available, draft copies of the plan was maintained throughout the planning process.

Any comments received were reviewed and incorporated by the local hazard mitigation team. Revisions to the draft plan included the addition of recommendations for multi-language public education, updating several city projects, and revising the priorities for mitigation for invasive insects, trees, and green infrastructure.

**Planning Timeline**

|                    |   |
|--------------------|---|
| April 13, 2011     | Meeting of the Metro Boston Regional Committee                          |
| March 9, 2011      | Hazard Mitigation Kickoff Meeting with MEMA and Boston                  |
| April 20, 2011     | Hazard Mitigation & RiskMAP Collaboration Meeting                       |
| June 23, 2011      | US Army Corp of Engineers and FEMA on Boston Hurricane Evacuation Study |
| November 18, 2011  | Meeting with COSTEP, North Andover                                      |
| January 30, 2012   | Meeting with Boston Water and Sewer Commission and SERI                 |
| February 8, 2012   | Boston Hazard Mitigation Executive Steering Committee                   |
| March 28, 2012     | Infrastructure Stakeholders meeting with SERI                           |
| April 4, 2012      | Regulations Stakeholders meeting with SERI                              |
| April 25, 2012     | Buildings and Facilities Stakeholders meeting with SERI                 |
| April 18, 2012     | First Public Meeting with Boston Conservation Commission                |
| May 10, 2012       | Public Safety Stakeholders meeting with SERI                            |
| July 18, 2012      | Meeting with Boston and DCR   |
| July 20, 2012      | Meeting with Boston and MassDOT   |
| September 6, 2012  | Boston Hazard Mitigation Executive Steering Committee                   |
| January 16, 2013   | Meeting of the local Hazard Mitigation staff team                       |
| January 31, 2013   | Meeting with COSTEP, Boston   |
| September 18, 2013 | Second Public Meeting with Boston Conservation Commission               |
| October 18, 2013   | Close of Comment Period; draft revisions and final city review          |
| December 16, 2013  | Draft Plan Update submitted to MEMA                                     |
| January 28, 2014   | Plan Review Tool received from MEMA                                     |
| March 24, 2014     | Revised Draft Plan Update submitted to MEMA                             |
| September 11, 2014 | Plan Review Tool received from FEMA                                     |
| November 18, 2014  | Revisions to Plan Review Tool Received from MEMA                        |
| April 15, 2015     | Revised Draft Plan Update submitted to MEMA                             |
| August 3, 2015     | FEMA issued Approval Pending Adoption                                   |
| September 16, 2015 | Final Plan Adopted by Boston City Council                               |

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## **IV. RISK ASSESSMENT**

The risk assessment analyzes the potential natural hazards that could occur within Boston as well as the relationship between those hazards and land uses 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.

In addition to a review of historic trends for natural hazard events as an indicator of Boston’s vulnerability, the potential future impacts of climate change are also incorporated into this plan. The City of Boston has embarked on a significant initiative to address climate change mitigation and adaptation, as documented in its 2011 climate action plan, *A Climate of Progress*.

### **Overview of Hazards and Impacts**

According to the *Massachusetts Hazard Mitigation Plan 2010* (state plan), Massachusetts is subject to the following natural hazards (listed in order of frequency): floods, heavy rainstorms, nor’easters or winter storms, coastal erosion, hurricanes, tornados, wildfires, and earthquakes. State and federal disaster declarations are summarized in Table 2.

Table 9 summarizes the current hazard risks for Boston. This evaluation takes into account the historic frequency of the hazards; it does not consider the effect of future

| <b>Table 9 - Hazard Risks Summary</b> |                    |                    |                      |
|---------------------------------------|--------------------|--------------------|----------------------|
| <b>Hazard Type</b>                    | <b>Probability</b> | <b>Consequence</b> | <b>Hazard Rating</b> |
| <b>Flooding</b>                       |                    |                    |                      |
| <i>Inland/Riverine</i>                | Possible           | Critical           | High (8)             |
| <i>Coastal Storms/Storm Surge)</i>    | Unlikely           | Critical           | Medium (7)           |
| <i>Urban Flooding</i>                 | Likely             | Limited            | Medium (7)           |
| <i>Dam Failure</i>                    | Unlikely           | Limited            | Low (3)              |
| <b>Wind</b>                           |                    |                    |                      |
| <i>Hurricanes</i>                     | Possible           | Critical           | High (8)             |
| <i>Tornados</i>                       | Possible           | Critical           | High (8)             |
| -Nor’easters                          | Highly Likely      | Limited            | Medium (6)           |
| -Thunderstorms                        | Highly Likely      | Limited            | Medium (6)           |
| <b>Winter Storms</b>                  |                    |                    |                      |
| <i>Severe Winter Storm</i>            | Likely             | Limited            | Medium (7)           |
| <b>Geologic</b>                       |                    |                    |                      |
| <i>Earthquakes</i>                    | Unlikely           | Catastrophic       | High (9)             |
| <i>Landslides</i>                     | Possible           | Minor              | Low (3)              |
| <i>Tsunami</i>                        | Unlikely           | Critical           | Medium (4)           |
| <b>Other Natural Hazards</b>          |                    |                    |                      |
| <i>Fire / Conflagration</i>           | Possible           | Critical           | High (8)             |
| <i>Extreme Temperatures</i>           | Highly Likely      | Minor              | Medium (6)           |

Source: Massachusetts Hazard Mitigation Plan, 2010, adapted for Boston

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climate change. The rating for each hazard type is based on two factors: the probability of occurrence and the relative severity of consequences should it occur. This analysis is drawn from the hazard rating found in the City of Boston Hazard Identification and Risk Assessment (HIRA). The rating definitions are summarized in Table 10.

| <b>Table 10 - Hazard Rating Assessment used in the Boston HIRA Report</b> |   |   |
|---|---|---|
| Probability (Weight x1)*  |   | Average Frequency*  |
| Ratings   | Definitions   |   |
| Highly Likely (4)   | Event expected to occur at least once within the next year.   | On average, this event occurs once a year or more frequently.   |
| Likely (3)  | Event expected to occur at least once within the next 1-3 years.  | On average, this event occurs at least once every 3 years, but less often than once a year.           |
| Possible (2)  | Event expected to occur at least once within the next 3-10 years.   | On average, this event occurs at least once every 10 years, but less often than once every 3 years.   |
| Unlikely (1)  | Event expected to occur at least once within the next 11-100 years.   | On average, this event occurs at least once every 100 years, but less often than once every 10 years. |
| Consequence (Weight x2)   |   |   |
| Ratings   | Definitions   |   |
| Catastrophic (4)  | Mass fatalities OR basic life services disrupted for up to 30 days OR more than 50% of property severely damaged.                         |   |
| Critical (3)  | Multiple fatalities and severe injuries OR basic life services disrupted for up to 2 weeks OR more than 25% of property severely damaged. |   |
| Limited (2)   | Some injuries OR basic life services disrupted for up to one week OR more than 10% of property severely damaged.                          |   |
| Minor (1)   | Minor injuries OR basic life services disrupted for 72 hours or less OR less than 10% of property severely damaged.                       |   |

\*The probabilities and averages used in this table are not always based on extensive data, but in some cases reflect the collective judgment of emergency responders. Source: Boston HIRA

**Impacts of Climate Change**

Many of the natural hazards that Boston has historically experienced are likely to be exacerbated by climate change in future years. This is particularly true for flooding caused by extreme precipitation, coastal flooding and damage due to sea level rise, and extreme heat. These are described in more detail below.

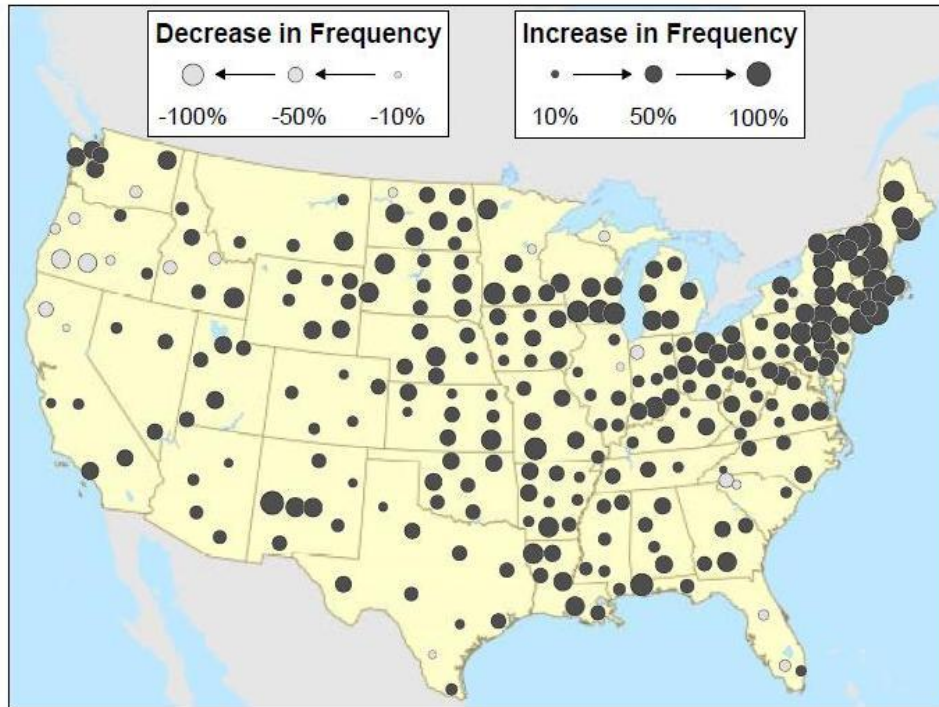
*Climate Change Impacts: Extreme Precipitation*

Boston’s average annual precipitation is 42 inches. While total annual precipitation has not changed significantly, 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 (see Figure 3). In other words, large rain or snow storms

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that happened once every 12 months, on average, in the middle of the 20th century, now happen every nine months.

**Figure 3 - Change in Frequency of Extreme Downpours, 1948 – 2011**



Source: *When It Rains It Pours – Global Warming and the Increase in Extreme Precipitation*, Environment America Research and Policy Center, July 2012

Not only are these intense storm events more frequent, they are also more severe: the largest annual storms now produce 10 percent more precipitation, on average, than in 1948. In particular, the report finds that *New England has experienced the greatest change with intense rain and snow storms occurring 85 percent more often than in 1948*

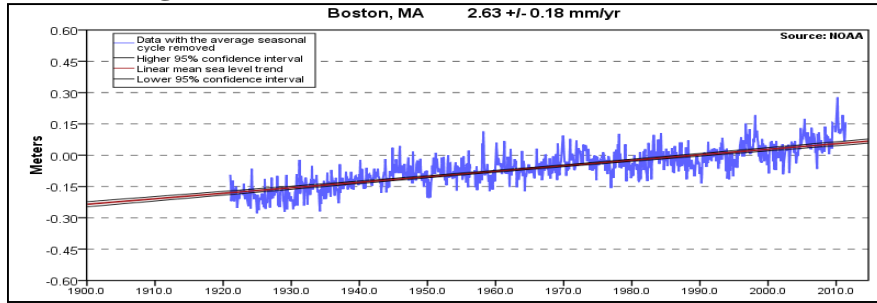
At the other extreme, changes in precipitation patterns and the projected future rising temperatures due to climate change (discussed below) will likely increase the frequency of short-term (one- to three-month) droughts and decrease stream flow during the summer.

### *Climate change impacts: Sea-level rise and storm surges*

A higher sea level increases the frequency and extent of coastal flooding. In the past 100 years, the relative change in sea level in Boston Harbor has been a rise of about one foot (Figure 4). The change is relative, because it consists of two components: a rise in the absolute sea level and a sinking of the land. In the past 100 years, these two factors have been roughly equal, and, for the most part, represent long-term processes that have been underway since the end of the last Ice Age, approximately 14,000 years ago.

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**Figure 4 - Boston Sea Level Trends, 1920-2011**



Source: National Oceanic and Atmospheric Administration (NOAA)

Climate change is accelerating the rate of global (absolute) sea-level rise (SLR) primarily by warming the oceans, causing the water already in them to expand, and by warming the land and air, causing ice on land (glaciers, ice sheets) to melt and flow into the ocean. A recent report as part of the U.S. National Climate Assessment states that there is “very high confidence (>9 in 10 chance) that global mean sea level will rise at least 0.2 meters (8 inches) and no more than 2.0 meters (6.6 feet) by 2100 (see Table 11).”<sup>1</sup> The low end of this range represents a continuation of the current trend, which has a relatively small contribution from melting ice. The higher end includes greater contributions from melting ice, for which there is an increasing amount of data, though still not enough to resolve some uncertainties. The report presents four scenarios of sea-level rise that could be used depending on the time frame of projects and the level of risk that communities are willing to accept. Whatever the actual amount of sea-level rise by the end of the century, the oceans will likely continue to rise after that.

**Table 11- Global Sea-Level Rise Scenarios<sup>2</sup>**

| <b>Scenario</b>   | <b>SLR by 2100 (m)*</b> | <b>SLR by 2100 (ft)*</b> |
|-------------------|-------------------------|--------------------------|
| Highest           | 2.0                     | 6.6                      |
| Intermediate-High | 1.2                     | 3.9                      |
| Intermediate-Low  | 0.5                     | 1.6                      |
| Lowest            | 0.2                     | 0.7                      |

\* Using mean sea level in 1992 as a starting point.

In addition to the rise of the global average, changes to the distribution of water around the globe will vary the amount of absolute sea-level rise that different localities experience. Changes in the temperature and salinity of water will affect ocean currents, and the melting of ice will alter the Earth’s gravitational field. Both of these mechanisms could cause Boston (and the Northeast coast overall) to see sea-level rise that, in the higher scenarios, is more than a foot greater than the global average. Early evidence of the predicted ocean-current effect was published in June 2012.<sup>3</sup>

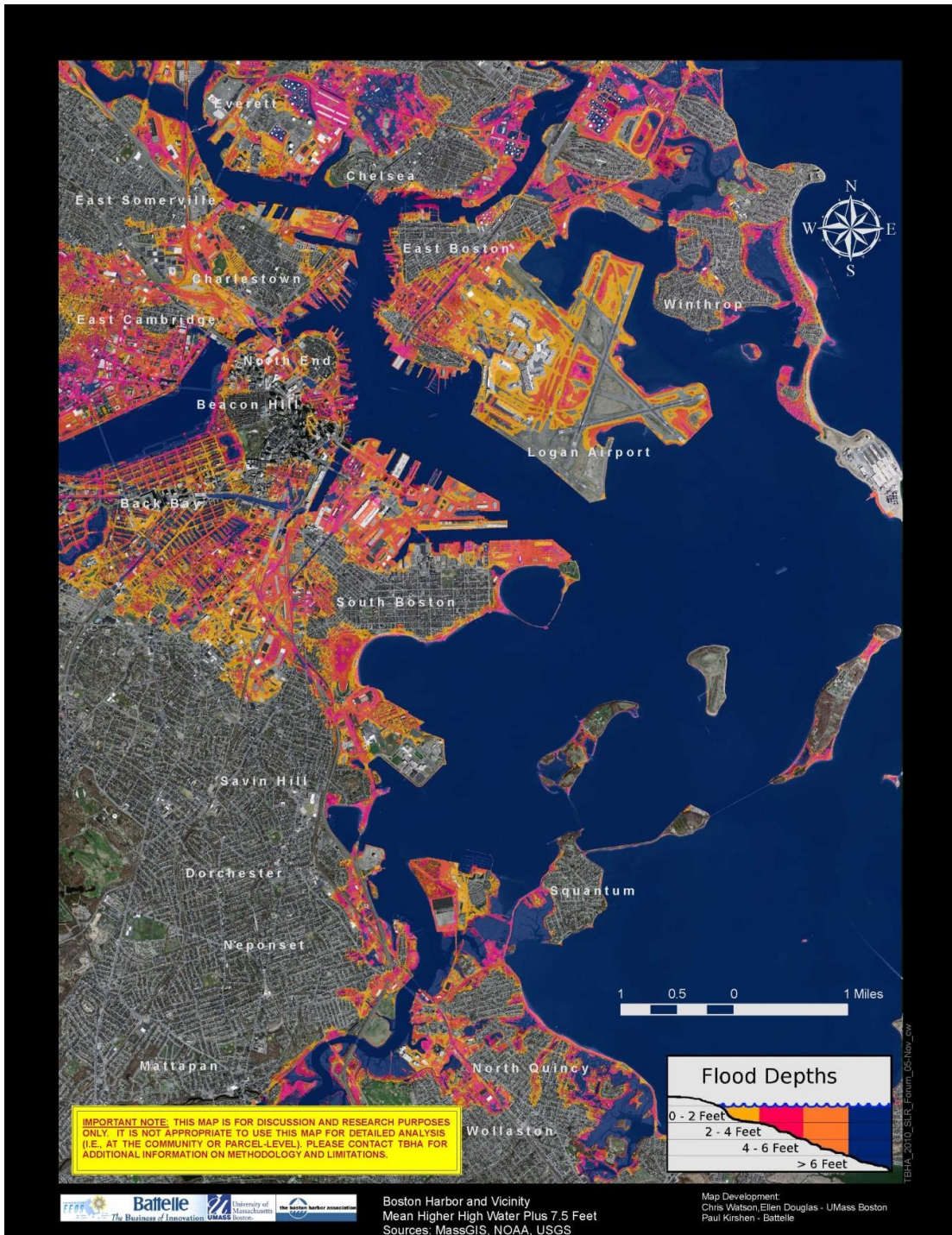
<sup>1</sup> Parris, Adam, et al. *Global Sea Level Rise Scenarios for the United States National Climate Assessment*, NOAA Technical Report OAR CPO-1, National Oceanic and Atmospheric Administration, December 2012.

<sup>2</sup> *ibid.*

<sup>3</sup> Sallenger Jr, A. , K. Doran, P. Howd, “Hotspot of accelerated sea-level rise on the Atlantic coast of North America,” *Nature Climate Change* (2012) 2, 884–888, doi:10.1038/nclimate159724, June 2012. See also, Parris et al., *supra.*, for a summary of all contributing factors.

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**Figure 5 - Projected Flooding of Boston Harbor and vicinity  
with water at 7.5 feet above mean higher high water<sup>4</sup>**



Source: Chris Watson and Ellen Douglas, U. Mass Boston, and Paul Kirshen, Battelle Laboratories

<sup>4</sup> Chris Watson, Ellen Douglas, and Paul Kirshen, The Boston Harbor Association, <http://tbha.org/boston-harbor-sea-level-rise-maps>, 2010.

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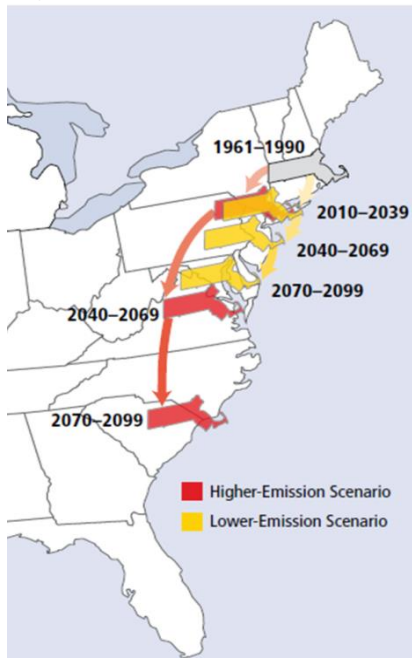
With average global sea-level rise approaching four feet under an intermediate-high scenario, another foot or so from local sea-level effects, and another half-foot of relative sea-level rise due to continuing land subsidence, the City of Boston may need to evaluate the effects of five feet or more of sea-level rise, compared to 1990 levels, by the end of the century.

Higher sea levels mean that, first, any given coastal storm will cause greater flooding than it would have at a lower sea level, and, second, that smaller, more frequent storms will cause the same amount of flooding that larger, less frequent storms used to (these are two different ways at looking at the same phenomenon.) Figure 5 shows an estimate of the amount of flooding that would be caused by a five-foot storm surge hitting Boston at high tide on top of 2.5-feet of sea-level rise (total water level, 7.5 feet above current mean higher high water). The area of flooding is much greater than today's 100-year floodplain, its rough, contemporary equivalent. Conversely, the flooding caused by the current 100-year storm—with a one-percent chance of occurring in a given year—will have about a 30-percent annual chance of occurring after one foot of sea-level rise.<sup>5</sup>

### *Climate Change Impacts: Extreme Heat*

Recent temperature trends suggest greater potential impacts to come due to climate change. In the report “Confronting Climate Change in the U.S. Northeast,” (2007), the Union of Concerned Scientists presented temperature projections to 2099 based on two scenarios, one with lower carbon dioxide emissions, and the other with high emissions.

**Figure 6 - Extreme Heat Scenarios**



Source: Union of Concerned Scientists

Between 1961 and 1990, Boston experienced an average of 11 days per year over 90°F. That could triple to 30 days per year by 2095 under the low emissions scenario, and increase to 60 days per year under the high emissions scenario. Days over 100°F could increase from the current average of one day per year to 6 days with low emissions or 24 days with high emissions. By 2099, Massachusetts could have a climate similar to Maryland's under the low emissions scenario, and similar to the Carolinas' with high emissions (Figure 6). Furthermore, the number of days with poor air quality could quadruple in Boston by the end of the 21<sup>st</sup> century under higher emissions scenario, or increase by half under the lower emissions scenario. This would have significant impacts on public health, particularly for those individuals with asthma and other respiratory system conditions, which typically affect the young and the old more severely.

<sup>5</sup> Ellen Douglas, personal communication, 2008.



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## Flood Related Hazards

Flooding is the most prevalent serious natural hazard identified by local officials in Boston. Flooding can be caused by hurricanes, nor'easters, severe rainstorms, and thunderstorms among other causes. Sea level rise as well as more intense storms brought on by global climate change has the potential to increase the frequency and extent of flooding from all of these causes.

### Overview of City-Wide Flooding

Boston is subject to three kinds of flooding: *coastal flooding* where wind and tide leads to flooding along tidal waterways; *inland/riverine flooding* where the rate of precipitation and/or amount of stormwater runoff overwhelms the capacity of natural or structured drainage systems causing overflows; *urban flooding* in which 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 is blocked by the inland push of wind and tide driven water.

The city is divided into four watersheds, Boston Harbor, Charles River, Mystic River and Neponset River. All of these waterways have the potential to flood sections of the city. In addition, a number of smaller brooks and waterways have flooded in the past, most notable of these being the Muddy River and Mother Brook. In many rivers and streams, years of shoreline modifications, land reclamation, stream piping, and development have severely altered the natural flow of water in Boston. Stormwater drainage from developed areas occurs primarily through the manmade system of storm drains.



Photo: Quinn Eureka

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### Inland/Riverine Flooding

Inland/riverine flooding occurs when water overflows the banks of an existing stream or river. These flood events can cause serious damage to structures and property and can threaten the lives and safety of area residents. Large amounts of impervious area in the City's four watersheds increase the frequency and severity of flooding because storm water is prevented from absorbing into the ground and flows overland directly into the waterway, increasing the volume of flow. This type of flooding most often occurs within the mapped floodplain areas. Boston has a significant history of damaging flood events in many different parts of the City.

Based on the current Suffolk County FEMA Flood Insurance Rate Maps (FIRM, effective September 24, 2009) available for Boston, the following areas are in 100-year flood hazard zones, which FEMA defines as an area with a 1% annual chance of flooding.

- Most of the coastline including Deer Island, and the Harbor Islands
- In East Boston, Belle Isle Marsh, Constitution Beach and the Wood Island Bay Marsh area; the flood plain at Belle Isle Marsh is protected as part of the Belle Isle Marsh Reservation
- In Charlestown, portions of piers and land in the Navy Yard area, along the Little Mystic Channel and along the Mystic River
- Most of the wharves from the Charlestown Bridge to the Northern Avenue Bridge
- In South Boston, the MASSPORT Marine Terminal area and portions of other piers along Boston Harbor; land on the southern side of the Reserved Channel; some land between A Street and the Fort Point Channel; Castle Island; the Conley Terminal; and the coast along Dorchester Bay extending to Columbus Park and including William J. Day Boulevard
- Land along the Charles River
- Land along the Muddy River from the Charles River to Jamaica Pond
- In Dorchester, land around the Bayside Exposition Center, land along the southern coast of Columbia Point, the coast around Savin Hill including Morrissey Boulevard, the Victory Road Park and Tenean Beach area including land west of I-93, the Port Norfolk area, and land along the Neponset River including the Neponset River Reservation
- In West Roxbury, land along the Charles River including land between the river and the VFW Parkway near Bridge Street and along Millennium Park
- In Roslindale, land within the Stony Brook Reservation
- In Hyde Park and Mattapan, land along the Neponset River including the Neponset River Reservation, land along Mill Pond and Mother Brook

Based on data from the National Weather Service, National Climatic Data Center, FEMA disaster declarations, the Suffolk County FIS, and local data sources, historic flood events from 1950 through 2011 were compiled and are summarized in Table 12.

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**Table 12 Riverine Flood Events\***

| Location       | Date       | Property Damage |
|----------------|------------|-----------------|
| Boston         | 03/1968    | N/A             |
| Boston         | 6/13/1998  | \$9-\$17M       |
| Boston         | 4/22/2000  | \$0             |
| Suffolk County | 5/13/2006  | \$0             |
| Boston         | 10/28/2006 | \$8,000         |
| Allston        | 2/13/2008  | \$5,000         |
| Suffolk County | 3/14/2010  | \$10.7M         |
| Suffolk County | 8/25/2010  | \$0             |

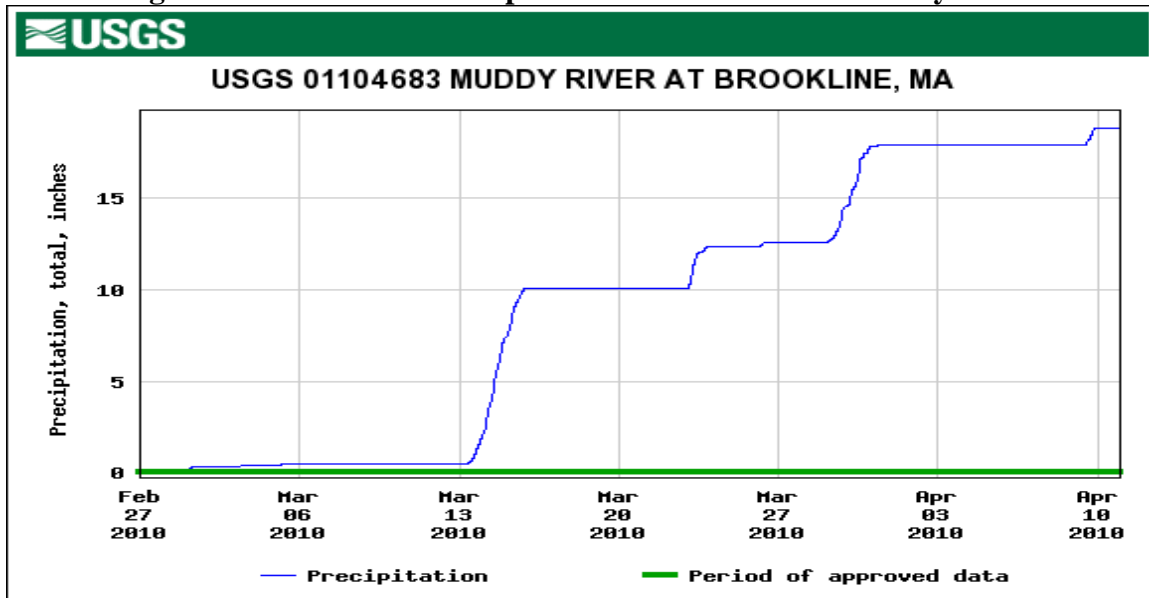
*\*excludes events classified as Coastal Flood or Urban/Small Stream Flood* Source: Boston HIRA

The Floods of March 2010

The most severe recent flooding occurred during the major storms of March 2010, when the City of Boston broke the record of 11 inches of rain set in 1953. During the month of March of 2010, a new total of 14.83 inches of rainfall accumulation was officially recorded by the National Weather Service (NWS).

The weather pattern that caused these floods consisted of early springtime prevailing westerly winds that moved three successive storms, combined with tropical moisture from the Gulf of Mexico, across New England. The most precipitation came with the first storm on March 14-15 and the third storm on March 31. A smaller storm occurred between these two on March 22 (see Figure 7). Torrential rain falls caused March 2010 to be the wettest month on record for the City of Boston. Historically, NWS determined that March 2010 was the fourth wettest of any month since 1872.

**Figure 7 - March 2010 Precipitation Measured at the Muddy River**



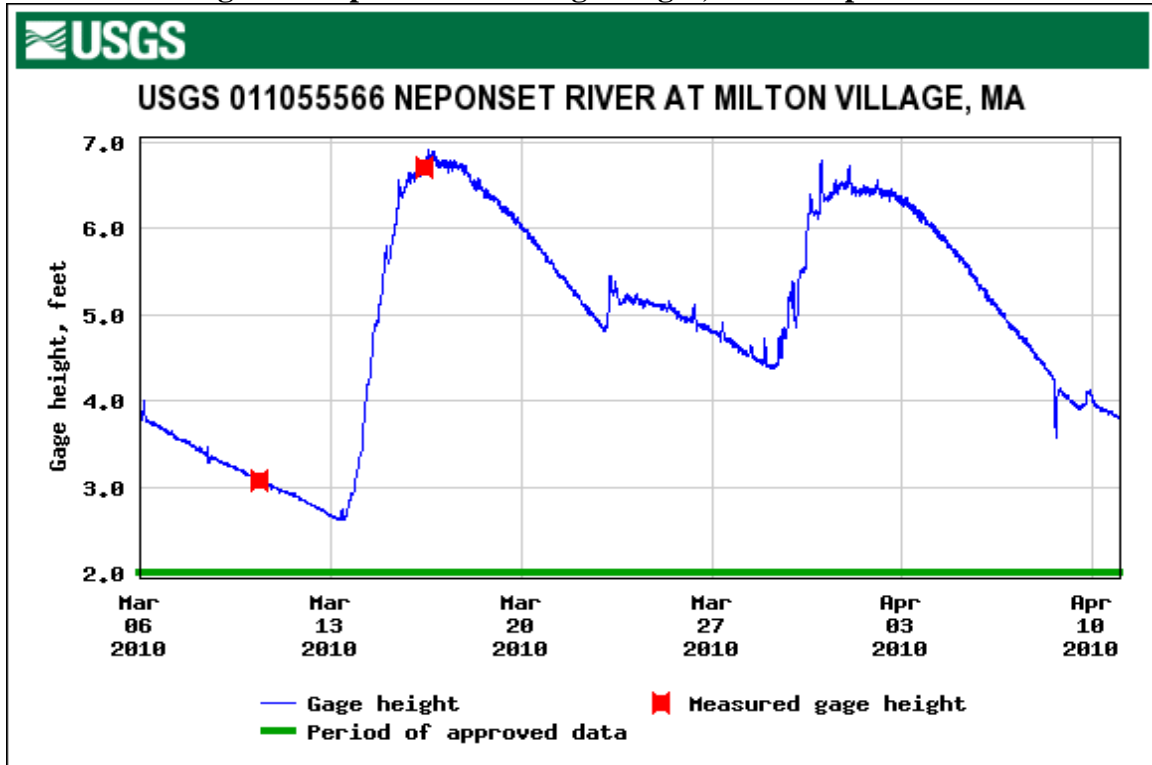
*March 2010 Flood Levels by Watershed*

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*Neponset River Watershed*

The Neponset River, with headwaters about 25 miles southeast of Boston in the Town of Foxborough, flows past the southern-most Boston neighborhoods of Hyde Park, Mattapan, and Dorchester, and forms the border between Boston and the Town of Milton to the south. The most severe flooding in recent years was in March and early April of 2010, due to successive storm events. USGS streamflow data show that there were two periods of high water in the Neponset River at the Milton Village streamflow gage, corresponding with successive storms. The river peaked at 6.9 feet on March 16 following the first storm, and again at 6.8 feet on March 31 following a second storm. See Figure 8 below.

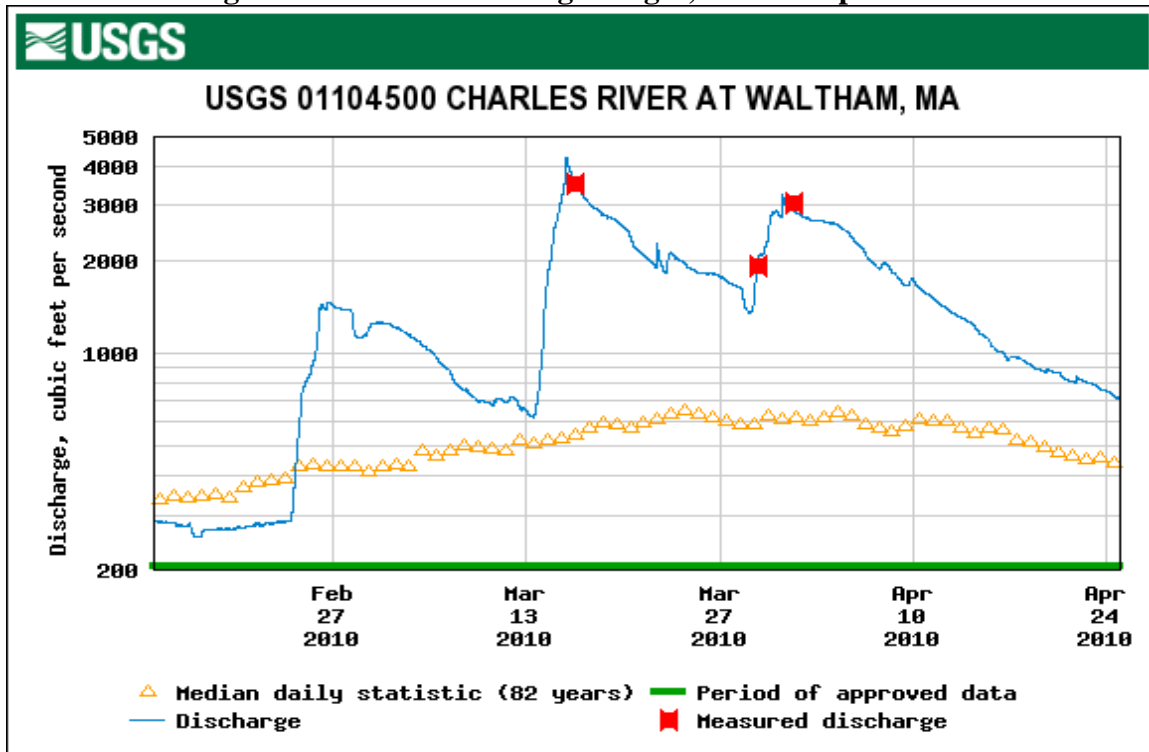
**Figure 8 Neponset River Gage Height, March-April 2010**



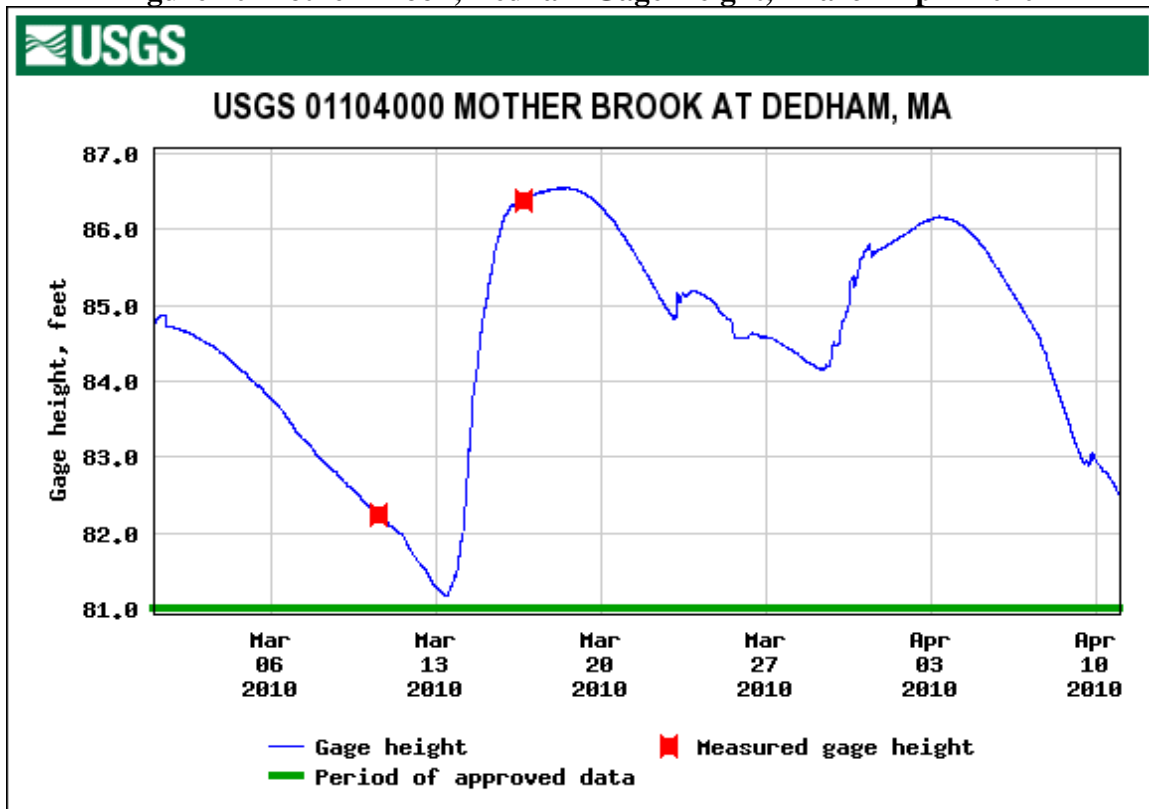
The Charles River flows from its headwaters in Hopkinton, MA and flows past the West Roxbury neighborhood of Boston, then further downstream it flows along the northern Boston neighborhoods of Allston/Brighton, Back Bay, and Downtown Boston, forming the border between Boston and neighboring communities of Cambridge and Watertown. As was the case with the Neponset River, the storms of March 2010 caused two successive peak elevations in the Charles. As measured at the nearest USGS gage in Waltham just upstream from Boston, the Charles River rose to an elevation of 7.5 feet on March 15 following the first March storm, and rose again to an elevation of 6.5 feet on March 31 following the second storm. See Figure 9 below.

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**Figure 9 Charles River Gage Height, March-April 2010**



**Figure 10 Mother Brook, Dedham Gage Height, March-April 2010**

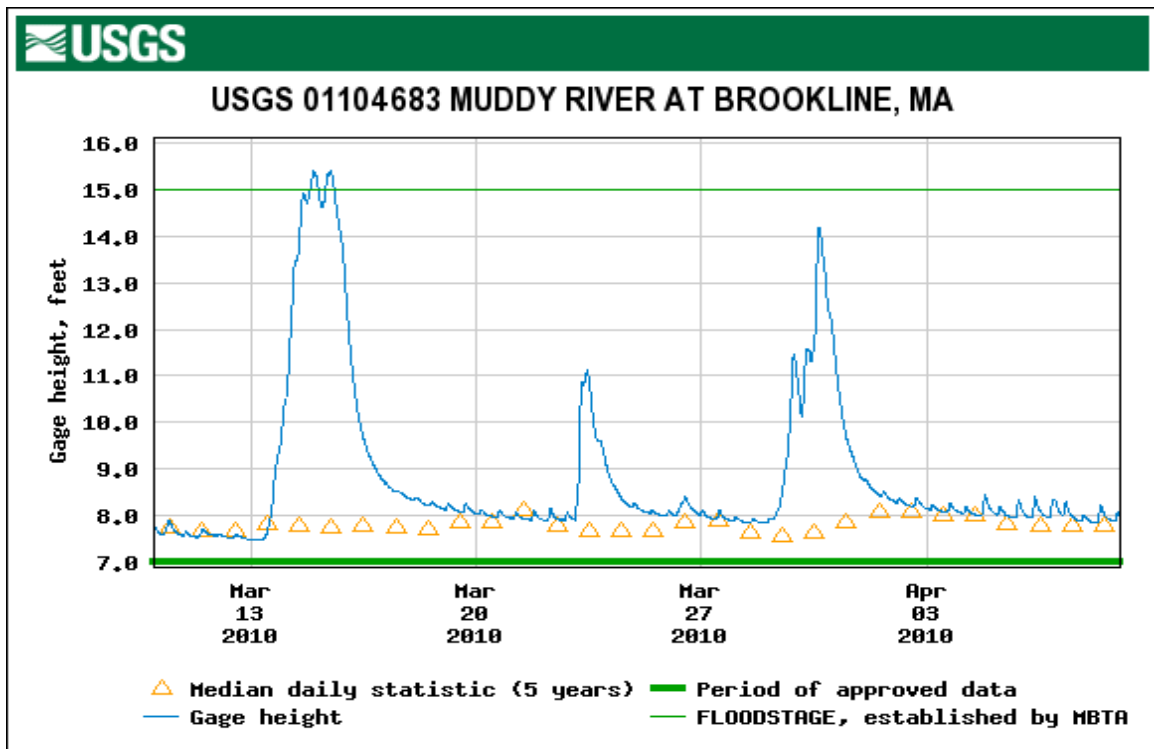


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Mother Brook is a man-made diversion that flows from Charles River to the Neponset River through Dedham and the Hyde Park section of Boston. During the storms of 2010 Mother Brook also experienced two peak stages, reaching 86.5 feet on March 18 and 86.1 feet on April 4. See Figure 10.

The Muddy River is a tributary of the Charles River that flows from Jamaica Plain through the Fenway and Back Bay neighborhoods of Boston. The river forms the border between Boston and the Town of Brookline. During the storms of 2010 the Muddy River reached a peak elevation of 15.4 feet on March 14-15, which was slightly above flood stage of 15.0 feet (see Figure 11). The river reached an elevation of 14.1 feet on March 31, 2010.

**Figure 11 Muddy River Gage Height, March-April 2010**



*March 2010 Flood Issues by Neighborhood*

Davenport Creek flooded Minot and Adams Street, in the Adams Village neighborhood of Dorchester

Toohig Playground on Gallivan Boulevard: Before the development of Toohig Playground, a small stream was visible and flowed through a field off of Minot Street, Dorchester. The stream is underground diverted through a culvert flowing through the Adams Village Business District. The stream called Davenport Creek “works its way underground from the corner across the street from Rite Aid Drug Store, and continues through Toohig Playground. The creek continues underneath homes and streets in

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Neponset and crosses Gallivan Boulevard and emerges out of ground on Hallet Street feeding into the Neponset River in the middle of Pope John Paul II Park.”

*Mother Brook Pond and Mother Brook, Neponset and Charles Rivers*

Business Street, Hyde Park: During the March 2010 Flood, Business Street was reported closed due to flooding of Mother Brook from Reservation Road to River Street, Hyde Park.

Almont Park/Hunt Playground – 40 Almont Street, Mattapan: The impacted streets adjacent to the Almont Park are 78 and 80 Favre Street next to Almont Park and Messinger Street, Mattapan. Reported from 14-16 Favre Street that basement and street flooded with sewage.

New Housing Development on Metropolitan Avenue, Hyde Park: It was reported that the property adjacent to 528 Metropolitan Avenue, Hyde Park was undeveloped thickly forested land. The land was clear-cut and 6 new homes were built behind Metropolitan Avenue, Hyde Park. Rain water flows downhill from impermeable ground and collects in the yard and basement.

Morrissey Boulevard, Dorchester: On March 30 – 31, 2010, a section of Morrissey Boulevard from Tolman Street to Pope Hill was closed in both directions on Tuesday afternoon. The road was reopened late Tuesday evening. Morrissey Boulevard was closed in both directions from Freeport Street to the University of Massachusetts at Boston.



**Morrissey Blvd flooding during Hurricane Sandy**

Photo: Devin M., Dorchester Reporter

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Wilmot Street, Roslindale: According to residential reports by Michael Westwater and Yolanda Poma, "the Stop and Shop Supermarket and Plaza at 950 American Legion Highway placed a retention pond at the end of the plaza to catch rainwater run-off." Both 42 and 46 Wilmot Street experienced flooding from the Stop and Shop parking lot when the retaining pond overflowed.

Trailer Park, West Roxbury, 1608 VFW Parkway, Parking Lot flooded.

### *Muddy River – The Fenway*

The Muddy River Restoration Project started in 2013. The mitigation of flooding from the Muddy River into the Fenway was as a result of the October Floods of 1996, which caused the flooding of the Green Line station at Kenmore Square. On March 30-31, 2010, Massachusetts Bay Transportation Authority crews were on standby to build sandbag dams at the Fenway MBTA station tracks in the event the Muddy River again overflows its banks.

### *Other More Recent Flooding Events*

August 27, 2011 Heavy rain was experienced from the South End to West Roxbury at a precipitation rate of 2 inches per hour from the outer bands of Hurricane Irene which was centered 380 miles southwest of Cape Hatteras.

The City of Boston was under a Tropical Storm Watch.

October 4, 2011 Localized roadway ponding was caused due to heavy rainfall throughout the Boston's neighborhoods.

June 5-6, 2012 A coastal flood advisory was in effect due to astronomically high tides which caused Morrissey Boulevard to be closed.

September 5, 2012 Isolated thunderstorms and heavy rain caused Boston streets to be flooded. ASOS recorded 1.10 inches of rainfall at Logan IAP.

July 23, 2013 Severe thunderstorms and torrential rainfall closed Columbia Road in Dorchester where the roadway flooding was greater than one foot in depth. The neighborhood impacted included Quincy Street, Hancock Street, Dudley Street and Geneva Avenue.

September 1, 2013 The 400 City of Boston residents experienced a power loss due to heavy rain. A flash flood warning was issued at 8:27am.

December 19, 2013 The Storrow Drive Tunnel was closed due to flooding.

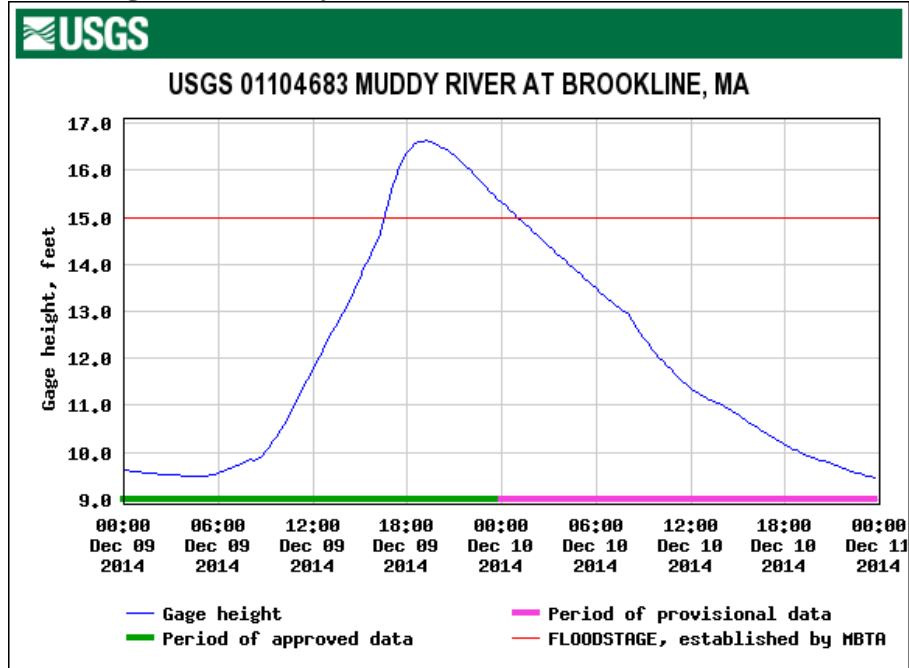
December 9-10, 2014 After 4 inches of rain fell on December 9-10, Storrow Drive westbound had several inches of standing water slowing traffic through the evening commute on December 10. The Muddy River's elevation is normally seven to eight feet,



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but late on December 9, 2010, [the river rose to 16.4 feet](#), which is 1.4 feet above flood stage determined by the MBTA. Transit workers were deployed to the Green Line tunnel's entrance to create barricades using sandbags to prevent the river from overflowing into the station and cause flooding similar to what occurred in 1996.

**Figure 12 Muddy River Elevation, December 9, 2010**



**MBTA Workers deploying sandbags at the Green Line tunnel (MBTA photo)**

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Based on the record of previous occurrences, inland/riverine flooding in Boston is a high frequency event as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur more frequently than once in 5 years (greater than 20% per year).

Urban Flooding

Urban flooding can occur virtually anywhere in the City. In many places this hazard amounts to little more than a nuisance but in some circumstances groundwater-sourced flooding or urban flooding can cause serious property damage and put people at risk. Flooding in road underpasses can cause cars to become trapped, and basement flooding can damage property and lead to mold growth, which can lead to breathing problems. Managing groundwater in Boston can be complicated. In some many of the areas of the City built on fill, such as the Back Bay, the building foundations rest on wooden piers sunk deep into the ground, and the historically high water table must be maintained to prevent these piers from rotting. The Boston Groundwater Trust works to ensure that the appropriate policies are in place to ensure stormwater infiltration in these areas.

Trees can provide significant mitigation of urban flooding. On average, a tree’s leaves can retain 100 gallons of water. Planting trees can provide a cost savings over installing larger culverts and pipes. Milwaukee, Philadelphia and Austin have avoided large capital improvement projects by investing in green infrastructure, including planting trees and directing water to planted stormwater retention areas. The City of Boston’s “Complete Streets” Project provides guidelines for green infrastructural improvements and larger growing spaces for trees (see examples of Complete Streets projects on page 80).

One indicator of flooding impacts is the number of work orders issued by the Boston Water and Sewer Commission (BWSC) for crews to respond to flooding problems throughout the City. Tables 13A and 13B summarize the flood-related work orders identified by the BWSC from January 2009 to November 2012. Each work order can impact hundreds or possibly thousands of residents.

**Table 13A - BWSC Flood-Related Work Orders, Jan. 2009 to Nov. 2012**

| <b>Neighborhood</b>  | <b>Work Orders</b> | <b>Neighborhood</b> | <b>Work Orders</b> |
|----------------------|--------------------|---------------------|--------------------|
| Allston/Brighton     | 301                | Jamaica Plain       | 272                |
| Back Bay/Beacon Hill | 205                | Mattapan            | 209                |
| Bay Village          | 113                | North Dorchester    | 152                |
| Beacon Hill          | 42                 | North End           | 160                |
| Charlestown          | 198                | Roslindale          | 209                |
| Chinatown            | 43                 | Roxbury             | 401                |
| East Boston          | 170                | South Boston        | 228                |
| Fenway/Kenmore       | 233                | South Dorchester    | 338                |
| Financial District   | 165                | South End           | 159                |
| Government Center    | 46                 | West End            | 59                 |
| Hyde Park            | 270                | West Roxbury        | 130                |
| Other (Newton)       | 3                  | <b>Total</b>        | <b>4,087</b>       |

Source: Boston HIRA, Boston Water and Sewer Commission

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**Table 13B BWSC Flood-Related Work Orders, Jan. 2009-Nov. 2012**

| Year  | Number of Work Orders |
|-------|-----------------------|
| 2009  | 1,067                 |
| 2010  | 1,424                 |
| 2011  | 1,261                 |
| 2012  | 335                   |
| Total | 4,087                 |

Source: Boston HIRA, Boston Water and Sewer Commission

Based on the record of previous occurrences, on average urban flooding in Boston occurs at least once every 3 years, but less often than once a year.

Potential Flood Hazard Areas

The frequency and locations of flood hazard events in Boston can be estimated based on a number of sources of information. One of these is the National Flood Insurance Rate Maps. The FIRM flood zones are shown on Map 3. A new series of updated FIRM maps has recently been prepared by FEMA, and should be released in 2015. The new maps may result in some areas being designated in flood hazard zones that have not previously been so designated.

Another indicator of flood risk is the number of repetitive loss structures. As defined by the Community Rating System (CRS) of the National Flood Insurance Program (NFIP), a repetitive loss property is any property for which the NFIP has paid two or more flood claims of \$1,000 or more in any given 10-year period since 1978. For more information on repetitive losses see <http://www.fema.gov/business/nfip/replps.shtm>.

There are 23 repetitive loss properties in Boston. These include single-family homes, 2-4 family residences, condos, other residential and non-residential properties. From 1978 to 2012, these 23 properties experienced a total of 55 losses, resulting in \$945,191 in claims for both building losses and contents losses. Table 14 shows the breakdown of structure type by number and amount of losses over this period.

**Table 14 - Repetitive Loss Properties Summary**

|                   | Number of Claims | Building Losses     | Contents Losses     | Total Losses        |
|-------------------|------------------|---------------------|---------------------|---------------------|
| Single Family     | 13               | \$137,259.39        | \$30,385.02         | \$167,644.41        |
| 2-4 Family        | 6                | 39,240.46           | 5,350.00            | 44,590.46           |
| Condo             | 2                | 28,136.75           | 29,480.25           | 57,617.00           |
| Other Residential | 11               | 119,531.01          | 0                   | 119,531.01          |
| Non-Residential   | 23               | 191,071.05          | 364,737.93          | 555,808.98          |
| <b>TOTAL</b>      | <b>55</b>        | <b>\$515,238.66</b> | <b>\$429,953.20</b> | <b>\$945,191.86</b> |

Source: Federal Emergency Management Agency, National Flood Insurance Program via DRC

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**Coastal Flooding, Astronomical High Tides and Storm Surge Impact**

Coastal flooding is associated with severe coastal storms that, through the combination of winds and tides, drive tidal waters to higher levels than normally experienced, leading to the inundation of low lying land areas and the overtopping of sea walls. Boston has exposure to coastal flooding along the entire length of the harbor. Also, the high tide and storm surge can limit the ability of stormwater to drain from inland waterways. Coastal flood and storm surge records for Boston are shown in Table 15 below.

Storm surge is defined as "an abnormal rise in sea level accompanying a hurricane or other intense storm, whose height is the difference between the observed level of the sea surface and the level that would have occurred in the absence of the cyclone. Storm surge is usually estimated by subtracting the normal or astronomic tide from the observed storm tide," according to the NOAA/NWS description in Boston's Storm Ready certification.

**Table 15 - Coastal Flood/Storm Surge Records, 1993 - 2013**

| <b>Date</b> | <b>Type</b>      | <b>Deaths</b> | <b>Injuries</b> | <b>Property Damage</b> |
|-------------|------------------|---------------|-----------------|------------------------|
| 12/13/1993  | Coastal Flood    | 0             | 0               | 50K                    |
| 12/16/1993  | Coastal Flood    | 0             | 0               | 0                      |
| 12/20/1995  | Coastal Flood    | 0             | 0               | 0                      |
| 3/5/2001    | Coastal Flood    | 0             | 0               | 15.0M                  |
| 11/6/2002   | Storm Surge      | 0             | 0               | 10K                    |
| 1/4/2003    | Storm Surge      | 0             | 0               | 550K                   |
| 12/6/2003   | Storm Surge      | 0             | 0               | 50K                    |
| 1/23/2005   | Storm Surge      | 0             | 0               | 825K                   |
| 5/24/2005   | Storm Surge      | 0             | 0               | 95K                    |
| 1/31/2006   | Coastal Flood    | 0             | 0               | 155K                   |
| 2/12/2006   | Storm Surge/Tide | 0             | 0               | 80K                    |
| 4/15/2007   | Coastal Flood    | 0             | 0               | 5K                     |
| 4/16/2007   | Coastal Flood    | 0             | 0               | 5K                     |
| 4/17/2007   | Coastal Flood    | 0             | 0               | 20K                    |
| 10/18/2009  | Coastal Flood    | 0             | 0               | 0                      |
| 1/2/2010    | Coastal Flood    | 0             | 0               | 0                      |
| 3/14/2010   | Coastal Flood    | 0             | 0               | 0                      |
| 12/27/2010  | Coastal Flood    | 0             | 0               | 50K                    |
| 11/23/2011  | Coastal Flood    | 0             | 0               | 0                      |
| 8/28/11     | Storm Surge      | 0             | 0               | 0                      |
| 06/03/2012  | Coastal Flood    | 0             | 0               | 0                      |
| 06/04/2012  | Coastal Flood    | 0             | 0               | 0                      |
| 10/29/2012  | Coastal Flood    | 0             | 0               | 3.0M                   |
| 02/09/2013  | Coastal Flood    | 0             | 0               | 30K                    |
| 03/07/2013  | Coastal Flood    | 0             | 0               | 0                      |

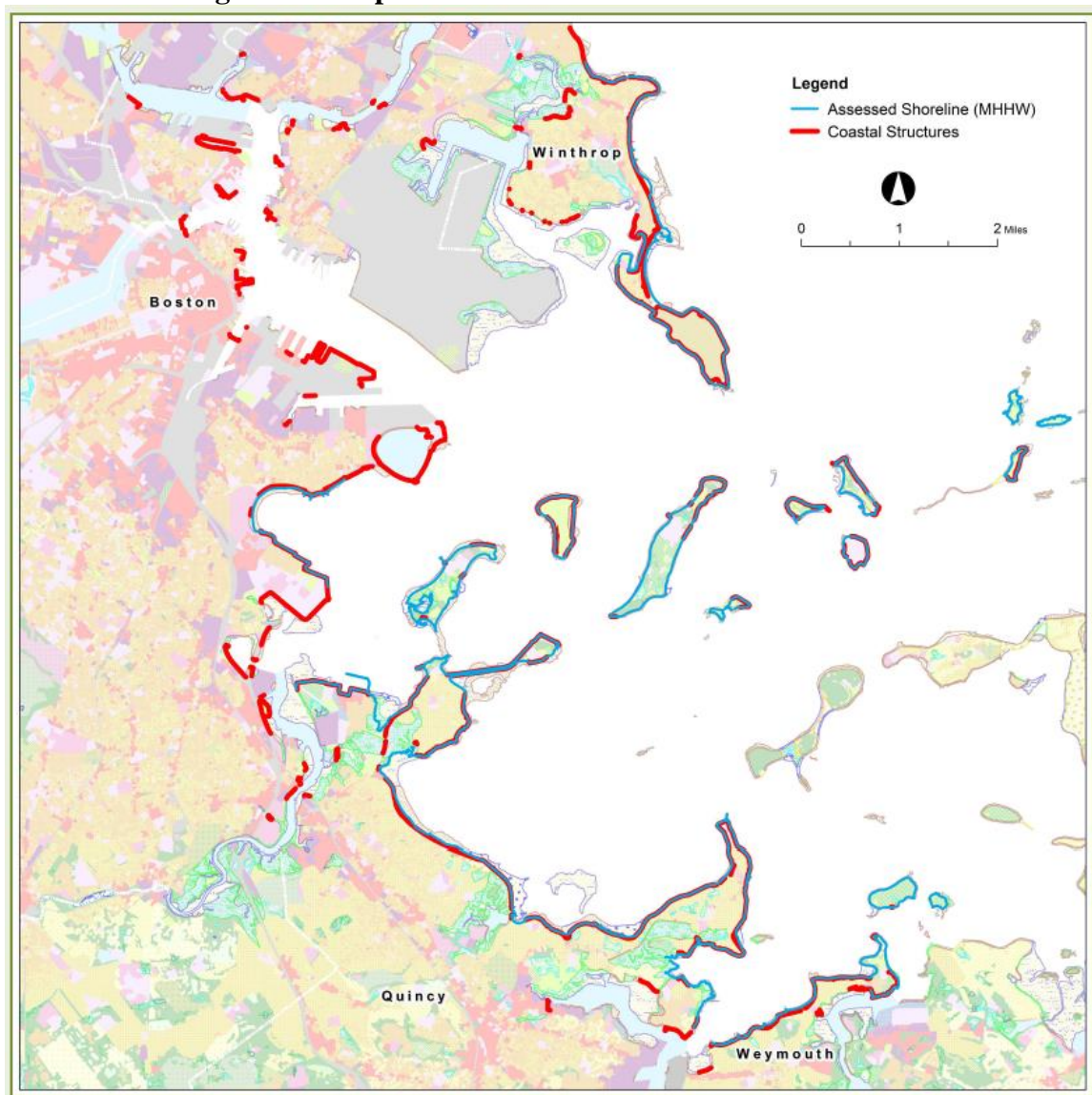
NOAA Satellite and Information Service, National Climatic Data Center, US Department of Commerce

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Coastal erosion is caused by multiple factors, including wind, waves, tides, sea level fluctuation, human alteration, and other factors that influence the movement of sand and material within a shoreline system. The loss (erosion) and gain (accretion) of coastal land is a visible result of the way shorelines are reshaped in the face of these dynamic conditions.

The neighborhoods of Charlestown, East Boston, Boston, Dorchester and South Boston make up the coastal portion of the City of Boston. The estimated length of shoreline is 15 miles that is directly exposed to open ocean. The City is protected from major coastal storms by both natural and man-made shoreline structures that require maintenance to insure the long term protection of its coastline. (see Figure 13).

**Figure 13: Map of Coastal Structures in Boston Harbor**



Source: MA Coastal Erosion Commission, May 2014

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The Massachusetts Coastal Inventory and Assessment Project investigated the publicly owned coastal protection structures in the City of Boston for their ability to provide adequate protection from major coastal storms. Since more than half of Boston’s coastline is protected by man-made structures, these areas do not normally erode, but the condition of these structures is an indication of the impacts and damages caused by coastal hazards. The results of the investigation are summarized below.

Within the City of Boston, there are 110 structures which provide significant coastal protection. East Boston has 18 structures, Charlestown has 16 structures, Boston has 13 structures, South Boston has 36 structures, and Dorchester has 27 structures. The structures were categorized by their type and by their structural condition based on a preliminary field assessment. The ratings of structures by type and condition as well as their length can be seen in Table 16 below. Definitions of ratings are in Table 18.

**Table 16 Coastal Structure Type and Condition Rating**

| Primary Structure (1) | Total Structures | Structure Condition Rating |    |    |    |   | Total Length |
|-----------------------|------------------|----------------------------|----|----|----|---|--------------|
|                       |                  | A                          | B  | C  | D  | F |              |
| Bulkhead / Seawall    | 59               | 4                          | 29 | 16 | 9  | 1 | 36804        |
| Revetment             | 40               | 3                          | 26 | 9  | 2  |   | 31905        |
| Breakwater            |                  |                            |    |    |    |   |              |
| Groin / Jetty         |                  |                            |    |    |    |   |              |
| Coastal Dune          | 1                |                            | 1  |    |    |   | 850          |
| Coastal Beach         | 10               |                            | 9  | 1  |    |   | 14614        |
|                       | 110              | 7                          | 65 | 26 | 11 | 1 | 84173        |

Source: Mass. Coastal Infrastructure Inventory and Assessment Project Massachusetts DCR, Office of Waterways

The costs of repair and reconstruction are summarized by structure type and by condition in Table 17. In the City of Boston there are a total of 110 structures which would require approximately \$ 46 million to bring all the coastal structures to “A” Rating. Most critical will be the structures in the “D” and “F” classifications as those are assumed to undergo some level of damage or failure during the next major coastal storm event. To reconstruct these structures, identified in the preliminary survey as being in poor condition, an estimated \$ 23 million would be required to upgrade the City’s coastal protection.

**Table 17 Coastal Structure Repair/Reconstruction Cost**

| Primary Structure (1) | Total Structures | Structure Condition Rating |               |               |            |               | Total Cost |
|-----------------------|------------------|----------------------------|---------------|---------------|------------|---------------|------------|
|                       |                  | A                          | B             | C             | D          | F             |            |
| Bulkhead / Seawall    | 59               | \$ 4,686,429               | \$ 8,665,714  | \$ 20,382,001 | \$ 814,216 | \$ 34,548,360 |            |
| Revetment             | 40               | \$ 4,484,796               | \$ 3,903,108  | \$ 1,361,760  |            | \$ 9,749,664  |            |
| Breakwater            |                  |                            |               |               |            |               |            |
| Groin / Jetty         |                  |                            |               |               |            |               |            |
| Coastal Dune          | 1                | \$ 148,512                 |               |               |            | \$ 148,512    |            |
| Coastal Beach         | 10               | \$ 1,411,625               | \$ 491,040    |               |            | \$ 1,902,665  |            |
|                       | 110              | \$ 10,731,362              | \$ 13,059,862 | \$ 21,743,761 | \$ 814,216 | \$ 46,349,201 |            |

Source: Mass. Coastal Infrastructure Inventory and Assessment Project Massachusetts DCR, Office of Waterways

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**Table 18 Coastal Structure Type and Condition Rating Definitions**

| <b>Preliminary Condition Assessment</b> |           | <b>Definition Based Upon Perceived Immediacy of Action and Potential to Cause Damage if Not Corrected</b>  | <b>Level of Action Required</b> |
|---|-----------|--|---------------------------------|
| <b>A</b>                                | Excellent | Like new condition. Structure expected to withstand major coastal storm without damage.<br><br>Stable landform (beach, dune or bank). Adequate system exists to provide protection from major coastal storm  | None                            |
| <b>B</b>                                | Good      | Structure observed to exhibit very minor problems, superficial in nature. Minor erosion to landform is present.<br><br>Structure / landform adequate to provide protection from a major coastal storm with no damage. Actions taken to prevent / limit future deterioration and extend life of structure   | Minor                           |
| <b>C</b>                                | Fair      | Structure is sound but may exhibit minor deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure adequate to withstand major coastal storm with little to moderate damage. Actions taken to reinforce structure to provide full protection from major coastal storm and for extending life of structure.<br><br>Moderate wind or wave damage to landform exists. Landform may not be sufficient to fully protect shoreline during a major coastal storm. Actions taken to provide additional material for full protection and extended life  | Moderate                        |
| <b>D</b>                                | Poor      | Structure exhibits advanced levels of deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure has strong risk of significant damage and possible failure during a major coastal storm Structure should be monitored until repairs/reconstruction can be initiated. Actions taken to reconstruct structure to regain full capacity to resist a major coastal storm.<br><br>Landform eroded, stability threatened. Landform not adequate to provide protection during major coastal storm. Actions taken to recreate landform to adequate limits for full protection from a major coastal storm.   | Major                           |
| <b>F</b>                                | Critical  | Conditions of structure/landform may warrant emergency stabilization as failure may result in potential loss of property and/or life. Landform eroded, loss of integrity<br><br>Structure exhibits critical levels of deterioration, section loss, cracking, spalling, undermining, and/or scour. Structure provides little or no protection from a major coastal storm. Actions taken to totally reconstruct structure to regain full capacity.<br><br>Landform stability is severely compromised, rate of erosion/material loss may be increasing, and landform does not provide adequate protection from a major coastal storm. Actions taken to recreate landform to adequate limits for full protection from a major coastal storm. | Immediate                       |

Source: Mass. Coastal Infrastructure Inventory and Assessment Project Massachusetts DCR, Office of Waterways

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The Massachusetts Coastal Erosion Commission issued a draft report in January 2015 which includes an assessment of rates of coastal erosion for all coastal communities, based on GIS analysis of historic short term trends (30 years) and long term trends (150 years). The Commission’s report finds that Boston has an overall short term average of shoreline accretion (as opposed to erosion) of 0.3 feet per year, and a long term trend of accretion of 0.2 feet per year (see Table 19). Nevertheless there are localized areas where erosion is a concern. Some of the major hotspots with vulnerable populations or other important features are Columbia Point, Long Island, Rainford Island, Moon Island, parts of the East Boston coastline, the Reserve Channel, Fort Point Channel, and Pier 5 in Charlestown.

**Table 19 Rates of Coastal Erosion, Short and Long Term**

| Town       | Town sub-region | Short-Term Rate |                 | Long-Term Rate |                 |
|------------|-----------------|-----------------|-----------------|----------------|-----------------|
|            |                 | Mean (ft/yr)    | Std Dev (ft/yr) | Mean (ft/yr)   | Std Dev (ft/yr) |
| Aquinnah   |                 | -0.3            | 2.8             | -0.5           | 1.6             |
| Barnstable | Entire town     | 0.4             | 5.2             | -0.4           | 2.2             |
|            | CCB             | 1.1             | 7.2             | -0.2           | 2.3             |
|            | NS              | -0.3            | 2.1             | <b>*-0.7</b>   | 2.0             |
| Beverly    |                 | -0.3            | 0.7             | -0.1           | 0.3             |
| Boston     |                 | 0.3             | 2.0             | 0.2            | 1.7             |

Source: MA Coastal Erosion Commission, Vol. 1 Report and Recommendations, Jan. 2015

Even in the absence of a coastal storm, astronomical high tides periodically flood and close Morrissey Boulevard adjacent to Dorchester Bay, Sea-level rise will increase the frequency of such flooding. The National Climatic Data Center depicts an increased frequency of coastal flooding events, listing 13 coastal floods and 4 storm surge tide events since 2007.

The National Weather Service-Taunton anticipates that it is probable for the Boston tide gage to exceed the value of at least 16 to 17 feet MLLW given a 4 to 6 foot storm surge on a high spring tide cycle. A NWS Boston High Water Seminar held November 22, 2013 started planning an exercise (to be held in 2015) for a scenario with a storm tide reaching 18 feet above MLLW, easily attainable with a six-foot storm surge on a high spring tide cycle. In this scenario, a major concern is the restriction of access to a major transportation boulevard adjacent to the interstate highway system and the most impacted residents reside in Savin Hill and Columbia Point in Dorchester. The scenario is based on seven coastal flooding incidents:

On February 25-26, 2010, northeast winds built up seas along the east-facing coastline and combined with astronomical high tides to produce in moderate coastal flooding.

On November 23, 2011, high astronomical tides combined with weak wave action produced minor coastal flooding along the east-facing shore of Massachusetts. Minor coastal flooding during high tide closed Morrissey Boulevard.



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On June 4, 2012, Boston experienced high spring astronomical high tides. Coastal flooding lasted through several high tide cycles with heavy rainfall. Morrissey Boulevard was closed due to minor coastal inundation. On Long Wharf, 14 to 16 inches of water flooded restaurants there.

October 29, 2012, Superstorm Sandy brought high winds and coastal flooding to Boston, closing the ramp for Morrissey Boulevard (Exit 14) off of I-93 and flooding the Harborwalk at Columbia Point. Savin Hill Beach experienced splash over the seawall.



**Storm Surge at Long Wharf, February 2013**

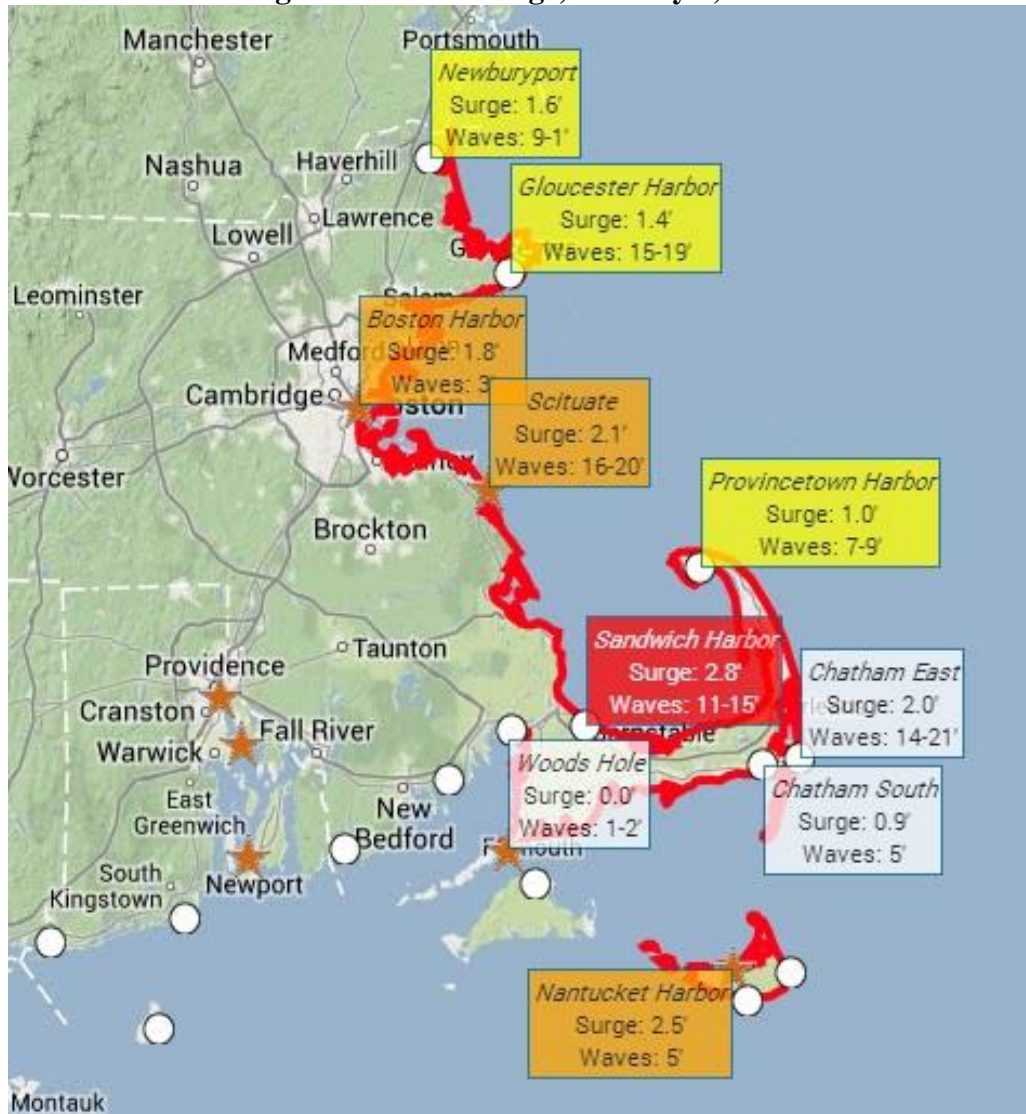
During the February 8-9, 2013 Blizzard, moderate coastal flooding occurred during high tide on Saturday morning along Boston's waterfront, including Long Wharf. Waves built to 30 feet just 15 miles off shore due to the astronomical high tide and high winds.

On March 7-8, 2013, widespread moderate coastal flooding during 5 tide cycles closed Morrissey Boulevard in both directions from the University of Massachusetts – Boston to Freeport Street, as well as Exit 14 from I-93 northbound.

On January 2, 2014 the City of Boston declared a Snow Emergency. Morrissey Boulevard was closed to traffic at 10:30am due to tidal flooding. Moderate storm surge was predicted to be 1.8 feet with 3 foot waves (see Figure 14)..

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**Figure 14 Storm Surge, January 2, 2014**



National Weather Service – Taunton, MA, January 2, 2014

Based on the record of previous occurrences, coastal flooding in Boston is a high frequency event as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur more frequently than once in 5 years (greater than 20% per year).

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 number of fatalities and amount of property damages depends on the amount of warning provided to the population and the number of people and value of property in the path of the dam's floodwaters. Dam failure in general is infrequent but has the potential for severe impacts.

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According to the inventory dams maintained by the Massachusetts Department of Conservation and Recreation, Office of Dam Safety, there are five dams located in Boston, and one located in Somerville upstream of Boston on the Mystic River (see Table 20).

Table 20 DCR Inventory of Dams

| <b>Dam Name</b>     | <b>River</b>   | <b>Owner -Type</b>       | <b>Hazard Potential</b> |
|---------------------|----------------|--------------------------|-------------------------|
| Amelia Earhart Dam  | Mystic River   | DCR Flood Control        | Low Hazard              |
| Baker Chocolate Dam | Neponset River | DCR Flood Control        | Significant Hazard      |
| Charles R. Dam      | Charles River  | DCR Flood Control        | Significant Hazard      |
| Chestnut Hill Res.  | Offstream      | DCR-MWRA Operated        | High Hazard             |
| Southwest Campus    | Sawmill Brook  | City of Boston-Municipal | Small Unregulated Dam   |
| Westinghouse Dam    | Mother Brook   | DCR Flood Control        | Significant Hazard      |

Source: Mass. DCR Inventory of Dams

Table 20 shows that DCR categorizes dams according to the potential extent of hazard in the event of dam failure. DCR defines dam hazard classifications as follows:

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

**Neponset River Dam Failure August 1955**

The only known case of a dam failure in Boston occurred in 1955 on the Neponset River. On August 11 and 12, 1955, Hurricane Connie produced 4-6 inches of rainfall over most of southern New England, saturating the ground and elevating river and reservoir levels above normal levels. A few days later, on August 17-19, Hurricane Diane delivered up to nearly 20 inches over a two-day period. These two storms contributed to making August 1955 the wettest month on record in Boston. Both the Neponset and Charles Rivers flooded.

As a result of the back-to-back storms, over 200 dams in New England had partial to complete failure. The U.S. Army Corps of Engineers deployed 1200 pieces of heavy equipment in response. One of the failed dams was the Neponset River Dam. To mitigate future flooding of the Neponset River, the Commonwealth of Massachusetts passed a

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bond bill in September 1956 authorizing a major overhaul of the Neponset between Fowl Meadow and the Baker Dam.

### Dam Failure Impact

The greatest impact of the Neponset dam failure was the spreading of sediment contaminated with polychlorinated biphenyls (PCBs) from Mother Brook into the Neponset River estuary. According to the U.S. Geologic Survey, “PCBs from this source area likely continued to be released after the flood and during subsequent rebuilding of downstream dams. Today (2007), PCBs are mostly trapped behind these dams; however, some PCBs either diffuse or are entrained back into the water column and are transported downstream by river water into the estuary or volatilize into the atmosphere. In addition to the continuing release of PCBs from historically contaminated bottom sediment, PCBs are still originating from source areas along Mother and Meadow Brook as well as other sources along the river and Boston Harbor.” (Source: Breault, R.F., 2011, Concentrations, loads, and sources of polychlorinated biphenyls, Neponset River and Neponset River Estuary, eastern Massachusetts: U.S. Geological Survey Scientific Investigations Report 2011–5004)

Other dams in Boston include the following:

*Charles River Dam* – The Charles River Dam effectively controls water levels in the river in order to minimize the potential for riverine flooding from upstream flows from the Charles River watershed. The dam also protects against storm surges traveling upstream from Boston Harbor. The dam is actively monitored by DCR and is in good condition. The dam's pumps were recently completely overhauled as a mitigative measure. Six prime 2700 horsepower diesel pumps and 2 transmissions were overhauled.

A potential future impact of climate change on the dam is the possibility of a coastal storm surge overtopping the dam due to a combination of sea level rise and higher storm surges. The finished floor elevation inside the dam's pump station is 122.17 (MDC base). The new surge model being developed by the Army Corps of Engineers indicates that a Category 3 hurricane would be above that level.

*Amelia Earhart Dam (Mystic River)* – Another DCR managed facility, the Amelia Earhart Dam similarly protects against riverine flooding from the upstream Mystic River watershed and storm surges from the lower Mystic River and Boston Harbor.

*Neponset River Dams* – The Neponset River forms the boundary of the City of Boston and the Town of Milton. There are two major dams on the Neponset River adjacent to the City of Boston. The first is located in the vicinity of the former Walter Baker Complex and the second at the Bay State Paper Company in the Hyde Park area. Failure of either of these two dams would be unlikely to lead to loss of life.

*Chestnut Hill Bradley Basin Dam* – Located at the Chestnut Hill Reservoir, this dam is owned and maintained by DCR, and is in good condition.

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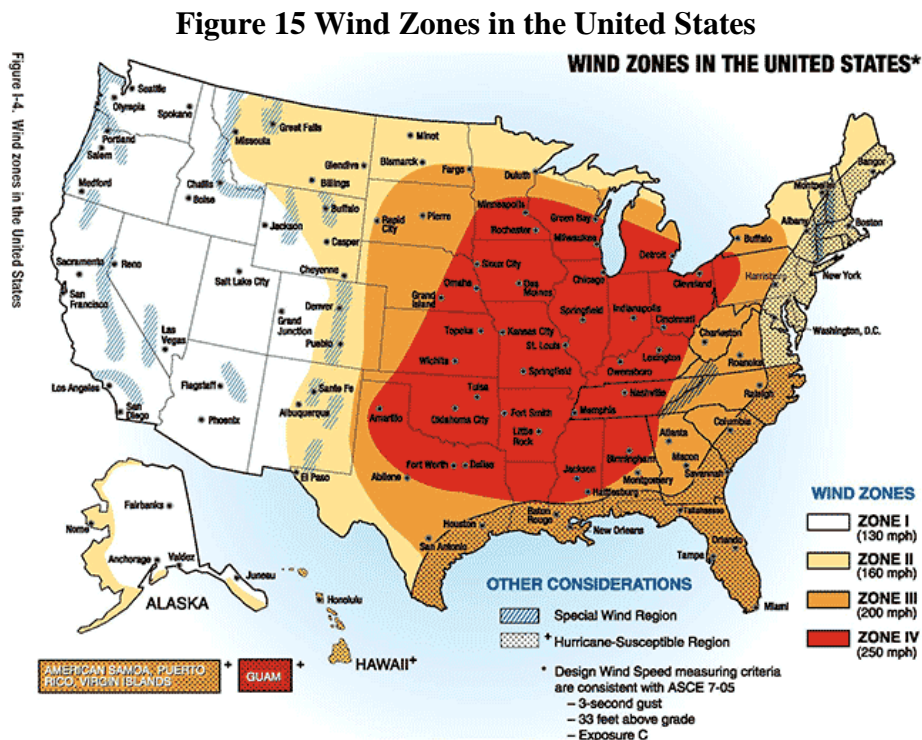
Based on the record of previous occurrences, dam failures in Boston are very low frequency events as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur less often than once in 100 years (Less than 1% probability per year).

### Wind Related Hazards

Wind-related hazards include hurricanes and tornados 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 caused by high winds can down power lines and cause power outages. Hazardous situations can be mitigated by routine maintenance and care of street and park trees. Many cities operate on a 6-7 year pruning cycle, although this number is often closer to 10, due to lack of funding for forestry staff and crews. Trees are vulnerable to strong winds due to insufficient planting spaces and soil volumes. New standards for street tree plantings need to be developed and adopted as part of mitigation planning. Information on wind related hazards can be found on Map 5 in Appendix C.

According to the national classification of wind zones in the US, Boston lies within Zone II, with maximum winds of 160 mph. Boston is also within the Hurricane-Susceptible Region, as is all of the East Coast and Gulf of Mexico (see Figure 15).



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Hurricanes and Tropical Storms

A hurricane is "a tropical cyclone in the Atlantic, Caribbean Sea, Gulf of Mexico, or eastern Pacific, which the maximum 1-minute sustained surface wind is 64 knots (74 mph) or greater," according to the NOAA/NWS definition included in Boston's Storm Ready certification. Given its location near the coast, the City is highly vulnerable to hurricanes. A hurricane is strongest as it travels over the ocean and is particularly destructive to coastal property as the storm hits the land. Hurricanes generally occur between June and November. A tropical storm is "a tropical cyclone in which the maximum 1-minute sustained surface wind ranges from 34 to 63 knots (39 to 73 mph)."

A hurricane or storm track is the line that delineates the path of the eye of a hurricane or tropical storm. Two recorded storm tracks have passed directly through Boston: a tropical storm that passed through Hyde Park, Mattapan, Roxbury, Dorchester, South Boston, and East Boston; and a hurricane that passed through Allston/Brighton. However, the City experiences the impacts of the wind and rain of hurricanes and tropical storms even when the storm track passes nearby, but not directly through the City. Storms that track west of the City result in stronger winds in Boston, while those that pass to the east may bring more rainfall. The hazard mapping indicates that the 100 year wind speed is 110 miles per hour. Major tropical storms and hurricanes that passed through or near Boston are summarized in Table 21, and historic hurricane tracks are shown in Figure 16 below.

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

| Scale No.<br>(Category) | Winds(mph)<br>Storm | Surge (ft) | Potential<br>Damage |
|-------------------------|---------------------|------------|---------------------|
| 1                       | 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

Tropical storms are not included in the Saffir/Simpson scale, but by definition they feature wind speeds under 74 mph, or lower than a Category 1 hurricane.

Of the 28 hurricanes and tropical storms listed in Table 21 below, the Hurricane of 1944 from September 9 – 16, 1944 and the Tropical Storm of 1902 from June 12 – 17, 1902 tracked directly through the City of Boston. It is important to note, that Hurricane Irene from August 21 – 30, 2011 and most recently Hurricane Sandy from October 22 – 31, 2012 fortunately did not track directly over the City of Boston. Hurricane Sandy was a Category 3 hurricane at its peak intensity and weakened to a Category 2 off the northeastern Atlantic coast. Hurricane Sandy became the largest Atlantic hurricane on

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**Table 21 - Historic Hurricane Records for Boston and New England**

|                                       |                                      |
|---------------------------------------|--------------------------------------|
| Hurricane Sandy                       | October 29-30, 2012                  |
| Tropical Storm Irene                  | August 28, 2011                      |
| Hurricane Earl                        | September 4, 2010                    |
| Hurricane Hanna                       | August 28, 2008 to September 8, 2008 |
| Tropical Storm Barry                  | May 31, 2007 to June 5, 2007         |
| Tropical Storm Hermine                | August 27 - 31, 2004                 |
| Hurricane Bertha                      | July 5 - 17, 1996                    |
| Hurricane Bob                         | August 16 - 29, 1991                 |
| Hurricane Gloria                      | September 27, 1985                   |
| Hurricane Donna                       | September 12, 1960                   |
| Hurricane Diane                       | August 17-19, 1955                   |
| Hurricane Edna*                       | September 11, 1954                   |
| Hurricane Carol*                      | August 31, 1954                      |
| Hurricane Doug                        | September 11-12, 1950                |
| <b>Great Atlantic Hurricane 1944*</b> | <b>September 9 - 16, 1944</b>        |
| Great New England Hurricane*          | September 21, 1938                   |
| Tropical Storm of 1923                | October 15 – 19, 1923                |
| Extratropical Storm of 1916           | May 13 – 18, 1916                    |
| Hurricane of 1916                     | July 10 - 22, 1916                   |
| Hurricane of 1915                     | July 31, 1915 to August 5, 1915      |
| Hurricane of 1908                     | May 24 - 31, 1908                    |
| <b>Tropical Storm of 1902</b>         | <b>June 12 - 17, 1902</b>            |
| Hurricane of 1897                     | September 20 - 25, 1897              |
| Hurricane of 1888                     | August 14 - 24, 1888                 |
| Tropical Storm of 1888                | September 6 -13, 1888                |
| Hurricane of 1876                     | September 12 - 19, 1876              |
| Hurricane of 1869                     | September 7 – 9, 1869                |
| Hurricane of 1861                     | November 1 – 3, 1861                 |

\*Category 3

Source: National Oceanic and Atmospheric Administration

*Hurricane Irene Impact and Extent of Damage*

Irene weakened to a Category 1 hurricane as it made landfall along the Outer Banks of North Carolina. The most severe impact in New England was experienced from catastrophic inland flooding in Western Massachusetts, Vermont and New Hampshire. In Boston, tropical storm force winds from the northeast quadrant of Irene toppled trees, including some of Boston’s most treasured historic trees onto homes and vehicles and downed electrical power lines and street lighting wiring, leaving thousands of residents without electrical power, blocking roadways, and closing off emergency access. Emergency responders, coordinating tree cutting operations with utility crews, prioritized response according to public safety hazards.

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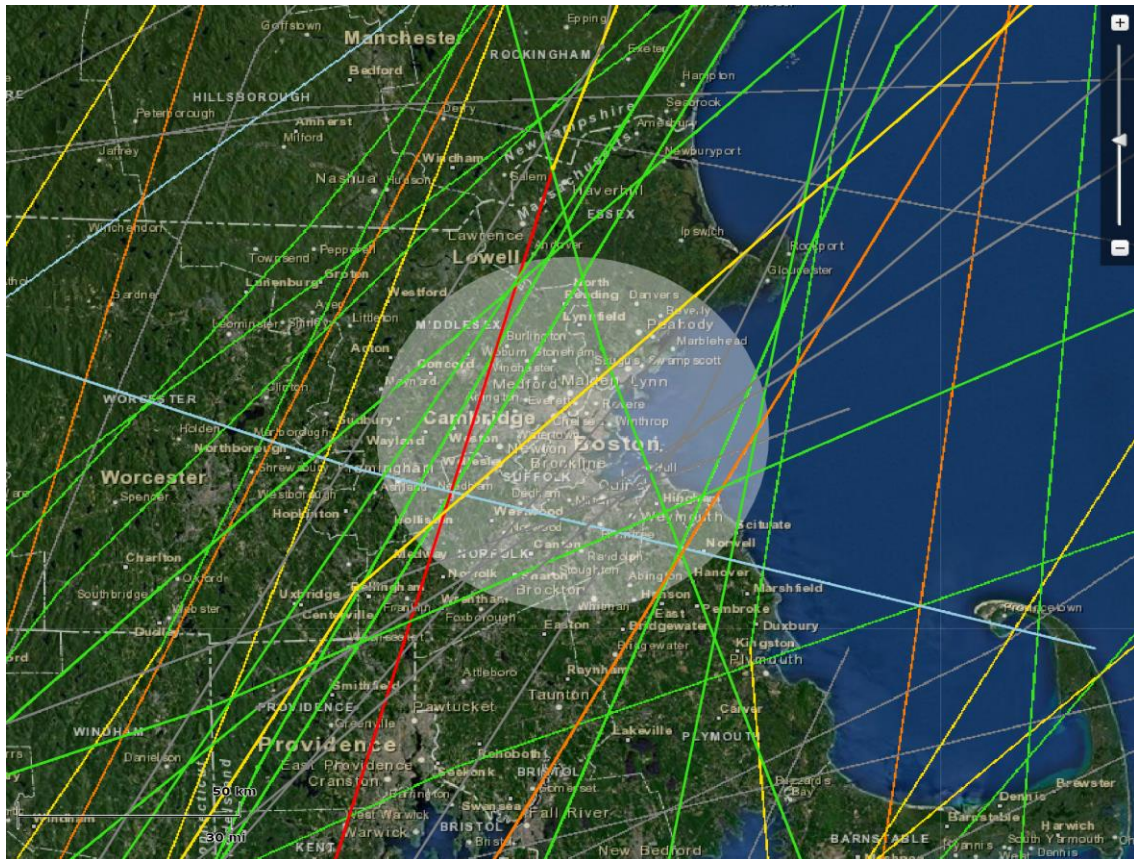
record with winds spanning 1,100 miles. Strong tropical force winds from the northeast quadrant of the post tropical cyclone, Sandy developed into a super storm nor'easter that impacted the City of Boston. Preliminary estimates assess costs at \$4.8 million for the City of Boston as compared to a total of \$75 billion in all impacted states, making Sandy the second most expensive hurricane in U.S. history. Only Hurricane Katrina was more costly. The most recent federal disaster declarations for hurricanes impacting the City of Boston are shown in Table 22

**Table 22 - Hurricane Disaster Declarations**

| Disaster | Title                        | Dates               |
|----------|------------------------------|---------------------|
| DR-751   | Hurricane Gloria             | 9/27/1985           |
| DR-914   | Hurricane Bob                | 8/19/1991           |
| EM-3252  | Hurricane Katrina Evacuation | 8/29/2005-10/1/2005 |
| EM-3315  | Hurricane Earl               | 9/1/2010-9/4/2010   |
| EM-3350  | Hurricane Sandy              | 10/29/12-10/30      |

Source: Federal Emergency Management agency (FEMA)

**Figure 16 - Historic Hurricane Tracks In or Near Boston**





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**Tree Damage from Hurricane Irene**

Approximately, 2,000 calls to 911 were recorded for downed trees. The storm caused structural damage to 42 homes. In addition, the 24 Hour Constituent Hotline received 1,199 storm-related requests and 650 reports of downed wires that did not involve fallen trees. A total of 1,027 locations were responded to during the storm.

### *Hurricane Sandy Impact and Extent of Damage*

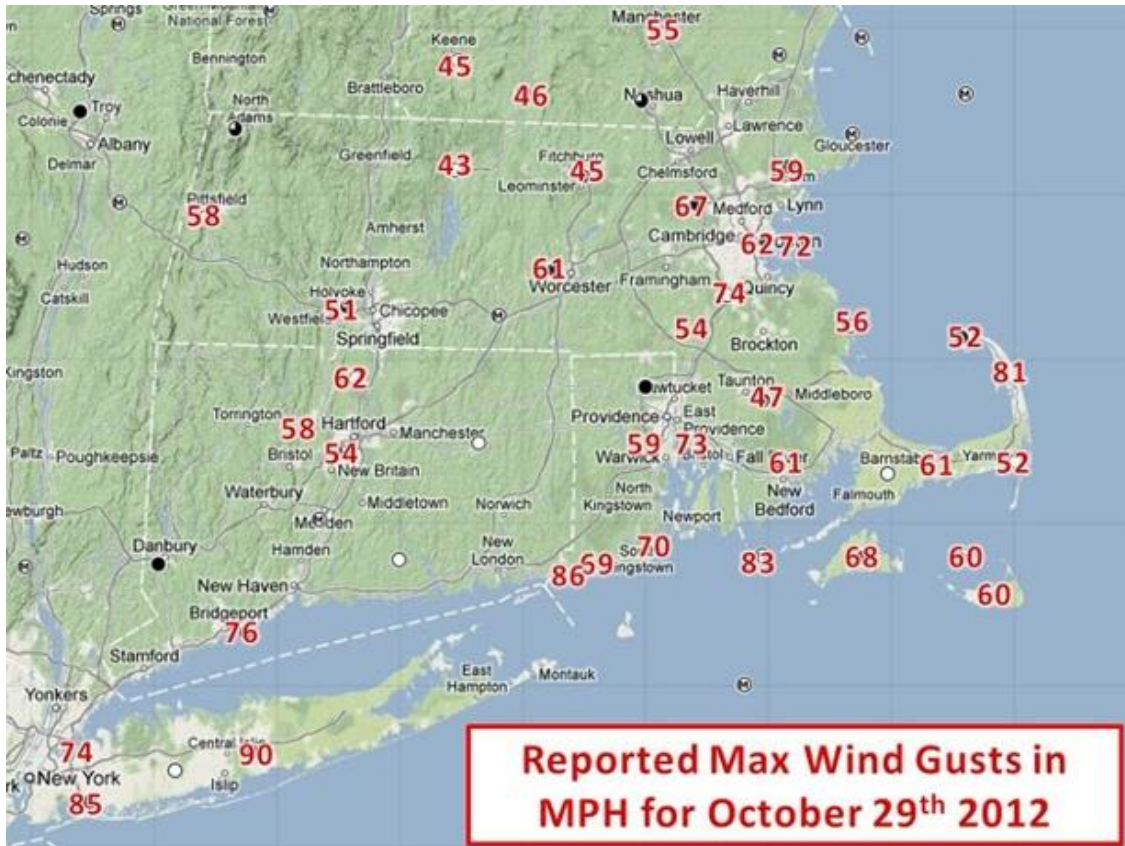
Although Superstorm Sandy made landfall in New Jersey, its effects were felt in Boston. A pre-landfall emergency declaration was in place for all of Massachusetts and precautions included a shutdown of the MBTA. High winds from the northeast quadrant of the storm toppled trees, power lines and ripped roofs off of houses and schools (see Figure 17). Coastal inundation flooded the Boston's Harborwalk. A sailboat ran aground at Carson Beach, South Boston.

Sandy caused \$2 million of damage to Boston's municipal buildings , primarily from wind damaged to roofs and water damage to ceilings and plaster walls. Approximately, 770 calls to 911 reported downed wires, street and sidewalk debris, transformer fires, flooding, road closures and partial structural collapse. The 24 Hour Constituent Hotline received 1,573 storm related requests, including 78 for flooding at 68 locations; 344 for downed wires at 291 locations; 790 for damaged or downed tree at 608 locations; 326 for street debris at 303 locations; and 35 for power outages.

Hurricanes are a city-wide hazard for Boston. Based on the record of previous occurrences, hurricanes in Boston are medium frequency events as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur from once in 5 years to once in 50 years (2% to 20% probability per year).

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**Figure 17 Maximum Wind Gusts 10/29/12 (Superstorm Sandy)**



**Boat beached during Superstorm Sandy on Carson Beach**

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### **Tornados**

#### **Tornado Risk and Vulnerability**

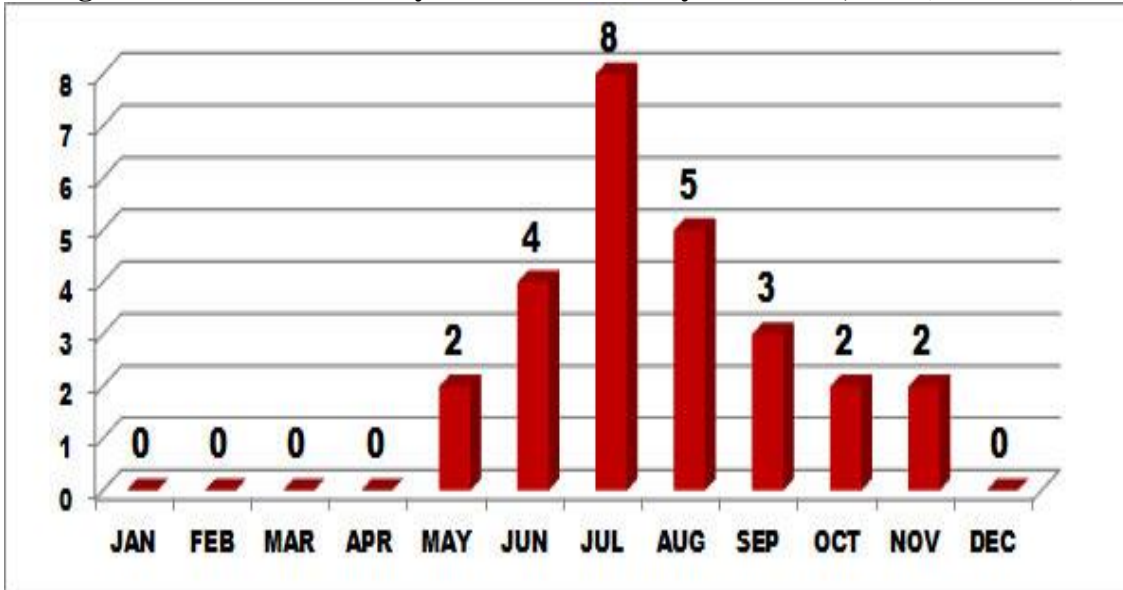
A tornado is "a violently rotating column of air, usually pendant to a cumulonimbus, with circulation reaching the ground. It nearly always starts as a funnel cloud and may be accompanied by a loud roaring noise," according to the NOAA/NWS definition included in the City of Boston's Storm Ready certification. The City of Boston is at high risk for high winds from severe thunderstorms but at moderate risk of tornado activity. From August 21, 1951 to date there have been no reported tornados that touched-down within the City of Boston. However, on Monday, July 28, 2014 a tornado struck the City of Revere, MA which is located adjacent to Boston to the north. There were several minor injuries but no deaths. The tornado was F-2 in magnitude and was on the ground for approximately four minutes in Revere. Since 1951 there have been 101 tornados within 50 miles of central Boston. Two of these were rated as an F3 and were within 36 miles of central Boston. A 1971 F1 tornado in the City of Newton injured six people and caused one death (HIRA). The strongest tornado in Massachusetts history was the Worcester Tornado in 1953 (NESEC). More recently a tornado caused significant damage in Springfield, resulting in 4 deaths in June of 2011. During that tornado outbreak, tornado warnings were issued for Middlesex and Norfolk counties including the Town of Dedham. The City of Boston took precautions warning residents of the trailer park in West Roxbury of the tornado warning due to the vulnerability of these mobile homes.

On July 18, 2012 the National Weather Service in Taunton issued a Tornado Warning for Suffolk and Essex Counties. At 2:09 PM a waterspout was observed in Boston Harbor from Logan International Airport. According to Glenn Field, Warning Coordination Meteorologist at NOAA's National Weather Service office in Taunton, MA, "a supercellular storm structure, complete with rotating wall cloud, formed out by Woburn and the rotation seen on radar prompted issuance of a tornado warning. The storm intensified further as it moved out to sea and we still think there was likely to have been an unreported waterspout farther off the coast, beyond the camera range. One and a half inch hail was reported in Nahant, 1.25 inch hail in Revere and Peabody. There was a funnel cloud reported by a very well trained amateur radio coordinator in Peabody. Federal Street was impassable from flooding in Lynn and there were a few trees downed as well."

Tornados are most common in the summer, and most form in the afternoon or evening. The most probable month for a tornado is July, but the tornado season for the City of Boston runs from May through November (see Figure 18). Tornados are often associated with strong thunderstorms.

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**Figure 18: Tornado Risk by Month for the City Of Boston, MA (1950-2011)**



Source: Tornado climatology information compiled by [Dr. Greg Forbes](#), Severe Weather Expert for The Weather Channel.

Tornado damage severity is measured by the Fujita Tornado Scale, in which wind speed is not measured directly but rather estimated from the amount of damage. As of February 01, 2007, the National Weather Service began rating tornados using the Enhanced Fujita-scale (EF-scale), which allows surveyors to create more precise assessments of tornado severity. The EF-scale is summarized below:

| Fujita Scale |                      |                     | Derived   |                     | Operational EF Scale |                      |
|--------------|----------------------|---------------------|-----------|---------------------|----------------------|----------------------|
| F Number     | Fastest ¼ mile (mph) | 3-second gust (mph) | EF Number | 3-second gust (mph) | EF Number            | 3-second gusts (mph) |
| 0            | 40-72                | 45-78               | 0         | 65-85               | 0                    | 65-85                |
| 1            | 73-112               | 79-117              | 1         | 86-109              | 1                    | 86-110               |
| 2            | 113-157              | 118-161             | 2         | 110-137             | 2                    | 111-135              |
| 3            | 158-207              | 162-209             | 3         | 138-167             | 3                    | 136-165              |
| 4            | 208-260              | 210-261             | 4         | 168-199             | 4                    | 166-200              |
| 5            | 261-318              | 262-317             | 5         | 200-234             | 5                    | Over -200            |

Source: Massachusetts State Hazard Mitigation Plan, 2010

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**Wall Cloud over Boston Harbor, July 18, 2012**

Photo: Mark Garfinkel – Boston Herald

There is little historical data with which to estimate possible tornado damage. Government Center, Copley Square, Prudential Center, Financial District and the new Innovation District are at greater potential risk from tornado winds due to the density and height of the buildings. These buildings can generally sustain moderately high winds, but their glass facades may be vulnerable. The façades of unreinforced masonry buildings are more susceptible. Tornado damage in Massachusetts is estimated from \$500 to \$227,600,000 per the Massachusetts Tornado History Project estimates that damages from Massachusetts tornadoes ranges from \$500 to \$228 million. Tornadoes are a city-wide hazard for Boston.

Based on the record of previous occurrences, tornadoes in Boston are a very low frequency events as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur less often than once in 100 years (Less than 1% probability per year).

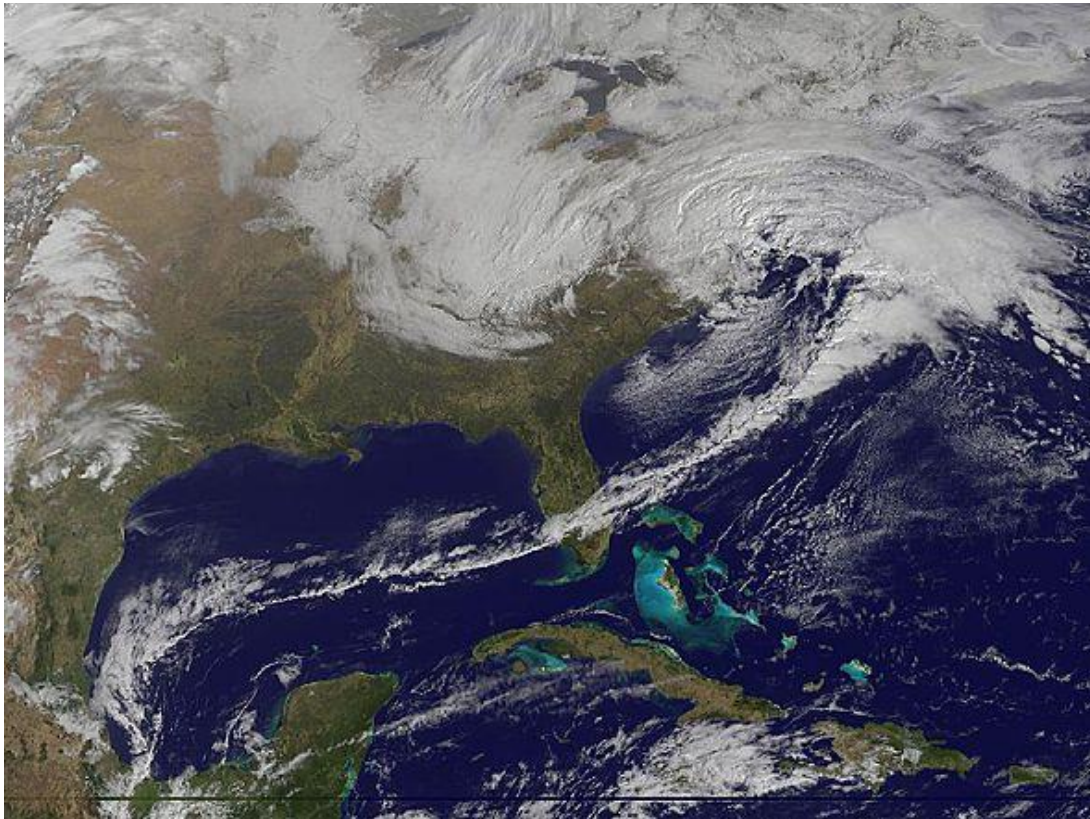
### Nor'easters

A classic nor'easter is a strong low pressure system that forms over land or is positioned just off the coastal waters of New England. Nor'easters are relatively common in the winter months in New England, occurring one to two times a year, and are notorious for producing heavy snow, rain and tremendous waves that crash onto Atlantic beaches causing beach erosion and structural damage. The characteristics of a nor'easter produce strong northeasterly winds blowing in from the ocean ahead of the storm and over the

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coastal areas. These strong northeast winds typically cause coastal flooding, coastal erosion and gale to hurricane force winds. The storm radius of a nor'easter can be as much as 1,000 miles (see Figure 19) and these storms feature sustained winds of 10 to 40 mph with gusts of up to 70 mph.

**Figure 19- Satellite Image of March 2013 Nor'easter**



Source: The Geostationary Operational Environmental Satellite Program (GOES), a joint effort of NASA and NOAA..

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 large nor'easters, as was the major winter storm of March 2013. The latter two storms are described in the section on winter storms below: Nor'easters are a city-wide hazard for Boston.

Based on the record of previous occurrences, nor'easters in Boston are high frequency events as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur more frequently than once in 5 years (greater than 20% per year).

### Thunderstorms

While less severe than the other types of storms, a thunderstorm, which features lightning, strong winds, and rain or hail, can lead to localized damage and represent a

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hazard risk for communities. Hail is defined as "showery precipitation in the form of irregular pellets or balls of ice more than 5 mm in diameter, falling from a cumulonimbus cloud," according the NOAA/NWS description included in Boston's Storm Ready certification. Hail is considered a secondary impact to thunderstorms, and therefore is not analyzed as a separate hazard.

Hail size refers to the diameter of the hailstones. Warnings and reports may report hail size through comparisons with real-world objects that correspond to certain diameters:

| <b>Description</b>       | <b>Diameter (inches)</b> |
|--------------------------|--------------------------|
| Pea                      | 0.25                     |
| Marble or Mothball       | 0.50                     |
| Penny or Dime            | 0.75                     |
| Nickel                   | 0.88                     |
| Quarter                  | 1.00                     |
| Half Dollar              | 1.25                     |
| Walnut or Ping Pong Ball | 1.50                     |
| Golfball                 | 1.75                     |
| Hen's Egg                | 2.00                     |
| Tennis Ball              | 2.50                     |
| Baseball                 | 2.75                     |
| Tea Cup                  | 3.00                     |
| Grapefruit               | 4.00                     |
| Softball                 | 4.50                     |

Thunderstorms sometime give rise to tornados. On average, thunderstorms storms are only around 15 miles in diameter and last for about 30 minutes. The National Weather Service-Taunton issues a severe thunderstorm warning when a severe thunderstorm is indicated on radar or a spotter reports a thunderstorm producing 1 inch or larger hail in diameter and/or winds equal to or exceeding 58 miles an hour.

On August 19, 2011, the National Weather Service Doppler radar indicated a strong thunderstorm at about 4 p.m., capable of producing penny-sized hail with gusty winds of up to 60 mph. Heavy downpours, thunder and lightning were reported in the City of Boston. As a safety precaution for a major public event, participants at Greenfest on City Hall Plaza were evacuated successfully into City Hall as high winds; lightning and heavy rain fell directly over Government Center. During the same thunderstorm, a State Police trooper and his canine were struck by lightning in their vehicle at Boston's Logan International Airport in East Boston.

During severe thunderstorms buildings in Boston have been struck by lightning. On May 7, 2011, a three alarm fire broke out when lightning struck a third floor rear porch in the

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Ashmont Hill section of Dorchester. On July 18, 2012, a lightning strike briefly knocked out power to the building housing WBZ-TV and WBZ News Radio 1030. The potent lightning strike, during a live news broadcast took the station off air. The same thunderstorm created a lightning strike that set a home on fire in the Codman Hill/Lower Mills section of Dorchester. In Roslindale Square, lightning hit a transformer and the business district lost power when wires fell on parked cars and residential property. Thunderstorms are a city-wide hazard for Boston.

Lightning creates hazardous conditions for pedestrians. On July 20, 2008, during a soccer game, 10 people were hospitalized following a lightning strike when taking shelter under a tree on Talbot Avenue, Dorchester. On May 5, 2010 lightning struck a cell tower on River Street in Hyde Park and the powerful electrical bolt traveled through the ground striking a man working on a lift. On August 5, 2010, a man was struck by lightning and succumbed to his injuries while walking along the Sugar Bowl in South Boston. During the July 4<sup>th</sup> 2012 celebrations, the Boston Esplanade was evacuated as a public safety measure during the Fourth of July Boston Pops Concert, and two people were struck by lightning at Thomas Park in South Boston.

Based on the record of previous occurrences, thunderstorms in Boston are high frequency events as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur more frequently than once in 5 years (greater than 20% per year).



**Lightning Strike During Esplanade Concert, July 4, 2012**

Photo: Patrick Flanagan



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**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 winter storm becomes a true disaster, and necessitates intense large-scale emergency response. Occasionally winter storms also hinder the tidal exchange in tidally restricted watersheds and result in localized flooding within these areas. Ice build-up at gate structures can damage tide gates and increase the hazard potential as a result of malfunctioning tide gates. Winter storms are a combination hazard because they often involve wind, ice and heavy snow fall. Heavy wet snow is considered a secondary impact of winter storms and therefore is not analyzed as a separate hazard.

The average annual snowfall for the northern portion of Boston (including Jamaica Plain, Roxbury, Mattapan, north Dorchester, South End, South Boston, Allston/Brighton, Back Bay, Beacon Hill, the Financial District, North End, East Boston, and Charlestown) falls within a range of 38.1 to 48 inches while the southern portion of the City, including Roslindale, West Roxbury, and Hyde Park, are in the range of 48.1 - 72 inches of snow annually.

Severe snow accumulation can have a number of different impacts on a community. Hazardous driving conditions can impact emergency response and vulnerable citizens in need of services, heavy snow on tree branches can cause them to fall and damage electric lines, and, in extreme situations, heavy snow can cause collapse or cave-in of building roofs. Blizzards include all the hazards associated with heavy snow storms also accompanied by winds of at least 35 miles per hour and temperatures below 20 degrees Fahrenheit. The most significant winter storm in recent history was the “Blizzard of 1978,” which resulted in over 3 feet of snowfall and multiple day closures of roadways, businesses, and schools. Severe winter storms and blizzards in Boston since 1978 are summarized in Table 23, and the winter storms of 2013 are described below.

**Table 23  
Blizzards and Severe Winter Storms in Boston**

|                   |               |
|-------------------|---------------|
| 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 | December 2010 |
| Severe Snow Storm | January 2011  |
| Blizzard          | February 2013 |

Source: National Oceanic and Atmospheric Administration

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### *The Blizzard of February 2013*

On Friday, February 8, 2013, two major storm systems combined off the North Atlantic coast forming severe Nor'east blizzard conditions for the City of Boston. The low pressure and central pressure systems created an intense winter Nor'east blizzard cyclone of historic proportions with a signature classic shaped comma being well defined. Very intense convective snow fell north of the low pressure system creating a 48 hour snow storm. The City of Boston was under a Blizzard Warning. Officially, the City of Boston recorded the 5<sup>th</sup> largest snow accumulation of 24.9 inches at Boston's Logan International Airport breaking a record in over 100 years of recordkeeping. Along the coast, the City of Boston was under a Coastal Flood Warning. There was a moderate risk of coastal flooding in Boston Harbor from the powerful coastal Nor'east blizzard. Morrissey Boulevard was flooded by coastal inundation and was closed. A Hurricane Force Wind Watch was in effect for coastal waters of Eastern Massachusetts, and Gale Warning for Boston Harbor. The strongest winds were off shore. The City of Boston experienced a gust of 76 mph.

### *The Nor'east Coastal Snow storm of March 2013*

On March 6, 2013, a slow moving strong mid-Atlantic storm developed into a very powerful coastal nor'easter located 323 miles off of Nantucket. The City of Boston was under a Winter Storm Warning, Coastal Flood Warning, and Wind Advisory. A Gale Warning was issued for Boston Harbor. The nor'easter stalled off the coast which significantly increased snow fall amounts for the City of Boston. The snowfall recorded at Logan Airport was 13.1 inches; Brighton at 15.0; Jamaica Plain at 18.0 and West Roxbury at 14.8. Sustained 38 mph winds were recorded at Boston ASOS Logan Airport with peak winds gusts of 48 mph. The impact of extremely long duration and onshore northeast winds contributed to coastal inundation causing DCR to close coastal roadways and Morrissey Boulevard during the astronomical high tide cycles.

Managing snow can be a challenging and expensive task. Generally the denser areas of the City, such as Beacon Hill, Charlestown, and the North End pose greater challenges to snow removal. Narrow streets and on-street parking, particularly double and triple parking can prevent adequate plowing and impede access for emergency vehicles. Residents and property owners often have little land to place snow that accumulates on their driveways, parking lots and sidewalks, so they often shovel snow onto roadways. In recent years, the City has used about 100,000 tons of salt on its roads each winter. Most, if not all, of the salt is imported from overseas. The City has been seeking additional supply options so as to not rely on one vendor. There are seven locations for salt storage and about 34,000 tons are stored at each one. Boston has a 'black pavement policy' meaning that every street is to be cleared. The City is divided into 15 plow districts. Approximately 350 pieces of equipment are used for snow control. The main objective is to ensure that streets are passable for emergency vehicles. The greatest impacts are seen when the City is hit by back-to-back storms where the short period of time does not allow for existing snow to melt. The result has been street closures. Time of day of a storm is

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also a concern. Overnight storms are easier to plow since there are fewer vehicles on the road. Daytime storms on a weekday are much more of a challenge.

According to the NOAA/NWS definition included in Boston's Storm Ready certification, an ice storm is characterized by "damaging accumulations of ice are expected during freezing rain situations. These accumulations of ice make walking and driving extremely dangerous. Significant ice accumulations are usually accumulations of ¼" or greater." Ice storms can arise in any part of the city and are a city-wide hazard. Expected impacts can include impaired transportation conditions, impaired delivery of emergency services, iced trees and downed limbs, and loss of power and communications due to ice coated lines or falling tree limbs.

Impacts from winter weather – in addition to non-passable streets and sidewalks – include downed power lines causing loss of electric power service, catch basins being buried and sometimes clogged, water service pipes bursting, and shut-off valves being buried (more common when cold and windy), fire hydrants being buried by snow, older water mains bursting, and dangerous icicles forming on buildings. Snow can also block building ventilation, increasing the risk of indoor carbon monoxide poisoning and place a heavy load on roofs.

The City's overall vulnerability to winter storms is primarily related to restrictions to travel on roadways, temporary road closures, school closures, and potential restrictions on emergency vehicle access. Other vulnerabilities include power outages due to fallen trees and utility lines, and damage to structures due to heavy snow loads.

Based on the record of previous occurrences, winter storm events in Boston are high frequency events as defined by the 2013 Massachusetts State Hazard Mitigation Plan. This hazard may occur more frequently than once in 5 years (greater than 20% per year).

### **Ice Jams**

Although known to occur in central and western Massachusetts, ice jams are not a hazard for Boston. The Army Corps of Engineers Cold Regions Research and Engineering Laboratory database on ice jams shows no record of ice jams in Boston from 1913 to 2013.

### **Geologic Hazards**

Geologic hazards include earthquakes, landslides, sinkholes, subsidence, and unstable soils such as fill, peat, and clay. Although the most recent building codes have higher seismic standards, many older structures are more vulnerable to seismic hazards. Information on geologic hazards can be found on Map 4 of the hazard mitigation map series (Appendix C).

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### Earthquakes

An earthquake is the vibration, sometimes violent, of the earth's surface that follows a release of energy in the earth's crust due to fault fracture and movement. A fault is a fracture in the earth's crust along which two blocks of the crust have slipped with respect to each other. Faults are divided into three main groups, depending on how they move. Normal faults occur in response to pulling or tension: the overlying block moves down the inclined dip of the fault plane. Thrust (reverse) faults occur in response to squeezing or compression: the overlying block moves up the inclined dip of the fault plane. Strike-slip (lateral) faults occur in response to either type of stress; the blocks move horizontally along a vertical fault past one another. Most faulting along spreading zones is normal, along subduction zones is thrust, and along transform faults is strike-slip.

The focal depth of an earthquake is the depth from the Earth's surface to the region where an earthquake's energy originates (the focus). Earthquakes with focal depths from the surface to about 43.5 miles are classified as shallow. Earthquakes with focal depths from 43.5 to 186 miles are classified as intermediate. The focus of deep earthquakes may reach depths of more than 435 miles. The focuses of most earthquakes are concentrated in the crust and upper 20 miles of the Earth's crust. The depth to the center of the Earth's core is about 3,960 miles, so even the deepest earthquakes originate in relatively shallow parts of the Earth's interior.

The epicenter of an earthquake is the point on the Earth's surface directly above the focus, and the focus is the area of the fault where a sudden rupture initiates. The location of an earthquake is commonly described by the geographic position of its epicenter and by its focal depth. Earthquakes beneath the ocean floor sometimes generate immense sea waves or tsunamis if the earthquake causes upward or downward movement of the sea floor. The tsunami originates where this movement takes place.

The cause of earthquakes in eastern North America is the forces moving the tectonic plates over the surface of the Earth. New England is located in the middle of the North American Plate. One edge of the North American plate is along the west coast where the plate is pushing against the Pacific Ocean plate. The eastern edge of the North American plate is at the middle of the Atlantic Ocean, where the plate is spreading away from the European and African plates. New England's earthquakes appear to be the result of the cracking of the crustal rocks due to compression as the North American plate is being very slowly squeezed by the global plate movements.

Seismologists use a Magnitude scale (Richter Scale) to express the seismic energy released by each earthquake. The typical effects of earthquakes in various ranges is summarized below.

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| <b>Richter Magnitudes</b> | <b>Earthquake Effects</b>  |
|---------------------------|--|
| Less than 3.5             | Generally not felt, but recorded   |
| 3.5- 5.4                  | Often felt, but rarely causes damage   |
| Under 6.0                 | At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions. |
| 6.1-6.9                   | Can be destructive in areas up to about 100 km. across where people live.  |
| 7.0- 7.9                  | Major earthquake. Can cause serious damage over larger areas.  |
| 8 or greater              | Great earthquake. Can cause serious damage in areas several hundred meters across.   |

Source: Nevada Seismological Library (NSL), 2005

Damage to structures in an earthquake can be caused by several geologic mechanisms, including ground motion, surface faulting, and ground failure in which weak or unstable soils, such as those composed primarily of saturated sand or silts, liquefy (a process called liquefaction). The effects of an earthquake increase with earthquake magnitude, decrease with distance from the earthquake epicenter, and are highly dependent on the type of geologic materials present at a site. Even if the epicenter of an earthquake is not located in the City of Boston, it is important to note that due to the harder, cooler rocks that comprise the eastern U.S. (compared to the western U.S.), distant earthquakes are more widely felt in the metropolitan Boston area.

According to Dr. John Ebel, Director of the Boston College Weston Observatory, the bedrock of the northeastern United States is much colder as compared to that of the western US. Our colder bedrock is why the 5.8 magnitude earthquake in Mineral, Virginia on August 23, 2011 and the 4.0 magnitude earthquake 3 miles west of Hollis Center, Maine on October 16, 2012 both resulted in tremors being felt in the City of Boston. A summary of earthquakes affecting the City is found in Table 24.

According to the Northeast States Emergency Consortium, from 1668 to 2007, 355 earthquakes were recorded in Massachusetts. The region has experienced larger earthquakes, including a magnitude 6.0 quake that struck in 1755 off the coast of Cape Anne. The closest recorded earthquake epicenter was at the Braintree/Quincy border, southwest of the Route 3 interchange with Interstate Route 93. This quake occurred in 1979 with a magnitude of 2.2, which is the smallest quake normally felt by people.

The Northeast States Emergency Consortium documented 165 earthquakes within 250 miles of the NESEC northeast region from January 1 through December 5, 2012. These earthquakes ranged from 0.3 to 4.5, and 30 of them were 2.5 or greater (see Figure 20 below). NESEC also notes that of particular interest in 2012 was a sequence or “swarm” of 12 offshore earthquakes that occurred off the continental slope east of Massachusetts,

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ranging from magnitude 0.5 to 4.5. The 4.5 event occurred 250 miles east of Boston on April 12, 2012. Because of the proximity to Boston and other coastal cities such as Portsmouth, NH and Portland, ME, the NESEC State Geologists and State Directors of Emergency Management have requested that the US Geological Survey (USGS) conduct an immediate and thorough review and advise them on the potential for future activity in this offshore region. The USGS investigation is currently underway.

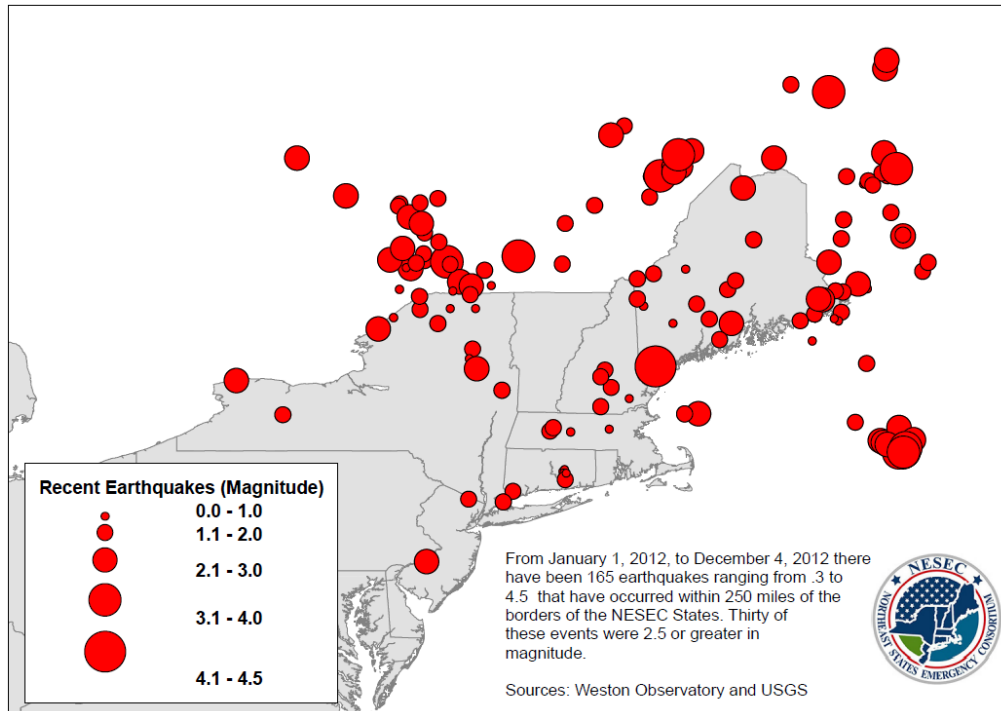
**Table 24 - Historical Earthquakes in Boston or Surrounding Area, 1727-2012\***

| <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          | 12/27/1974  | 2.3               |
| VA - Mineral         | 8/23/2011   | 5.8               |
| MA - Nantucket       | 4/12/2012   | 4.5               |
| ME - Hollis          | 10/17/2012  | 4.0               |

*\*Historical earthquakes without recorded magnitude were classified based on intensity using the Modified Mercalli Scale (intensity V or higher). Source: HIRA*

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Figure 20 -Northeast Earthquakes, 1/1/12 to 12/5/12



Sources: NESEC, from Weston Observatory and USGS

*Earthquake Impacts* – Earthquakes have multiple impacts beyond the obvious building collapse. Buildings may suffer structural damage which 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 building may be structurally engineered to withstand an earthquake, but if the equipment inside is not properly secured; the function of the hospital could be affected. Earthquakes can also trigger landslides.

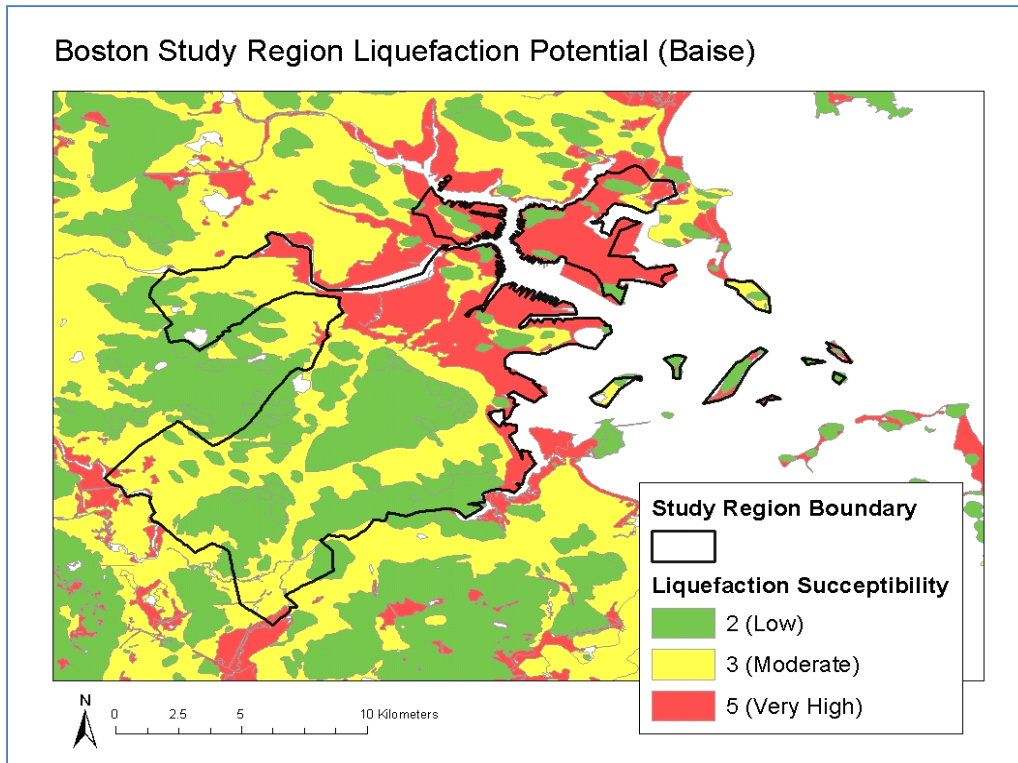
*Liquefaction* – Liquefaction poses a particular risk for Boston because of the extensive area of the City built on filled land (see Figures 21 and 22). During an earthquake these soils become unstable, effectively liquefying, destabilizing the buildings above leading to collapse, ruptured utilities, and other related impacts.

Potential earthquake damages to Boston have been estimated using HAZUS-MH. Total damages are estimated at \$3.4 billion for a 5.0 magnitude earthquake with an epicenter in downtown Boston, and \$345 million for a 6.5 magnitude earthquake with an epicenter in central New Hampshire. Other potential earthquake impacts are detailed in Table 29.

According to the Boston College Weston Observatory, in most parts of New England, there is a one in ten chance that a potentially damaging earthquake will occur in a 50 year time period. The Massachusetts State Hazard Mitigation Plan 2013 classifies earthquakes as "very low" frequency events that occur less frequently than once in 100 years, or a less than 1% per year.

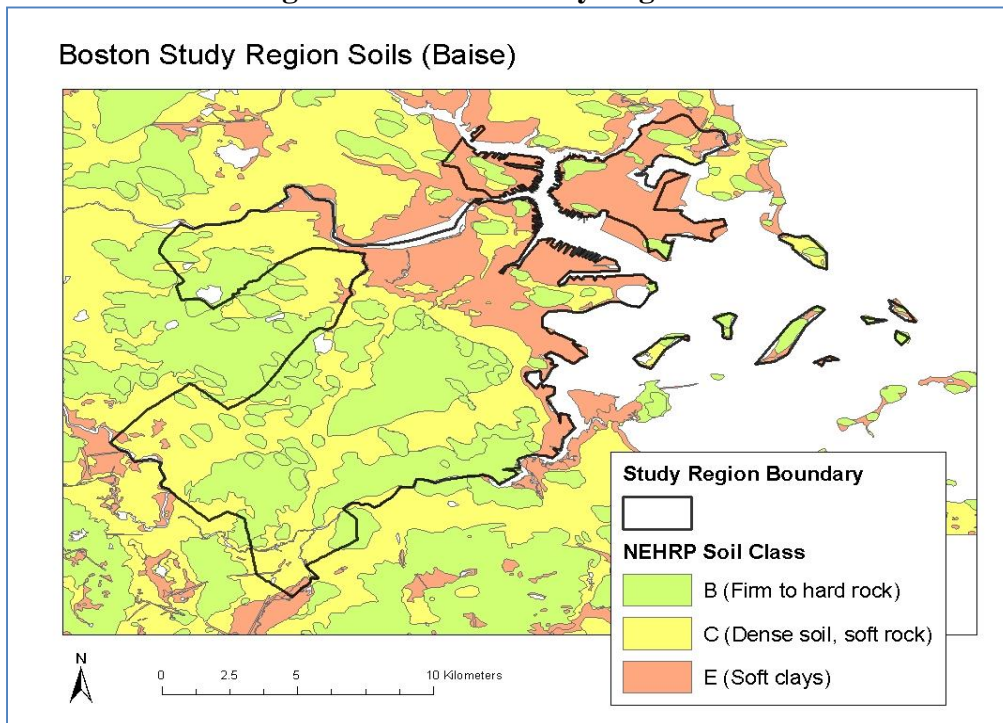
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**Figure 21 - Boston Study Region Liquefaction Potential**



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

**Figure 22 - Boston Study Region Soils**



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



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*Unreinforced Masonry Buildings* – Many older masonry structures lack structural components that would prevent collapse in the event of an earthquake. Based on research conducted by the Northeast States Emergency Consortium utilizing property assessment data on the structural classifications of buildings in Boston, there are as many as 18,919 unreinforced masonry buildings (URM) in the City (see Figure 23). These buildings include historic structures such as the Old Statehouse, Faneuil Hall, and most of the buildings on Beacon Hill and Back Bay. In addition, a number of the fire stations, police stations, and schools are vulnerable masonry buildings.



**Old State House, example of an Unreinforced Masonry Building**

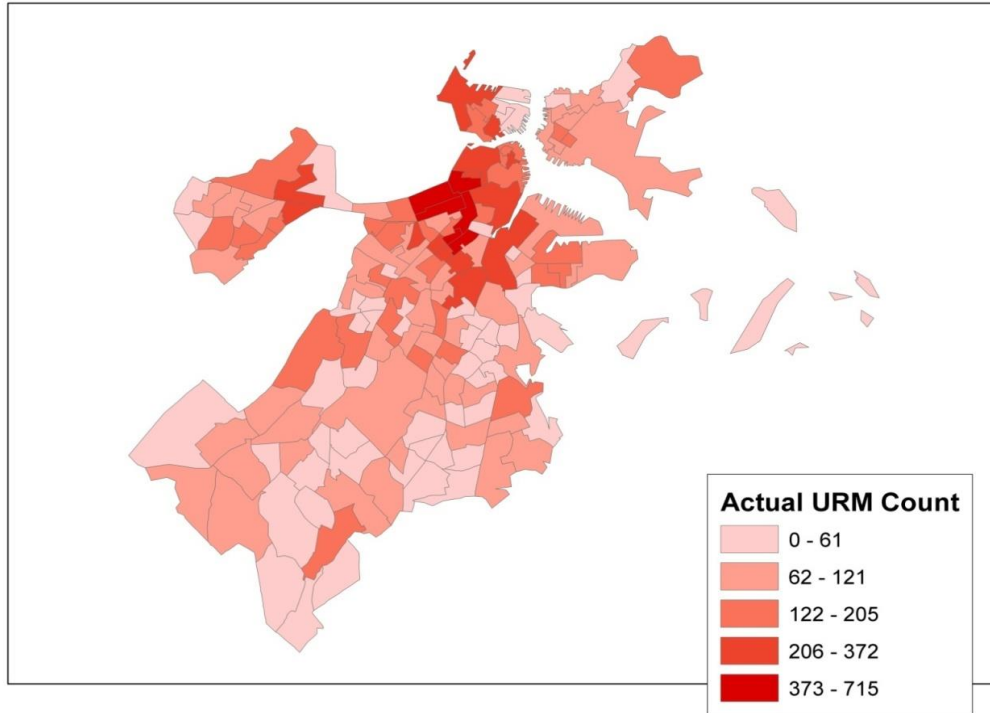
Beyond these unreinforced masonry buildings, roughly 50% of the residential building stock in the City was built before 1940 thereby pre-dating the building code and applicable earthquake damage mitigation design standards.

Although earthquakes are a potential city-wide hazard, the areas of the City with the greatest overall vulnerability to earthquake damage are those where unreinforced masonry buildings are located in areas with high liquefaction potential. Figure 24 shows these areas as mapped by NESEC.

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**Figure 23**

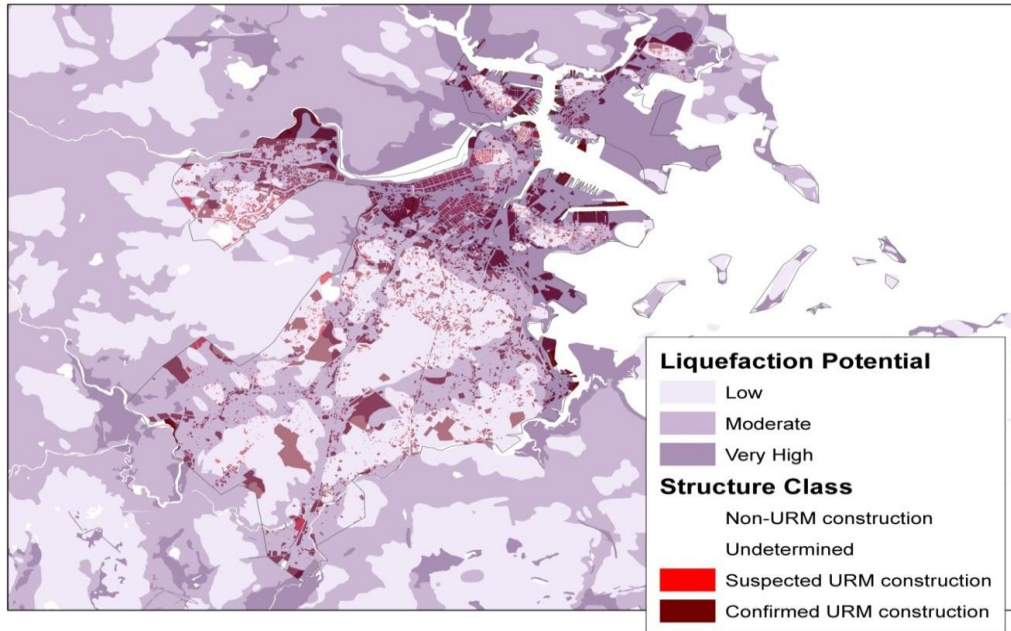
Observed Count of URM Buildings by Tract for Boston



Source: Northeast States Emergency Consortium

**Figure 24**

City of Boston Property Parcels with Liquefaction Potential



Source: Northeast States Emergency Consortium

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Landslides

Typically, a landslide occurs when the condition of a slope changes from stable to unstable. Natural precipitation such as heavy snow accumulation, torrential rain and run-off may saturate soil creating instability enough to contribute to a landslide. The lack of vegetation and root structure that stabilizes soil and human activity can destabilize hilly terrain.

There is no universally accepted measure of landslide extent but it has been represented as a measure of the destructiveness of a landslide. Table 25 represents the estimated intensity for a range of landslides. For a given landslide volume, fast moving rockfalls have the highest intensity while slow moving landslides have the lowest intensity.

**Table 25. Landslide Intensity**

| Estimated Volume<br>(m <sup>3</sup> ) | Expected Landslide Velocity       |                                      |                               |
|---------------------------------------|-----------------------------------|--------------------------------------|-------------------------------|
|                                       | Fast moving landslide (Rock fall) | Rapid moving landslide (Debris flow) | Slow moving landslide (Slide) |
| <0.001                                | Slight intensity                  |                                      |                               |
| <0.5                                  | Medium intensity                  |                                      |                               |
| >0.5                                  | High intensity                    |                                      |                               |
| <500                                  | High intensity                    | Slight intensity                     |                               |
| 500-10,000                            | High intensity                    | Medium intensity                     | Slight intensity              |
| 10,000 – 50,000                       | Very high intensity               | High intensity                       | Medium intensity              |
| >500,000                              |                                   | Very high intensity                  | High intensity                |
| >>500,000                             |                                   |                                      | Very high intensity           |

Source: *A Geomorphological Approach to the Estimation of Landslide Hazards and Risks in Umbria, Central Italy*, M. Cardinali et al, 2002

The City of Boston is at relatively low risk for landslides. However, the City of Boston has experienced small landslides in our neighborhoods. The hilly terrains throughout many of Boston’s neighborhoods have an older infrastructure of retaining walls, unreinforced masonry, granite boulders or stone slopes. Under proper conditions these structures are subject to erosion and collapse in the form of a landslide.

The City of Boston has experienced the collapse of a retaining wall in the Orient Height section of East Boston. Most recently, a large 40 foot rock cliff landslide collapsed carrying mud and large boulders onto Olive Street in the Brighton neighborhood of Boston, following three major back-to-back weekend winter storms that culminated on Sunday, February 24, 2013.

Based on past occurrences and the Massachusetts Hazard Mitigation Plan 2013, landslides are of Very Low frequency, events that can occur less frequently than once in 100 years (less than 1% per year).

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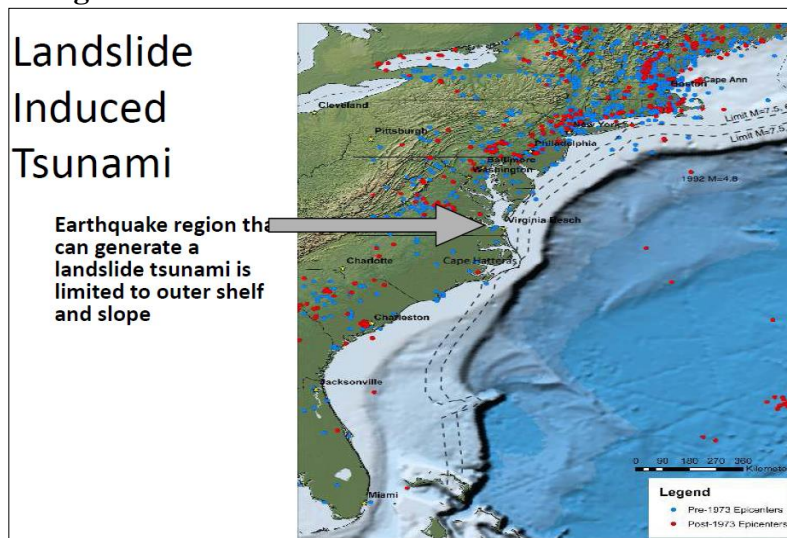
## Atlantic Based Tsunami

The Federal Emergency Management Agency defines tsunami as a series of enormous seismic sea waves created by an underwater disturbance caused by geologic activity in the form of earthquakes, volcanic eruptions, underwater landslides or meteorites striking the Earth. A tsunami can move hundreds of miles per hour in the open ocean and smash into land with waves as high as 100 feet or more. Earthquake induced movement of the ocean floor most often generates tsunamis. If a major earthquake or landslide occurs close to shore, the first wave in a series could reach the shore in a few minutes, even before a warning is issued. Coasts that are at greater risk are areas less than 25 feet above sea level and within a mile of the shoreline.

Tsunami wave action over the shore is variable and mainly dependent of the combination of both submarine and land topography in the area and the orientation of the arriving waves. The extent of damage and impact from tsunami depends upon the source and severity of onset on the tide cycle. As such, the Boston Harbor Islands, Deer Island Sewerage Treatment Plant, Boston's Inner Harbor, Dorchester Bay and the City of Boston's coastal neighborhoods are all vulnerable to coastal inundation from tsunami.

According to the West Coast and Alaska Tsunami Warning Center (WCATWC), an Atlantic based tsunami threat level for the US east coast is low when compared to the US Pacific and Caribbean coasts. Although the probability is low, a tsunami threat does exist and it is not out of the realm of possibility for the Atlantic. Geophysics specialists and geologists from the U.S. Geologic Survey and the Woods Hole Oceanographic Institute have researched Georges Bank Lower Slope of the western North Atlantic and the relationship there between submarine landslides and earthquakes (see Figure 25). "The US Atlantic coast would be particularly vulnerable to devastation from tsunami because of the high density of population and infrastructure along its low lying coastal areas and estuaries." Uri S ten Brink, et.al., Marine Geology 264, 2009, p.65)

**Figure 25 - Atlantic Based Tsunami Potential Threat**



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Further, Dr. ten Brink confirms that “the likelihood that a tsunami will hit this coast is fairly low. However, the most likely source will be a landslide that happens underwater at an area of about 215 miles offshore Boston in an area known as the Continental Slope. This is the area that separates the very wide and shallow shelf. The shelf is about 100 to 150 meters deep from the deep ocean.” The US Geologic Survey is researching the probability of a landslide on the Continental Shelf.

The City of Boston's justification to include Atlantic-based Tsunami on the east coast is based upon one of three possible scenarios for the City. First, a submarine landslide off the continental slope 215 miles off shore of the City of Boston. Such an underwater landslide occurred in 1929, when a 7.2 magnitude earthquake created large waves that killed 28 people in Newfoundland. Second, there is a subduction zone in the Caribbean called the Puerto Rico Trench that could create an east coast tsunami. A third scenario is from earthquake and volcanic activity in the form of a submarine landslide in the Canary Islands. This scenario involves the collapse of the western flank of the Cumbre Vieja Volcano located at La Palma, Canary Islands, potentially generating a giant wave which scientists have termed a megatsunami. The wave would radiate out across the Atlantic Ocean and inundate the eastern seaboard of North America including the American, the Caribbean, and northern coasts of South America some six to eight hours later. The impact from such an event is being analyzed as to how high the waves would actually become once crossing the Atlantic Ocean to the City of Boston and Eastern Massachusetts.

The NOAA National Weather Service -Taunton organized a NWS-WCATWC Tsunami Awareness Emergency Manager Workshop attended by the City of Boston on February 23, 2010. As a follow-up, the City of Boston participated in an Atlantic Tsunami Warning LANDEX 10 Exercise with the WCATWC on March 4, 2010. LANDEX 10 simulated a major earthquake, subsea landslide and tsunami generated 170 southeast of Boston. The Mayor's Office of Emergency Management (OEM) regularly monitors NWS-WCATWC Warning/Advisory Tsunami Alerts. Since 2010, the NWS-WCATWC issued Warnings and Advisories which have not resulted in a tsunami in the Atlantic to date.

### **Tsunami Vulnerability and Impact**

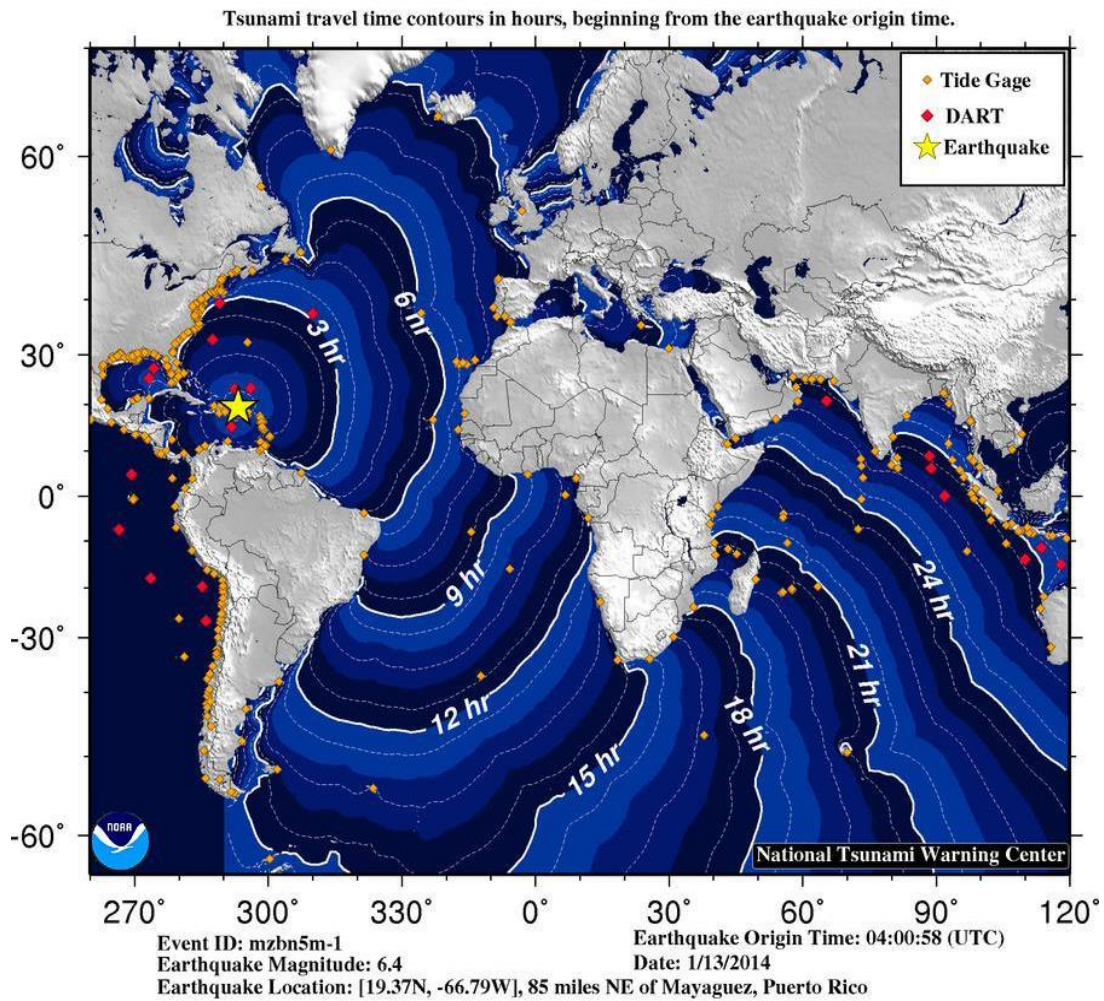
A tsunami generated in the Atlantic could severely impact populations and critical infrastructures along Boston's inner and outer harbor and Dorchester Bay. All of Boston's coastal neighborhoods are surrounded by hilly drumlins that would likely be above the inundation level of a tsunami. provide some elevation protection from tsunami. However, the population density of those living along and their ability to evacuate the coast increases their risk from tsunami. These residents and businesses include special needs populations, assisted living facilities, public housing, higher education, major modes of transportation, oil and natural gas refineries and steam power generation for Boston's hospitals. The City of Boston plans to conduct further loss estimation on the

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impacts of tsunami inundation along the entire Boston coastline when the new Tsunami HAZUS-MH tool is available.

Response to an approaching tsunami could easily require a one-mile coastal evacuation zone. Accurately predicting the timing of landfall is of the utmost importance for successful vertical evacuation. If the tsunami struck late evening/early morning, then it would be challenging to warn and evacuate residents quickly. Travel time for a tsunami could be as little as a few hours, as shown in Figure 26. In this example a 6.4 magnitude earthquake struck at 11:01pm EST, Sunday, January 12, 2014, located 85 miles northeast of Mayaguez, Puerto Rico. Fortunately, the earthquake did not generate a tsunami. The WCATWC issued tsunami travel times between 3 to 6 hours. If a tsunami alert had been issued it would have affected Boston between 2:00am EST to 5:00am on Monday morning, January 14, 2014.

**Figure 26 - Atlantic Based Tsunami Travel Times**



Relatively few tsunami waves have been recorded on the Atlantic coast. One of the most serious was on November 18, 1929, when a 7.3M earthquake generated a tsunami that

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killed 29 people in Newfoundland and Nova Scotia. The National Oceanic and Atmospheric Administration (NOAA) lists the following known or suspected East Coast tsunamis:<sup>6</sup>

1. Nov 1, 1755/ Lisbon, Portugal/ Tsunami in Newfoundland and the Caribbean. Computer models suggest 10' waves along the East Coast of the USA.
2. Oct 11, 1918/ Puerto Rico/ Waves recorded on Atlantic City, NJ, tidal gage.
3. Nov 18, 1929/ Grand Banks/ Tsunami in Newfoundland and Nova Scotia. Newfoundland Waves recorded on Atlantic City, NJ / Ocean City, Maryland / and Charleston, South Carolina tidal gages.
4. Aug 4, 1946/ Dominican Republic/ Waves recorded on Atlantic City, NJ, Daytona Beach, FL, and Bermuda tidal gages.
5. Aug 8, 1946/ Dominican Republic / Waves recorded on Atlantic City, NJ, tidal gage.
6. Nov 14, 1840/ Mid Atlantic Region / Tsunami in the Delaware River.
7. Nov 17, 1872 / Maine/ Maine
8. Jan 9, 1926/ Maine/ Maine
9. May 19, 1964/ Northeast USA/ Northeast USA

Severe coastal storms can produce meteo-tsunamis, tsunami-like wave phenomenon of meteorological origin. Climate change may increase the frequency of these. On June 13, 2013, thirty different tide gages and one buoy measured a tsunami-like wave from Barnegat Light, New Jersey to Southeastern Massachusetts, probably due to severe thunderstorms generating meteo-tsunami waves. Rogue waves knocked people into the ocean, damaged boat moorings, and caused minor coastal inundation.

Based on past occurrences and the Massachusetts Hazard Mitigation Plan 2013, tsunamis are of very low frequency, events that can occur less frequently than once in 100 years (less than 1% per year).

### **Extreme Temperatures**

Extreme temperatures can impact public health, economic activity, cultural artifacts, and governance functions when electrical and transport systems are disrupted. Ecological impacts may also occur as high temperatures can cause a deterioration of water quality. In Boston extreme heat events are most common in July. The highest temperature recorded was 104°F, on July 4, 1911, followed more recently with a high of 103°F on

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July 22, 2011. According to the Northeast Regional Climate Center at Cornell University, 2012 was the warmest year in the US to date, and the third hottest summer. Extreme cold is most common in January with the lowest recorded temperature being -18°F in February, 1934. Extreme temperatures are a city-wide hazard for Boston. Table 26 shows the recent history of extreme temperatures in Boston.

**Table 26 Extreme Temperatures in Boston, 2005-2012**

| <b>Year</b> | <b>Number of Days ≥ 90°F</b> | <b>Number of Days ≤5°F</b> |
|-------------|------------------------------|----------------------------|
| 2005        | 14                           | 8                          |
| 2006        | 11                           | None                       |
| 2007        | 18                           | 2                          |
| 2008        | 8                            | None                       |
| 2009        | 6                            | None                       |
| 2010        | 24                           | None                       |
| 2011        | 13                           | 2                          |
| 2012        | 12                           | 1                          |

Extreme Heat

Extreme heat is the primary cause of weather-related fatalities in the United States. Historically, from 1979–2003, excessive heat exposure caused 8,015 deaths in the United States. During this period, more people in this country died from extreme heat than from hurricanes, lightning, tornados, floods, and earthquakes combined. In 2001, 300 deaths were caused by excessive heat exposure.

During the summer months, the City of Boston is especially vulnerable to heat-related hazards. On summer days, the City can be as much as 16°F degrees warmer than surrounding areas. The City's development and infrastructure, which is largely made up of asphalt, concrete, and metal, traps the heat. This is known as the "Urban Heat Island" effect.

The Boston Public Health Commission defines severe heat as air temperature of 90°F or higher. Extending over multiple days, each day's maximum temperature would be considered extreme and constitute a natural hazard event. In 2010, there were 24 days in the City of Boston with recorded temperatures 90° F or greater.

Heat waves are particularly dangerous for children, seniors, people with cardiovascular disease, and people taking psychotropic and other medications. According to the Centers for Disease Control, social isolation and the inability to care for oneself put a person at greater risk for heat-related illness. However, even young and healthy individuals can succumb to heat if they participate in strenuous physical activities during hot weather or do not take appropriate precautions.

Exposure to extremely high temperatures impacts human health through heat stress and decreased air quality, which aggravates other respiratory diseases, such as emphysema. The elderly and other vulnerable populations generally suffer greater impacts and many



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elders die in extreme heat waves, especially with limited access to air-conditioning. Evacuations from buildings without air-conditioning or other cooling capability are crucial to avoid heat stress, both for people at work and those at home. Cooling centers may be stressed to capacity.

The probability of large-scale power outages is higher during extended heat waves. Outages in apartment complexes and congregate care facilities could result in loss of air conditioning services and subsequently displace large numbers of individuals who will require a location to escape the heat.

With increasing temperatures and summer extreme heat events, trees play a critical role in protecting public health by regulating local temperatures. In areas of the city where the public cannot afford to escape the summer heat by leaving town or finding access to air conditioning, trees reduce the urban heat island effect and keep people cool. Tree distribution and canopy coverage across the city needs to be evaluated for opportunities to plant and protect trees. Public outreach is equally important to educate the public on stewardship and the value of trees.

### Extreme Cold

Extreme cold is a dangerous situation that can bring on health emergencies, especially in susceptible populations such as homeless individuals, children, and the elderly. Wind chill factor, the combined effect of cold temperatures and wind speed, adds to the threat posed by low temperatures. Boston's Emergency Operations Plan notes that:

- Extreme cold conditions may last for several days.
- Frozen and burst pipes can be secondary events caused by extreme cold.
- The City of Boston has programs in place to prepare for extreme cold weather.

The City of Boston recognizes an extreme cold weather situation to exist when the National Weather Service (NWS) forecasts a wind chill of 0° F or below for three hours or more. During an extreme cold weather situation, depending upon the prevailing conditions, the City of Boston will issue any one of three types of alerts:

1. Extreme Cold Weather Advisory (Boston): When the NWS forecasts a wind chill of 0° F to -14° F for three hours or more
2. Wind Chill Advisory (NWS): When the NWS forecasts a wind chill of -15° F to -24° F for three hours or more
3. Wind Chill Warning (NWS): When the NWS forecasts a wind chill of -25° F or colder for three hours or more

Based on past occurrences extreme temperatures are of medium frequency, defined by the Massachusetts Hazard Mitigation Plan 2013 as events that occur from once in 5 years to once in 50 years (2% to 20% probability per year).

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## Fire Hazards

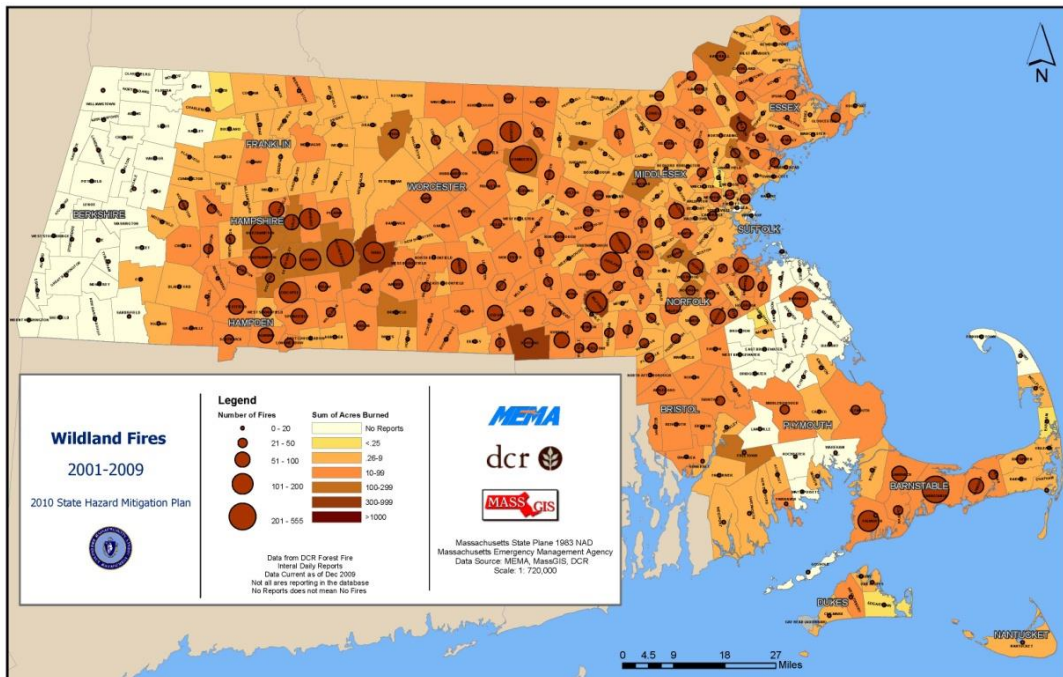
### *Brush Fires*

For the purposes of this plan, a brush fire is an uncontrolled fire occurring in a forested or grassland area. In the Boston region such fires rarely grow to the size of those 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. Some of the park areas in the City may have conditions suitable for brush fires, particularly those with large stands of phragmites (wetland grasses). These fires can lead to urban conflagrations.

Wildfires in Massachusetts are measured by the number of fires and the sum of acres burned. The most recent data available for wildfires, shown in Figure 27 below, indicates that the wildfire extent in Boston was between 0.25 and 9.0 acres burned, with the City experiencing fewer than 20 wildfires between 2001-2009.

On April 19, 2012, a brush fire broke out in a wooded area near Trenton Road in Dedham and burned between 50 to 100 acres along the Neponset River Reservation, bordering on the City of Boston. Due to the high winds and wind direction black ash could be seen floating in the air throughout the Boston neighborhoods of West Roxbury, Hyde Park, Jamaica Plain, Mattapan, and Dorchester. Likewise, the ash was located in Milton and Quincy along the Rt. 28 corridor.

**Figure 27. MA Wildfires 2001-2009**



Source: Massachusetts Hazard Mitigation Plan

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Potential vulnerabilities to wildfire include injuries and loss of human life, damage to structures and other improvements, and impacts on natural resources. Given the immediate response times to reported wildfires in Boston, the likelihood of injuries and casualties is minimal. Smoke and air pollution from wildfires can be a health hazard, especially for sensitive populations including children, the elderly, and those with respiratory and cardiovascular diseases. Wildfire may also threaten the health and safety of those fighting the fires. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke.

Based on past occurrences and the Massachusetts Hazard Mitigation Plan 2013, brushfires are of Medium frequency, events that can occur events that occur from once in 5 years to once in 50 years (2% to 20% probability per year).

### *Urban Conflagrations*

Urban conflagrations are large building-to-building fires that spread over a relatively large urban area. While not typically included as a natural hazard, urban conflagrations can be sparked by a natural hazard event like an earthquake, tornado, or lightning strike.

The National Fire Protection Association (NFPA) uses the term conflagration to describe a fire with major building-to-building flame spread over some distance. Numerous factors increase the chance of conflagration in an urban setting, including:

- closely built structures;
- the use of untreated wood shingles as exterior covering for roofs or walls;
- poor water supplies, weaknesses in automatic or manual fire suppression systems;
- dilapidated structures, especially abandoned buildings in large numbers;
- large-scale combustible construction or demolition projects;
- wild land / urban interfaces; and
- built-up areas near high-hazard locations, where a transportation or industrial fire or explosion could quickly involve large numbers of buildings.

Most urban conflagrations have two or more of the factors listed above. The City of Boston contains many of the above-listed conditions, increasing the possibility of Boston experiencing conflagration.

Conflagration may occur naturally (e.g., lightning strike) or be started by people, either intentionally (arson) or by accident (e.g., smoker's carelessness or lack of fire knowledge [incorrect use of space heaters]). In order for the Boston Fire Department (BFD) to classify a fire as a conflagration, the fire needs to be self-sustaining and last an extended period (approximately eight hours).

Boston has experienced numerous conflagrations over the years causing millions of dollars in damage, displacing hundreds of businesses, and leaving hundreds of people homeless. The largest property loss to conflagration to date was the Great Boston Fire of 1872, which destroyed 776 buildings and caused \$75,000,000 (approximately \$3.5 billion

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in current dollars). Although many building codes were changed in the aftermath of this and subsequent fires, much of Boston's housing stock predates those changes. In 1964, a rear porch fire on Bellflower Street (Dorchester) lined with three deckers caused another conflagration that damaged or destroyed 35 multi-family dwellings (there were fires reported on over 250 roofs). In 1987, a small plane crashed into a Lonsdale Street (Dorchester) house damaging or destroying 9 homes and 12 vehicles because of the ensuing fires.

Conflagration is a low probability, high impact event for the City of Boston. Several reasons for this are Boston's narrow streets, tightly spaced buildings, access issues and building construction that predates modern fire codes. Boston's geographic neighborhood layout, with Charlestown and East Boston separated from the rest of the City by bridges and tunnels can delay the arrival of first responders. Closely spaced wooden three-deckers (three-family homes) are common across numerous neighborhoods in the City. Most vulnerable are the non-masonry, balloon frame architecture and wood construction attached row houses.

Vulnerability to conflagration in the City of Boston includes the potential for human injury and/or death from burns, smoke inhalation, and psychological trauma. Personnel responding to the conflagration are particularly susceptible to upper respiratory problems because of the gases and toxins present in a fire. Property and infrastructure affected by a conflagration are vulnerable to structural collapses, specifically with structures built before modern fire codes.

### **Space Weather and Solar Storms**

The level of activity of the Sun—sunspots, flares, amount of radiation, and other phenomena—goes through an approximately 11-year cycle of increase and decrease. Solar astronomers count the cycle from 1755 to 1766 as the first cycle, and we are now in cycle 24. According to NOAA's Space Weather Prediction Center, the next maximum in solar activity is expected to occur in 2013, although the maximum will be of less-than-average intensity.<sup>7</sup>

NOAA divides disturbances on Earth caused by solar activity into three major categories: geomagnetic storms, solar radiation storms, and radio blackouts. For each category, disturbances are described by a rating scale that goes from 1 (minor) to 5 (extreme).<sup>8</sup> At the extreme end, solar storms can produce:

- Widespread voltage control problems and protective system problems in power systems, with some electrical grids experiencing complete collapse or blackouts
- Degradation of functionality of global positioning system (GPS), aviation air traffic control systems, telecommunication systems, and satellite communication

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<sup>7</sup> <http://www.swpc.noaa.gov/SolarCycle/>

<sup>8</sup> <http://www.swpc.noaa.gov/NOAAAscales/index.html#GeomagneticStorms>

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The primary concern for emergency responders is a geomagnetic storm. In March 1989, a major geomagnetic storm caused a chain reaction that took only 92 seconds to cause the entire electrical grid of the province of Quebec to blackout leaving over 6 million people without power for over 9 hours. The rapid onset did not allow operators any reaction time to evaluate what was occurring or to take corrective action. Our society may be becoming more vulnerable to such storms. The Northeast U.S. is particularly vulnerable due to its high geomagnetic latitude, the local geology, and the interconnectivity of the grid.

In the case of electric power grids, both the manner in which systems are operated and the accumulated design decisions engineered into present-day networks around the world have tended to significantly enhance geomagnetic storm impacts. The result is to increase the vulnerability of this critical infrastructure to space weather disturbances.<sup>9</sup>

If a major geomagnetic “superstorm”—about ten times larger than an ordinary G5—occurred today, over 300 large transformers in the United States could be at risk of permanent damage, with the potential to cut power to 130 million people.<sup>10</sup> Repair times could range from weeks to years depending on the size and types of the transformers damaged. In a solar cycle, there are typically three or four G5 events. There is about a 10 percent chance of a “superstorm” in each solar cycle.<sup>11</sup>

### **Invasive Species**

The Asian longhorned beetle (ALB, *Anoplophora glabripennis*) is a destructive wood-boring pest of maple and other hardwoods. ALB is believed to have been introduced into the United States from wood pallets and other wood packing material accompanying cargo shipments from Asia. The tree species preferred as hosts by the Asian Longhorned Beetle are hardwoods including several maple species (Norway, sugar, silver, and red maple), box elder, horse chestnut, buckeye, elm, London plane, birch, and willow.

The Asian Longhorned Beetle is classified in the wood boring beetle family, Cerambycidae. Adults are 1 to 1 ½ inches in length with long antennae and are shiny black with small white markings on the body and antennae. Once the eggs hatch, small white larvae bore their way through the bark into the tree, feeding on the sensitive

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<sup>9</sup> Kappenman, J. *Geomagnetic Storms and Their Impacts on the U.S. Power Grid*. Goleta: Metatech Corporation, 2010

<sup>10</sup> See *Severe Space Weather Events--Understanding Societal and Economic Impacts: A Workshop Report*, National Academy of Sciences, 2008, [http://www.nap.edu/catalog.php?record\\_id=12507](http://www.nap.edu/catalog.php?record_id=12507), and [http://science.nasa.gov/science-news/science-at-nasa/2009/21jan\\_severespaceweather/](http://science.nasa.gov/science-news/science-at-nasa/2009/21jan_severespaceweather/).

<sup>11</sup> See Riley, P. "On the probability of occurrence of extreme space weather events" *Space Weather*, vol. 10, S02012, doi:10.1029/2011SW000734, 2012, and Love, J. "Credible occurrence probabilities for extreme geophysical events: Earthquakes, volcanic eruptions, magnetic storms". *Geophysical Research Letters*, vol. 39, L10301, doi:10.1029/2012GL051431, 2012.

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vascular layer beneath. The larvae continue to feed deeper into the tree's heartwood forming tunnels, or galleries, in the trunk and branches. This damage weakens the integrity of the tree and will eventually kill it if the infestation is severe enough.

Over the course of a year, a larva will mature and then pupate near the surface, under the bark. From the pupa, an adult beetle emerges, chewing its way out of the tree; forming characteristic round holes approximately 3/8ths of an inch in diameter. Many of these holes will appear on a heavily infested tree frequently accompanied by frass (sawdust) and sap oozing from the holes. The emergence of beetles typically takes place from June through October with adults then flying in search of mates and new egg-laying sites to complete their life cycle.

In August 2008, ALB was discovered in Worcester County, Massachusetts, and in July 2010, ALB was found in the City of Boston. On July 2, 2010, an arborist at the Faulkner Hospital in Jamaica Plain discovered six red maples trees that were exhibiting signs of ALB infestation. The trees were removed on July 3, 2010.

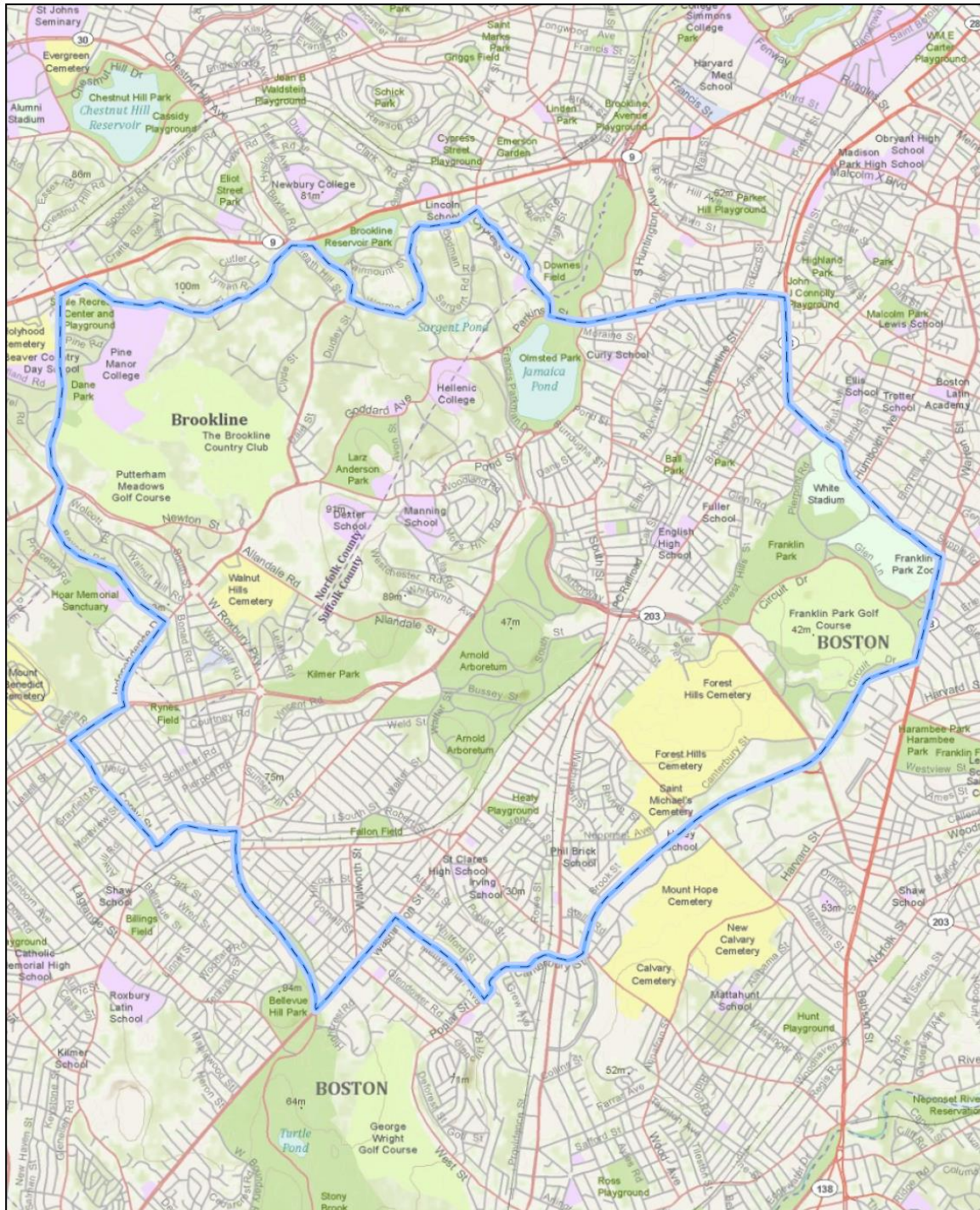
The Asian Long Horned Beetle Suppression Zone neighborhoods encompass parts of West Roxbury, Roslindale, Jamaica Plain, and Roxbury (see Figure 28). In 2011, the ALB Eradication Program shared their plans for a three-year treatment program in Boston in which all host trees within ¼ mile of the infestation was treated with imidacloprid. The 2012 spring update determined that since the onset, more than 70,000 trees have been surveyed and no other ALB damage has been identified.

On August 31, 2012, discovered for the first time in Massachusetts, the Emerald Ash Borer (EAB) was detected in the Town of Dalton. The Emerald Ash Borer has spread to Eastern Massachusetts and was detected on November 22, 2013 off of Route 125 in North Andover, MA. The first detection of an Emerald Ash Borer within the City of Boston was on July 16, 2014, when it was found in the Arnold Arboretum, and confirmed on July 18, 2014.

EAB is a very tiny, emerald-green metallic flying beetle native to Asia that prefers the northern hardwood of ash trees which is a common species in the Berkshires as well as in eastern Massachusetts. The eastward spread of *Agrilus planipennis* from western Massachusetts is inevitable because the EAB is a tiny flying insect. However, the City of Boston inventory of Ash trees is limited and the City is no longer planting the variety of *Fraxinus* species of Ash trees. The City of Boston remains vigilant in the continued monitoring to prevent the spread and eradication of invasive species protect our trees.

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## Figure 28 – Asian Longhorn Beetle Suppression Area in Boston



**City of Boston**  
Asian Long Horned Beetle Suppression Area

Source: City of Boston

0 1,000 2,000 Feet  
N  
MAPS  
\*\*Source: Department of Conservation and Recreation

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The Boston Parks and Recreation Department recently expanded an elm bark beetle program to fight the transmission of Dutch elm disease. The City placed experimental traps at 24 locations in the Emerald Necklace and Copley Square in an effort to protect elm trees from destructive elm bark beetles.

### **Vulnerability Assessment**

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

#### Critical Infrastructure in Hazard Areas

Critical facilities include facilities that perform important functions during a natural disaster, such as shelters, emergency operation centers, and public utilities, as well as locations that house sensitive populations, such as schools or nursing homes. In Boston 2733 critical facilities have been identified for this plan update, a significant increase over 892 facilities identified in the 2008 plan. These facilities are listed in the Critical Facilities Inventory in Appendix D.

The critical facilities are included on the maps that also portray the areas subject to natural hazards, to indicate the potential vulnerabilities of the critical facilities to natural hazards. Because of their large size, the full-scale map series is available in digital format, but a reduced-scale set of eight city-wide maps is included in Appendix C of this plan.

Because such a large portion of Boston was constructed on fill and low lying areas and because of the City's extensive coast line, a significant number of critical facilities are located in hazard zones, and some are located in more than one hazard zone, termed multi-hazard zones. The Critical Facilities Inventory in Appendix D displays which hazard zones each facility is located in, and the number of facilities located in each category of hazard zone is summarized in Table 27 below. Of the 2733 critical facilities inventoried, 57 are located within a flood hazard area (as identified on FEMA's Flood Insurance Rate Maps), and 870 are located within an area potentially subject to storm surges (as identified on the US Corps of Engineers "SLOSH" maps).

There are 46 multi-hazard sites that are located in both a flood hazard and a storm surge area. In addition to the critical facilities sites, components of the City's transportation infrastructure are also located within or partially within both hurricane surge zones and areas at high risk for liquefaction. This includes Storrow Drive, Soldiers Field Road, I-90, and I-93 (see Maps 4, 5, and 8 in Appendix C).



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**Table 27 Summary of Critical Facilities Located in Hazard Zones**

| <b>Hazard Zones</b>             | <b>Number of Critical Facilities</b> | <b>Percent of Total Facilities (2733)</b> |
|---------------------------------|--------------------------------------|---|
| <b>FLOOD ZONES</b>              |                                      |   |
| Zone A                          | 1                                    | --  |
| Zone AE                         | 29                                   | 1.1%                                      |
| 0.2% Chance                     | 27                                   | 1.0%                                      |
| <b>TOTAL in All Flood Zones</b> | <b>57</b>                            | <b>2.1%</b>                               |
| <b>HURRICANE SURGE ZONES</b>    |                                      |   |
| 1                               | 49                                   | 1.7%                                      |
| 2                               | 677                                  | 24.7%                                     |
| 3                               | 1                                    | --  |
| 4                               | 143                                  | 5.3%                                      |
| <b>TOTAL in All Surge Zones</b> | <b>870</b>                           | <b>31.8</b>                               |
| <b>LANDSLIDE SUSCEPTIBILITY</b> |                                      |   |
| Low                             | 456                                  | 17  |
| Moderate                        | 2271                                 | 83  |
| Not Classified                  | 6                                    | --  |
| <b>TOTAL in All Zones</b>       | <b>2,727</b>                         | <b>100%</b>                               |
| <b>AVG. ANNUAL SNOWFALL</b>     |                                      |   |
| Low (36 – 48 inches/year)       | 1,853                                | 67.8%                                     |
| High (48-72 inches/year)        | 850                                  | 32.2%                                     |
| <b>TOTAL in All Zones</b>       | <b>2733</b>                          | <b>100%</b>                               |

Damage Assessments

An estimate of damages for hurricanes, earthquakes, and flooding was performed by the Northeast States Emergency Consortium was the HAZUS-MH™ software.

HAZUS- MH™ (multiple-hazards) is a computer program developed by FEMA to estimate potential losses from earthquakes, floods, and hurricane winds. Loss estimates produced by HAZUS-MH™ are based on current scientific and engineering knowledge of the effects of hurricane winds, floods and earthquakes. There are three levels at which HAZUS-MH™ can be run. Level I uses default data on building types, utilities, transportation, from national databases, including the U.S. Census. The analysis in the

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2008 plan used Level I data. For this 2014 plan update, the Northeast States Emergency Consortium used Level II data, which is based on a city-specific inventory of critical facilities and infrastructure that was updated in 2011.

For more information on the HAZUS-MH™ software, go to <http://www.fema.gov/plan/prevent/hazus/index.shtm>

***Estimated Wind Damages from Hurricanes***

Table 28 shows the estimated potential wind damages to the City of Boston from several historic hurricanes, should they occur today. The hurricanes analyzed include:

- The Hurricane of 1938 (not named)
- Hurricane Carol, 1954
- Hurricane Irene, 2011

HAZUS-MH™ Hurricane estimates damage caused by wind only, and does not include damage caused by flooding, storm surge, or collateral impacts such as power outages. The HAZUS-MH™ analysis for hurricanes does not include estimates of casualties.

**Table 28  
Estimated Wind Damages from Hurricanes (2012 \$)**

|  | <b>1938 Hurricane</b> | <b>Hurricane Carol (1954)</b> | <b>Hurricane Irene (2011)</b> |
|--|-----------------------|-------------------------------|-------------------------------|
| <b>Direct Economic Losses for Buildings</b>        |                       |                               |                               |
| Building Damage (Structural and Non-Structural)    | \$298,978,000         | \$631,972,000                 | \$7,839,000                   |
| Building Contents Damage                           | \$32,408,000          | \$82,636,000                  | \$704,000                     |
| Business Interruption (Income Losses)              | \$40,784,000          | \$104,996,000                 | \$67,000                      |
| <b>Total Building-Related Losses</b>               | <b>\$372,170,000</b>  | <b>\$819,604,000</b>          | <b>\$8,610,000</b>            |
| <b>Displaced Households and People<sup>3</sup></b> |                       |                               |                               |
| Number of Displaced Households                     | 756                   | 2,176                         | 0                             |
| Number of Displaced People                         | 1,746                 | 5,027                         | 0                             |
| <b>Estimated Debris Generated (Tons)</b>           |                       |                               |                               |
| Tree (To be Disposed at Public Expense)            | 7,437                 | 12,077                        | 540                           |
| Reinforced Concrete and Steel                      | 0                     | 3                             | 0                             |
| Brick, Wood, Glass, Plaster and Other              | 61,673                | 127,106                       | 1,604                         |
| <b>Total Debris</b>                                | <b>69,110</b>         | <b>139,186</b>                | <b>2,144</b>                  |

*Source: NESEC, HAZUS-MH Level II analysis for the City of Boston*

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*Estimated Damages from Earthquakes*

Table 29 shows the estimated potential damages to the City of Boston from several historic earthquakes, should they occur today. The earthquakes analyzed include:

- A magnitude 5.0 earthquake epicentered in downtown Boston. A magnitude 2.0 earthquake occurred at this location on December 27, 1974.
- A magnitude 6.0 earthquake epicentered in the Atlantic Ocean about 24 miles east of Cape Ann. A magnitude 6.0 earthquake occurred at this location on November 18, 1755.
- A magnitude 6.5 earthquake epicentered in central New Hampshire. A magnitude 6.5 earthquake occurred at this location on June 11, 1638.

This earthquake report estimates damage caused directly by the earthquake, and does not include damage caused by collateral impacts such as hazardous materials releases.

**Table 29  
Estimated Damages from Earthquakes**

|  | <b>5.0 Magnitude<br/>Downtown</b> | <b>6.0 Magnitude<br/>Cape Ann</b> | <b>6.5 Magnitude<br/>New Hampshire</b> |
|--|-----------------------------------|-----------------------------------|--|
| <b>Direct Economic Losses for Buildings<sup>2</sup></b>          |                                   |                                   |  |
| Building Damage<br>(Structural, Non-Structural)                  | \$1,920,605,000                   | \$234,978,000                     | \$246,399,000                          |
| Building Contents Damage   | \$1,019,422,000                   | \$83,158,000                      | \$73,999,000                           |
| Business Interruption (Income Loss)                              | \$509,999,000                     | \$113,579,000                     | \$136,705,000                          |
| <b>Total Building-Related Losses</b>                             | <b>\$3,450,026,000</b>            | <b>\$431,715,000</b>              | <b>\$457,103,000</b>                   |
|  |                                   |                                   |  |
| <b>Displaced Households and People<sup>3</sup></b>               |                                   |                                   |  |
| Number of Displaced Households                                   | 4,125                             | 509                               | 554                                    |
| Number of Displaced People                                       | 9,529                             | 1,176                             | 1,280                                  |
|  |                                   |                                   |  |
| <b>Casualties</b>  |                                   |                                   |  |
| Minor Injuries<br>(no hospitalization required)                  | 728                               | 107                               | 159                                    |
| Injuries Requiring Hospitalization<br>(but not life-threatening) | 357                               | 21                                | 24                                     |
| Life-Threatening Injuries  | 373                               | 11                                | 2                                      |
| Deaths   | 100                               | 5                                 | 4                                      |
|  |                                   |                                   |  |
| <b>Estimated Debris Generated (Tons)</b>                         |                                   |                                   |  |
| Reinforced Concrete and Steel                                    | 289                               | 50                                | 60                                     |
| Brick, Wood, Glass, Plaster,                                     | 304                               | 82                                | 91                                     |
| <b>Total Debris</b>  | <b>593</b>                        | <b>132</b>                        | <b>151</b>                             |

Source: NESEC, HAZUS-MH Level II analysis for the City of Boston

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*Estimated Damages from Riverine and Stream Flooding*

Table 30 shows the estimated potential damages to the City of Boston from a 100-year storm. The analysis was conducted for each of the major watersheds that cover the City, including the Charles River, Mother Brook, Muddy River, and Mystic River. The total direct economic losses from all watersheds combined is more than \$212 billion, as shown in Table 30. The HAZUS-MH™ analysis for flooding does not include estimates of casualties.

**Table 30  
Estimated Damages from Riverine and Stream Flooding  
100 Year Storm**

|   | <b>Charles River Watershed</b> | <b>Mother Brook Watershed</b> | <b>Muddy River Watershed</b> | <b>Mystic River Watershed</b> | <b>TOTAL</b>         |
|---|--------------------------------|-------------------------------|------------------------------|-------------------------------|----------------------|
| <b>Direct Economic Losses for Buildings<sup>2</sup></b> |                                |                               |                              |                               |                      |
| Building Damage (Structural)                            | \$4,727,000                    | \$44,045,000                  | \$24,341,000                 | \$2,792,000                   | \$75,905,000         |
| Building Contents Damage                                | \$10,899,000                   | \$60,985,000                  | \$55,867,000                 | \$5,919,000                   | \$133,670,000        |
| Business Interruption (Income Losses)                   | \$969,000                      | \$538,000                     | \$883,000                    | \$288,000                     | \$2,678,000          |
| <b>Total Building-Related Losses</b>                    | <b>\$16,595,000</b>            | <b>\$105,568,000</b>          | <b>\$81,091,000</b>          | <b>\$8,999,000</b>            | <b>\$212,253,000</b> |
|   |                                |                               |                              |                               |                      |
| <b>Displaced People<sup>3</sup></b>                     |                                |                               |                              |                               |                      |
| Number of Displaced People                              | <b>467</b>                     | <b>2,040</b>                  | <b>7,373</b>                 | <b>245</b>                    | <b>10,125</b>        |
|   |                                |                               |                              |                               |                      |
| <b>Debris Generated (Tons)</b>                          |                                |                               |                              |                               |                      |
| Finishes (Drywall, Flooring, Insulation, etc.)          | 113                            | 3,807                         | 3,052                        | 113                           | 7085                 |
| Structures (Framing, Walls, Exterior Cladding)          | 1                              | 812                           | 0                            | 1                             | 814                  |
| Foundations   | 2                              | 537                           | 0                            | 2                             | 541                  |
| <b>Total Debris</b>                                     | <b>116</b>                     | <b>5,156</b>                  | <b>3,052</b>                 | <b>116</b>                    | <b>8,440</b>         |

*Source: NESEC, HAZUS-MH Level II analysis for the City of Boston*

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## **V. HAZARD MITIGATION GOALS**

At its February 8, 2012 meeting, the Boston Hazard Mitigation Executive Steering Committee meeting established the goals and objectives for natural hazard mitigation planning in Boston. The committee reviewed and confirmed the goals at their subsequent meeting.

**Goal 1 Protect the health and safety of the public.**

- Encourage people to be prepared before, during and after a hazard event.
- Ensure that services related to public health can function during and after a hazard, e.g., sanitation, water, debris removal, hospitals and emergency services.
- Ensure that evacuation can happen in an organized and efficient manner.
- Minimize secondary impacts from hazards, such as the release of pollutants. e.g., by covering salt piles.
- Promote public communications

**Goal 2: Protect existing properties and structures.**

- Provide resources for residents and businesses to make their buildings and properties more disaster resistant.
- Educate the public on measures they can take to protect their property.
- Maintain existing mitigation structures.
- Ensure that future development / redevelopment does not make existing properties more vulnerable to hazards.
- Ensure that critical facilities are protected from hazards.

**Goal 3: Increase resilience by protecting and enhancing natural resources**

- Make green infrastructure a central part of the City's development strategy
- Protect natural areas to ensure that they buffer impacts to built areas during a natural disaster.
- Protect and increase urban tree canopy
- Manage stormwater with Low Impact Development techniques
- Preserve and restore the functions of natural resource systems such as wetlands.
- Promote green roofs and cool roofs

**Goal 4: Ensure that essential services can function during and after a hazard event.**

- Ensure that critical infrastructure is protected from natural hazards.
- Ensure that people (key service providers and employees) can get into the City to provide services.
- Ensure that interdepartmental communication is seamless.
- Maintain the Emergency Operations Plan (EOP) and supporting annexes.

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**Goal 5: Work regionally to mitigate impacts from natural hazards and to respond and recover from hazard events.**

- Continue to participate in regional efforts.
- Cooperate with other agencies, communities, and private entities.
- Understand priorities and capabilities of other entities to allow for resource-sharing, mutual aid, and entering into memoranda of understanding (MOU).

**Goal 6: Determine priorities for directing resources for hazard mitigation and response.**

- Prioritize mitigation projects.
- Continue to program mitigation projects in the Capital Investment Plan.
- Pursue various funding sources.
- Encourage private property-owners to implement measures to protect their own property.

**Goal 7: Maintain Hazard Awareness.**

- Track and compile hazard related data.
- Understand the potential implications of climate change on the frequency and extent of natural hazard events and incorporate that knowledge into hazard mitigation efforts.
- Maintain publicly available information on natural hazard risks in the City.
- Integrate hazard mitigation into other City initiatives and plans.

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## **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 requires evaluating previous and current community actions to mitigate 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.

### **Introduction**

The City of Boston's Natural Hazard Mitigation Strategy reduces or eliminates potential losses from hazards identified in the Natural Hazard Risk Assessment. The strategy focuses on existing and potential mitigation actions that will mitigate the effects of natural hazards. The Mitigation Strategy is a coordinated effort City of Boston Departments and intergovernmental stakeholders. These stakeholders recommended a comprehensive range of inventive and effective natural hazard mitigation actions.

### **Mitigation Strategy Goals**

- Establish mitigation goals and objectives that aim to reduce or eliminate long-term vulnerability to natural-hazards.
- Identify and analyze a comprehensive range of hazard-specific mitigation actions that aim to achieve the goals and objectives of the natural hazard mitigation strategy.
- Depict projects that prioritize, implement, and administer mitigation actions.

### **FEMA Requirements:**

The Boston Hazard Mitigation Executive Steering Committee developed the mitigation strategy consistent with the process and steps presented in the Federal Emergency Management Agency's (FEMA) How-To-Guide: Developing the Mitigation Plan (FEMA 386-3). This section satisfies the following requirements:

**Requirement §201.6(c)(3)(i):** [The hazard mitigation strategy *shall* include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

**Requirement §201.6(c)(3)(ii):** [The mitigation strategy *shall* include a] section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis

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on new and existing buildings and infrastructure. [The mitigation strategy] must also address the jurisdiction's participation in the National Flood Insurance Program (NFIP), and continued compliance with NFIP requirements and the Community Rating System as appropriate.

**Requirement: §201.6(c)(3)(iii):** [The mitigation strategy section *shall* include] an action plan describing how the actions identified in section (c)(3)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization *shall* include a special emphasis on the extent to which benefits are maximized according to a cost benefit review of the proposed projects and their associated costs.

### **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.

Hazard mitigation measures can generally be sorted into six categories, according to FEMA's Local Multi-Hazard Mitigation Planning Guidance:

- **Prevention:** Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built, and direct 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:** Modification or removal of existing buildings or infrastructure to protect them from a hazard. Examples include acquisition, elevation, relocation, structural retrofits, flood proofing, storm shutters, and shatter resistant glass.
- **Public Education and Awareness:** Actions to inform and educate citizens, elected officials, and property owners about the potential risks from hazards and ways to mitigate them. Such actions include outreach projects, real estate disclosure requirements, hazard information centers, and school-age and adult education programs.
- **Natural Resource Protection and Green Infrastructure:** Actions that, in addition to minimizing hazard losses, preserve or restore the functions of natural systems. These actions include low impact development, sediment and erosion control, stream corridor restoration, watershed management, urban forest and vegetation management, and wetland restoration and preservation.



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- **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, protection of emergency response infrastructure.

Funding to implement hazard mitigation projects may come from a variety of federal, state, and local sources. FEMA currently has three mitigation grant programs: the Hazards Mitigation Grant Program (HMGP), the Pre-Disaster Mitigation program (PDM), and the Flood Mitigation Assistance (FMA) program. The three links below provide additional information on these programs.

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

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

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

Other potential funding sources include the U.S. Army Corps of Engineering, the Small Business Administration.

### **Existing Mitigation Measures**

The City of Boston achieved Emergency Management Accreditation from the National Emergency Management Accreditation Program. The City implements an extensive set of existing mitigation measures related to all kinds of natural hazards. These are described below, and summarized in Table 31.

As there are a significant number of state facilities in the City of Boston, some of the mitigation measures are the responsibility of state agencies and authorities. These are also included in Table 31.

### Existing Multi-Hazard Mitigation Measures

*Emergency Operations Plan (EOP)* – Every community in the Commonwealth of Massachusetts is required to have a plan. Boston’s plan addresses mitigation, preparedness, response and recovery from a variety of natural and man-made emergencies, including flooding, hurricanes, tornados, dam failures, earthquakes, and winter storms. Boston’s EOP was last updated in 2012.

*Office of Emergency Management (OEM)* - The Mayor’s Office of Emergency Management coordinates emergency management and homeland security programs for the City of Boston. OEM works to mitigate, plan, and prepare for emergencies; educate the public about preparedness; coordinate resources for emergency response and recovery efforts; collect and disseminate critical information; and seek further opportunities to

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support the overall preparedness of Boston. In addition, OEM plays a critical role in emergencies by maintaining situational awareness of the incident as well as coordinating inter-agency response. OEM also manages Boston's Emergency Operations Center during a time of need. OEM coordinates with other federal, state, and local entities throughout the region to ensure that proper hazard mitigation measures implemented.

*Local Emergency Management Planning Committee (LEPC)* – The LEPC meets regularly to coordinate emergency management planning across various City departments, community institutions, and the private sector. Its membership includes representatives of law enforcement; emergency medical services, emergency management, fire service, public health, public works, environmental agencies, hospitals/healthcare, transportation, media, community groups, facilities using Extremely Hazardous Substance(s) (EHS), and elected state and local officials.

*Communications* - Redundant and diverse methods are used to alert the public prior to or during an emergency as described in the Boston EOP Emergency Public Information Annex and the Boston Communications and Warning Plan. This approach benefits the entire community, including people with access and functional needs, as it offers multiple options to access critical and timely information thus enabling all people to take the necessary steps under the circumstances. Methods of alert include but are not limited to the following: captioned television broadcasts, e-mail alerts, cell phones with text messaging capability, alpha-numeric pagers, personal digital assistants (PDA), National Oceanic and Atmospheric Administration weather radios with visual and tactile alerts, text radios, electronic message boards on highways and in other public places, alerts that are inclusive of and compatible with TTYs and accessible to individuals with hearing impairments, and written flyers that are brought door-to-door or posted in public places.

The City of Boston's emergency notification system, ALERTBoston, alerts residents about an emergency in their area by using listed phone numbers. This is a voluntary program where residents are able to register in advance and specify notification preferences. Residents may enter various modes of communication for contact, such as text messages, cell phones, business phones, social media, and e-mail.

Text messaging is used to transmit emergency notifications, updates, and other important information to individuals who register for the service. This service should be available to individuals with limited English proficiency, providing an option of selecting an alternative language for the message during the sign-up process. Alert types may include life safety, fire, weather, accidents involving utilities or roadways, team activation notifications, or disaster notification (such as notification of a terrorist attack).

As a StormReady community, the City of Boston provides information to the National Weather Service about the potential impact of natural hazards. This information is used to provide the public with weather reports that allow for pre-planning and preparedness in an effort to protect life and property in the wake of a natural disaster.

The national Emergency Alert System (EAS) was designed to ensure that if one link in the dissemination of alert information is broken, the public has alternate sources for warning. EAS provides capacity for the following:

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- Broadcast radio, television, and cable systems to send and receive emergency information quickly and automatically, even if their facilities are unattended.
- Authorized local and state personnel to distribute important emergency information.
- Direct monitoring of the National Weather Service (NWS) for local weather and other emergency alerts. Local broadcast stations, cable systems, and other EAS participants can then rebroadcast the alerts, providing an almost immediate relay of local emergency messages to the public.
- Automatic interruption of regular programming and relaying of the emergency messages in languages used by the EAS participant. EAS network participants are mandated to broadcast national EAS alerts. However, use of EAS for local broadcasting is encouraged, but not mandatory.

Boston coordinates EAS warnings with MEMA, who is responsible for implementing the EAS.

Not all broadcasts of emergency information trigger the EAS. Pursuant to 47 Code 38 of Federal Regulations (CFR), §79.2, the Federal Communications Commission (FCC) adopted separate requirements to meet the needs of people with disabilities in cases where radio and television broadcasters and cable service providers provide non-EAS emergency announcements and alerts.

*Disaster Preparedness Information* – The City of Boston provides information and education to the public concerning threats to life, safety, and property. Ready Boston is the city-wide community preparedness campaign, managed by the Office of Emergency Management (OEM), designed to educate and inform the public about the hazards they face, what they can do to prepare and what they can do to minimize or protect themselves in the face of hazards. Ready Boston educates and informs residents through various outlets. By using web and social media, the City has been successful in informing the public about emergencies, protective measures and keeping them educated about preparedness. OEM conducts emergency preparedness public presentations, exhibitions and workshops throughout the year to continually educate the public.

Through Ready Boston, the City also provides outreach that empowers Boston Public School students to help their families plan for emergencies through the Student Tools for Emergency Planning (STEP) program. Ready Boston also encourages adult residents to get involved with emergency response and recovery by volunteering as a member of the Community Emergency Response Team (CERT).

Residents have the option of signing up for ALERTBoston to receive emergency alerts via text, email TTY or voice messages. This program allows residents to opt-in to receive specific alerts about emergencies that impact the City. Many news outlets inform residents about ALERTBoston, while encouraging them to register for this free service.

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The City collaborates with numerous public and private agencies to initiate outreach, ensuring diverse populations are appropriately educated and advised. In an effort to ensure that information is accessible for non-English speaking populations, the City website provides a tool that allows the site to be translated multiple languages. This capability helps in the City's continued efforts to inform and educate diverse populations where language barriers may exist. In addition to providing information on the website, OEM works with various City agencies to ensure the elderly and residents with functional or accessibility needs have access to this information through public speaking workshops and presentations. For example, in November 2011 OEM conducted an emergency preparedness workshop with deaf and hard-of-hearing residents using interpreters and a PowerPoint presentation.

*Capital Improvement Planning* – The criteria used to prioritize capital improvement projects in Boston's 2014-18 Capital Planning Budget Procedures Manual includes consideration for natural hazard mitigation and reductions in energy consumption and greenhouse gas emissions. Section C of the Manual specifies that "planning for all new municipal construction and major renovation of City-owned facilities and other major City projects shall include an estimate of annual energy use and greenhouse gas emissions. Such planning shall also include an evaluation of the risks posed by the likely effects of climate change through 2050 to the project itself and related infrastructure and a description of the potential steps to avoid, minimize, or mitigate those risks." Section D of the Manual also describes natural hazard mitigation planning and FEMA's requirement for municipal adoption of plans to maintain eligibility for FEMA grant funding. It requires that "opportunities for mitigating natural hazards that could be eligible for FEMA project funding should be identified." One of these criteria is the extent to which a project mitigates an environmental hazard or is otherwise consistent with the City's hazard mitigation goals.

*Emergency Power Generators* – The City recently completed a Local Energy Assurance Plan that studied the need for emergency power generators in critical public facilities and emergency shelters. The findings indicate that there are 134 facilities which would require electrical power during an emergency, ranging from police and fire stations to emergency shelters and the City's Emergency Operations Center (EOC). Of these facilities, 14 currently have generators with sufficient power capacity to maintain normal operations, 44 have on-site generators capable of running lights and elevators, and the final 76 do not have any power generation capacities. There are some portable generators available to be shared as necessary amongst these critical facilities.

*Energy and Environment Services* - The mission of the Environmental and Energy Services Cabinet is twofold: to preserve and enhance the resources of Boston's built and natural environment and to promote affordable, efficient, reliable and safe energy systems for Boston residents. The Cabinet oversees the Inspectional Services Department, the Environment Department, the Parks and Recreation Department; serves as chair of the Mayor's Energy Management Board; and oversees programs and policies on climate change, green buildings, groundwater, park planning, recycling, renewable energy, and certain transportation issues. The Environment Department maintains

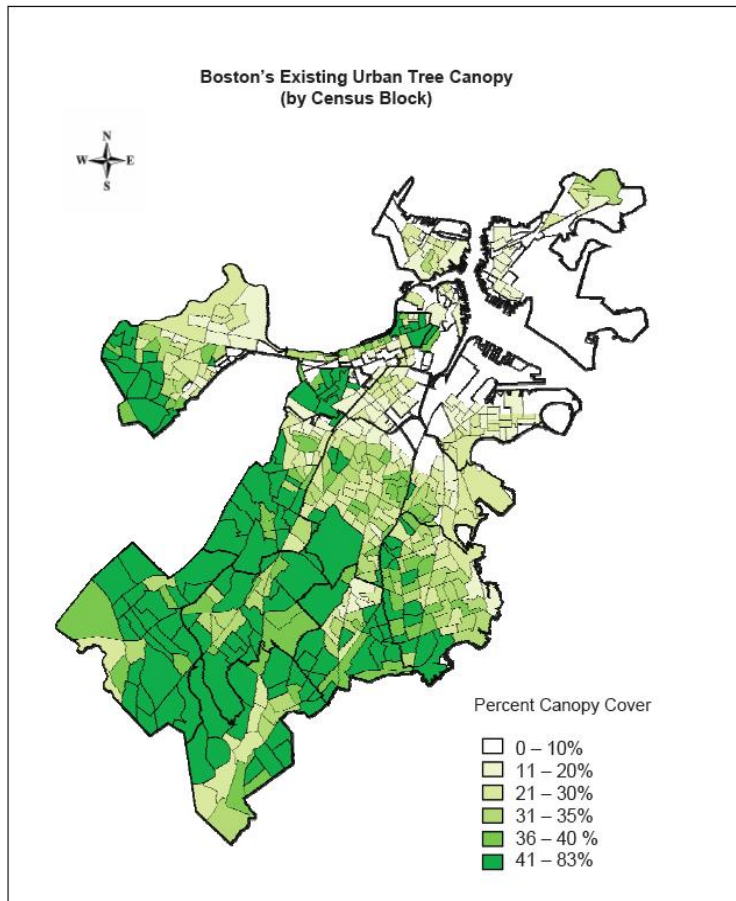
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Boston's historic sites, buildings, landscapes, and waterways through protective designation and review processes.

*Green Building* - Article 37 in the City's zoning code requires the utilization of green building design and practices in new large projects to reduce environmental impacts to conserve natural resources, and promote sustainable development. Many green building measures directly mitigate the impact of natural hazards, for example by reducing urban heat island effect, reducing storm water runoff, reducing energy demand, and raising building elevations above floodplains, among other provisions.

*Grow Boston Greener* is a collaborative effort of the City of Boston, the Massachusetts Department of Conservation and Recreation, and [Boston Natural Areas Network](#) (BNAN) to increase the urban tree canopy cover in the city by planting and caring for trees. The Grow Boston Greener program was launched on Arbor Day, April 30, 2007. An inventory of the City's trees showed that Boston had an overall tree canopy cover of 29% (see Figure 29). The GBG vision is to plant an additional 100,000 trees by 2020 to increase the urban tree canopy to 35% and make Boston a cooler, cleaner, healthier city. The goals of GBG are to increase tree canopy, mitigate heat island effect, reduce energy consumption, improve air quality and improve storm water management.

**Figure 29 - Boston Existing Urban Tree Canopy**



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*Mayor's Executive Order on Climate Action* - In 2007 Mayor Thomas Menino signed an Executive Order on Climate Action that established the framework for the City's subsequent planning and implementation. Some of the key provisions of the Executive Order include:

- Adopting goals for reduction of greenhouse gases
- Establishing the Mayor's Community Climate Action Task Force
- Requiring an updated Climate Action Plan every three years
- Preparing an integrated plan to reduce the risks from the effects of climate change, including natural hazard mitigation.

*Climate Action Plan* – The 2011 update to Boston's climate action plan, *A Climate of Progress*, includes a climate adaptation framework, which is focused “on preparing for the greatest near-term risks: sea-level rise, increased frequency and intensity of heat waves, and increased intensity of storms,” and addressing their health, economic, and social consequences. Although it uses a slightly different vocabulary, components of the adaptation plan have considerable overlap with natural hazard mitigation, and integration of the climate plan with the natural hazard mitigation plan is one important element. The adaptation plan follows three basic guidelines:

- Climate adaptation is as important as climate mitigation.
- Information on the effects of climate change is sufficient to start planning now, but flexibility and openness to new information are essential.
- Climate adaptation must be thoroughly integrated into all planning and project review conducted by the City.

*Climate Ready Boston*: In October 2013, the City released *Climate Ready Boston: Municipal Vulnerability to Climate Change*, the report of the Mayor's Climate Preparedness Task Force examining the preparedness of municipal facilities, operations, services, and policies for the effects of climate change. Individual departments identified vulnerabilities (based on the TBHA estimates of the effects of sea-level rise and UCS projections of temperature change, see above), established priorities, and planned next steps. Based on the departmental assessments, the Task Force had five key findings:

- Climate preparedness must be an important and explicit criterion in the City's capital planning. The City's critical IT, communications, and transportation centers need particular attention.
- The effects of rising temperatures should be a high priority.
- Municipal emergency plans should be reviewed and practiced in light of the expanded risks posed by climate change.
- Close coordination with regional, Commonwealth, and federal partners is necessary to address cross-jurisdictional infrastructure vulnerability.
- Education, engagement, and communication—within City government and with the community—are essential for preparing for both the short-term and long-term effects of climate change.

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The report and actions arising from it will be used as a source in implementing the City's Hazard Mitigation Plan. It is attached to this Hazard Mitigation Plan Update as Attachment G.

*Downtown Waterfront Municipal Harbor Plan:* In March 2013 the Boston Redevelopment Authority launched the new Downtown Waterfront Municipal Harbor Plan and zoning recommendations for the Greenway District with a series of public meetings and tours. BRA officials Peter Meade and Kairos Shen noted that the removal of the Central Artery roadway opens up opportunities for reconnecting neighborhoods to the waterfront, and for planning in a more environmentally sensitive manner. The focus of the plan is on encouraging development appropriate for an area sensitive to sea level rise.

Existing Flood Hazard Mitigation Measures

*Boston Water and Sewer Commission* – The Boston Water and Sewer Commission (BWSC), one of the most important flood mitigation agents in the City, actively manages the storm drain system, tracks data on water levels and makes this information publicly available, investigates reports of flooding, and develops solutions ranging from new management actions to capital projects like dredging, drainage reconstruction, and other physical improvements.

*Boston Conservation Commission* – The Boston Conservation Commission reviews all projects that remove, fill, dredge, or alter protected wetland resource areas. The Commission ensures that appropriate erosion and sediment controls are in place during and after construction activities, and that functions and values of coastal and inland resource areas are protected.

*National Flood Insurance Program (NFIP)* – Boston participates in the NFIP with 935 policies in force as of December 31, 2014. The FEMA database on flood insurance policies and claims ([www.fema.gov/policy-claim-statistics-flood-insurance/policy-claim-statistics-flood-insurance/policy-claim-13](http://www.fema.gov/policy-claim-statistics-flood-insurance/policy-claim-statistics-flood-insurance/policy-claim-13)) provides the following information for the City of Boston:

|  |                |
|--|----------------|
| Flood insurance policies in force ( as of Decenber 31, 2014) | 1,292          |
| Coverage amount of flood insurance policies                  | \$392,401,900  |
| Premiums paid  | \$1,313,805    |
| Total losses (all losses submitted regardless of the status) | 264            |
| Closed losses (Losses that have been paid)                   | 165            |
| Open losses (Losses that have not been paid in full)         | 2              |
| CWOP losses ( Losses that have been closed without payment)  | 97             |
| Total payments (Total amount paid on losses)                 | \$1,030,417.85 |

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The City complies with FEMA's NFIP requirements by enforcing floodplain regulations, adopting up-to-date floodplain maps in its zoning code, and providing information to property owners and builders regarding floodplains and building requirements.

*Catch Basin / Drain Maintenance* - Boston cleans its catch basins typically every three years. The BWSC has created a GIS-based database of information on its catch basins and is developing a city-wide catch basin preventive maintenance plan. A city-wide cleaning set the baseline, and now the amounts of debris removed are recorded and used to determine the future cleaning schedule. Extra maintenance occurs in areas that tend to flood. Some drains are cleaned in advance of forecasted significant storms. The Department of Conservation and Recreation (DCR), a state agency, aims to clean the catch basins in Boston for which it is responsible once per year.

*Street Sweeping* – The Boston Public Works Department (PWD) sweeps posted arterial roads year-round to the curb weather-permitting. During the winter months, sweeping operations may be suspended until snow is cleared and removed to the curb. Non-posted streets are swept every week to two weeks from April through November each year. However, in the neighborhoods of the North End, Beacon Hill and the South End street sweeping is done from March through December.

*Erosion and Sediment Control / Stormwater Management*– The Boston Water & Sewer Commission requires developers to assess methods to retain stormwater on site for new construction and renovation projects requiring BWSC review. BWSC requires Best Management Practices (BMP) to include erosion control measures during construction and has developed and implemented a Stormwater Construction Inspection Guide and staffed an enforcement program to address construction sediment issues. Developers are also required to design infiltration systems, Low Impact Development (LID) techniques and particle separators in accordance with BWSC Site Plan Requirements and Massachusetts Department of Environmental Protection Stormwater management policies.

*Green Infrastructure/Natural Flood Control* - Various low-lying areas around the City have been protected from development and provide flood storage capacity. The most significant greenway is the Emerald Necklace, a continuous greenway that extends from Franklin Park in Mattapan to the Back Bay. Other significant open space resources in Boston include the urban wilds and the wetlands along the Neponset River. Several protected sites that help mitigate stormwater impacts include a parcel along Bussey Brook that is leased by the Arnold Arboretum, the western campus of the Boston State Hospital site at the Boston Nature Center, and a 100-foot buffer zone along Canterbury Brook on the eastern campus.

*Inflow/Infiltration Removal* – Reducing inflow and infiltration (I&I) is an issue for the sanitary sewer system. I&I is excess water that flows into sewer pipes, and consists of two kinds of flows: inflow is stormwater that flows into sewers via roof drain downspouts, foundation drains, storm drain cross-connections, and through holes in manhole covers; infiltration is groundwater that seeps into sewer pipes through holes,



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cracks, joint failures, and faulty connections. Both types of “extraneous” flows. I&I is a concern for flooding because the additional water flowing into a sewer system can exceed its capacity, leading to the discharge of untreated wastewater. The BWSC’s I&I reduction program is based on the results of a comprehensive flow analysis in 1982 and further sewer system evaluation studies looking at identifying sources of I&I. BWSC conducts ongoing rehabilitation work and projects for I&I removal, including repairing leaky pipes and disconnecting roof leaders, sump pumps, and improper connections to the sewer system. In some places, reducing I&I can lead to localized flooding because water that once drained into the sewer system must find other paths.

*Combined Sewer Separation* - The Boston Water and Sewer Commission and the MWRA have been working to separate the storm water and wastewater systems since the 1980's as part of the cleanup of Boston Harbor. This reduces public health impacts during heavy rains.

*Floodplain Management* - Boston’s *Floodplain Overlay Zoning District (Zoning Article 25)* is administered by the Boston Redevelopment Authority. These regulations set floor elevation standards for construction in a flood hazard district and prohibit certain activities and uses, such as mobile homes and storage of flammable materials. Under the separate authority of the Massachusetts Wetlands Protection Act, the Boston Conservation Commission also reviews projects proposed in the 100-year floodplain and the two agencies expect applicants to give consideration to future sea level rise over the design life of the project, particularly in determining the ground-level floor elevation for buildings, as well as the location of building mechanical equipment, utilities, storage areas for hazardous materials, underground garage portals, exhaust and ventilation infrastructure, and building entry points.

*Development Review* - Many projects undergo two coordinated public review processes – the City’s Article 80 zoning review and state review under the Massachusetts Environmental Policy Act (MEPA). These reviews incorporate Chapter 91 review, flood plain issues, water access, storm water and drainage. Under the MEPA process, a number of city, regional and state entities and the public are able to review the project and provide input. BWSC also participates in this review and will also make recommendations on additional drainage provisions. BWSC must sign off on site plans before building permits can be issued.

*Greenbelt Protection District* – These districts are areas along the City’s greenbelt roadways designated to protect open space areas and scenic resources. There are nine areas designated as Greenbelt Protection Overlay Districts:

1. William J. Day Boulevard in Dorchester and South Boston
2. Veterans of Foreign Wars Parkway in West Roxbury
3. American Legion Highway in Roslindale
4. Jamaicaway in Jamaica Plain, Roxbury, and West Roxbury
5. Arborway in Jamaica Plain and West Roxbury
6. West Roxbury Parkway in West Roxbury

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7. Enneking Parkway, in West Roxbury and Hyde Park
8. Turtle Pond Parkway, in West Roxbury and Hyde Park
9. Dedham Parkway, in Hyde Park

*Massachusetts State Building Code* – The Massachusetts State Building Code contains detailed regulations regarding flood proofing, snow loads, wind loads, and earthquake resistant design. The code was amended in the 1980's to include stricter seismic standards, so the vast majority of buildings in Boston pre-date that change and were not built to the stricter standards. The code requires that new buildings and substantial improvements in flood hazard areas must be elevated so that the lowest floor is at or above base flood elevation. In coastal flood hazard areas subject to high velocity wave action (V Zones), new buildings and substantial improvements must be elevated so that the lowest floor is two feet above the base flood elevation

*DCR dam safety regulations* – The state has enacted dam safety regulations mandating inspections and emergency action plans. All new dams are subject to state permitting, although new dams are not likely to be developed in Boston.

*City of Boston Open Space Plan* – Adopted in 2008, this plan lays out strategies for preserving and expanding the open space and natural resource amenities of the City, with potential benefit for flood mitigation efforts. Particularly important are policies outline in the plan that call for the involvement of Parks and Recreation Department staff, with a range of environmental science and design expertise, to work with other agencies, particularly the BRA, on neighborhood plans and development review.

Open space areas in the City are essential “green infrastructure” for flood mitigation. The City, in concert with a number of State agencies and neighboring municipalities, has managed to preserve or create open space areas in floodplains and other areas of the City. These include natural areas and parks along the rivers, “urban wilds” and other park spaces that can serve as stormwater retention areas during storms, and small green spaces in road medians, along sidewalks, and in other urban spaces that can allow for some infiltration of stormwater.

*Underground Utility Protection* - The electric system for Boston's street lights is protected from flooding by being buried 33 inches deep, with openings at the bottom to allow water to drain out. Fire crews maintain the fire box system. Private utilities own and operate other underground utilities, including the electric grid, telecommunications systems, and natural gas distribution. Those utilities are responsible for maintaining and protecting their systems in the event of flooding or other hazards.

*Flood Prevention Education* - The BWSC provides information on its website and in flyers sent with bills on various items such as keeping catch basin grates clear of debris and sediment and backflow valves to protect properties in areas that flood. The Mayor's office reminds residents to keep catch basin grates clear of leaves.

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*Emerald Necklace Park System* – One of the original functions of this park system, designed in the 19<sup>th</sup> century, was to provide stormwater management and flood storage. Its ongoing maintenance to meet this purpose represents an important mitigation measure.

*Muddy River Flood Control* – The significance of past flooding in the Muddy River area has led to a number of mitigation actions that have focused on this area. Working with the U.S. Army Corps of Engineers (USACE), the State and the Town of Brookline, the City is pursuing a \$93 million project that will improve flood control, water quality, and habitat in the Muddy River. The project will increase the river's hydraulic capacity and establish management practices to reduce the sediment and debris load entering the waterway. A \$30.9 million construction contract was awarded for Phase I of the project on Aug. 10, 2012, and a groundbreaking ceremony was held in October 2012. DCR controls much of the land and roadways in this area and is responsible for maintaining drainage infrastructure as well as conducting street sweeping and other sediment and debris management activities.

*DCR Properties* – The state Department of Conservation and Recreation is responsible for the maintenance of many parks, roadways, and other properties throughout the City. These include important transportation corridors such as Day Boulevard, Morrissey Boulevard, and Storrow Drive. Some particular facilities of note are pumps in the tunnels along Storrow Drive, tide gates for mitigating flooding of Morrissey Boulevard, and dredging near the Belle Isle Marsh, and a range of other projects and management activities.

*Storm Ready Certification* – The City was recently recertified as a Storm Ready Community through the National Weather Service, good through May 20, 2015. To receive this certification, the City demonstrated that it:

- Established a 24-hour warning point and emergency operations center
- Had more than one way to receive severe weather warnings and forecasts and to alert the public
- Created a system to monitor weather conditions locally
- Promoted the importance of public readiness through community seminars
- Developed a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises.

*Charles River Dam* - DCR raises and lowers water levels at the Charles River Dam based on weather forecasts. For flood control purposes, they need to begin lowering water levels well ahead of a predicted storm. DCR has established operating parameters for control of water levels. If they raise or lower water levels outside of these parameters, they inform local emergency management personnel. The Charles River Dam has diesel pumps to use when needed. Otherwise DCR prefers to use the gates on the dams for changing the water levels. The operation of the dam is coordinated with MEMA and ACOE, and DCR works with these two agencies when there is a storm.

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*MassDOT and MBTA facilities:* MassDOT, with funding from the Federal Highway Administration, is starting a pilot project, “Climate Change and Extreme Weather Vulnerability Assessments and Adaptation Options of the Central Artery.” The project will focus on four critical study areas of the Central Artery, including the Sumner and Callahan Toll Plaza in East Boston, the Greenway, the Ted Williams Tunnel Boat Section in South Boston, and the MBTA Aquarium Station on the Blue Line. A hydrodynamic model will be used to analyze the vulnerability of the Central Artery to sea level rise and extreme weather events. MassDOT will investigate options for adaptation, and establish an emergency response plan for tunnel protection and/or shutdown in the event of a major storm. Key climate variables will be storm event frequency, storm surge height, and sea level rise. The investigation of adaptation options will include cost-benefit analysis. The project will focus on climate impacts and adaptive capacity of the Central Artery for today and the year 2030. Climate scenarios will also be developed for 2070 and 2100, which will result in high-level adaptive options only.

### Existing Wind Hazard Mitigation Measures

*Massachusetts State Building Code* – The City enforces the Massachusetts State Building Code whose provisions include design standards for wind speeds of 100 miles per hour (780 CMR Eighth Edition, Table R301.2(4)). The code’s provisions are the most cost-effective mitigation measure against high winds other than a tornado. However, if a tornado were to occur, the potential for severe damages would be extremely high.

*Tree Maintenance* - The Parks and Recreation Department has regulatory and operational responsibilities for public shade trees. The Department’s maintenance program includes pruning, disease control, removals, and storm damage repairs. NSTAR prunes trees on their utility Rights-of-Way. Utility companies also prune trees in their transmission corridors.

### Existing Winter Storm Hazard Mitigation Measures

*Snow disposal* –The City contracts for snow removal services and maintains a “black pavement” policy requiring all streets to be cleared to serve emergency vehicles. The Public Works Department coordinates with City agencies to identify snow disposal areas.

*Sidewalk Clearance* – The City requires by ordinance that property owners keep the public sidewalks in front of their property clear of snow and ice.

*Snow Event Communications* – City Hall, the BWSC, and other City agencies provide information and warnings with regard to such issues as freezing pipes, the danger of roof collapse under snow loads, the need to keep ventilation grates clear of snow, and other matters.

*Fire Hydrant Location Mapping* – The City’s fire hydrants have been located with GPS and mapped to assist with locating them in the event that they are buried in snow. The Mayor’s Office of New Urban Mechanics recently launched an ‘Adopt a Hydrant’

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smartphone application that allows community members to adopt a hydrant, taking responsibility for ensuring hydrants are accessible to firefighters after a snowstorm.

### Existing Geologic Hazard Mitigation Measures

*Massachusetts State Building Code* – Section 1612.1 of the State Building Code on designing for earthquake loads (780 CMR 1612.0) states that its purpose is “to minimize the hazard to life of 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”. Further, 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.

The code requires that every new structure be assigned a Seismic Design Category (SDC), and designed and constructed to resist effects of earthquake motions. The SDC is based upon the Occupancy Category and the severity of the design earthquake ground motion as expressed by  $S_s$  and  $S_1$ . Table 1604.11 in the code provides these values for each city and town in Massachusetts; for Boston the values are 0.29  $S_s$  and 0.068  $S_1$ . The  $S_s$  and  $S_1$  coefficients correspond to the Maximum Considered Earthquake (MCE), which is defined as "collapse prevention" motion. On the East Coast, the MCE is equivalent to an event with return period of 2,500 years (or an event with 2% probability of being exceeded in 50 years).

The Seismic Design Category defines the required level of structural analysis and construction detailing. SDC determines permissible structural systems, limitations on height and irregularity, requirements for design of components for seismic resistance, and types of lateral force analyses that should be performed. The Occupancy Category ranges from I to IV, depending upon the consequences of a potential failure and the need for operational accessibility following a seismic event. Section 1612.2.5 of the code assigns all buildings to seismic hazard exposure groups. Group II includes buildings that have a substantial public hazard due to occupancy or use, including those in which more than 300 people congregate, and, Group III are those buildings having essential facilities that are required for post-earthquake recovery, including fire, rescue and police stations, emergency rooms, power-generating facilities, and communications facilities.

On November 5 and 6, 2012, the City of Boston’s Inspectional Services Department (ISD), Boston Fire Prevention, Boston Public Works Department, Boston Redevelopment Authority (BRA), and the Boston Landmark’s Commission participated in a two-day National Earthquake Technical Assistance Program (NETAP) opportunity coordinated by the Mayor’s Office of Emergency Management and FEMA. There were a total of 56 course participants who successfully completed the FEMA 154 Rapid Visual Screening of Buildings for Potential Seismic Hazards and ATC 20 Post Earthquake Safety Evaluation of Buildings. The training focuses on how to identify potentially hazardous

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buildings before an earthquake occurs by providing methods to rapidly identify, inventory and rank buildings according to their expected safety and usability during and after earthquakes. The second day focused on rapid and detailed evaluation procedures for evaluating earthquake damaged buildings and posting them with color-coded placards as inspected, limited entry, or unsafe.

Of the 56 attendees, 46 represented the ISD Commissioner and his entire leadership team, senior managers, building and structures, planning and zoning, electrical, plumbing and gas inspectors and health inspectors from all divisions of Boston Inspectional Services Department. The additional 10 participants were civil engineers from the Boston Public Works Department; the State Fire Marshall and Boston Fire Building Inspectors; and staff architects representing the Boston Redevelopment Authority and the Boston Landmarks Commission.

### Existing Other Hazard Mitigation Measures

*Development Review* – The Fire Department reviews of all major development projects to ensure that proper fire safety provisions are incorporated.

*Cooling and Warming Centers* – The City maintains a network of cooling and warming centers that may be used by residents who do not have access to cool spaces during extreme heat events. The City also operates accompanying communications and transportation networks to support the provision of these services to residents in need.

*Homeless shelters* – During extreme temperature events, vulnerable homeless people are offered the opportunity to stay at shelter facilities.

### *Complete Streets Program*

The City of Boston is currently designing and constructing projects in Boston's neighborhoods that have embraced the Complete Streets guidelines. Many of these projects incorporate improvements to stormwater management and introduction of more trees and landscaping that will help mitigate both stormwater and urban heat impacts. A summary of the current projects follows:

#### Alford Street Bridge, Charlestown

Alford Street Bridge (State Route 99 over the Mystic River) is being reconstructed with a new deck and superstructure. The machinery of this twin leaf double bascule bridge is being reconditioned with new components and the substructure is being repaired. The rehabilitation was designed to withstand a 1,500 year seismic event.

Project Manager: Boston Public Works

Status: In construction

#### Audubon Circle, Fenway

The new design of Audubon Circle, a historically significant gateway from the north into Boston and the Emerald Necklace park system, will re-emphasize the historic circle with

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benches, walls, trees and planters that will green the space and treat stormwater from the streets and sidewalks. Status: Design

Project Manager: Boston Transportation Department

### Boylston Street, Fenway

The redevelopment of Boylston Street between Fenway Park and the Longwood Medical Area will capture setback space to create wider sidewalks with street trees and other greenscape elements, in keeping with the Emerald Necklace that bookends the space, and to add bike lanes.

Project Manager: Boston Transportation Department

Status: Design

### Broad Street- Crossroads Initiative, Downtown

This important Crossroad's widened tree-lined sidewalks will better connect well-traveled State Street, Faneuil Hall Marketplace and Government Center to the new Rose Kennedy Greenway at the harbor's edge. The project includes a unique passive irrigation system for the landscaping, and structural soil.

Status: Completed

Project Manager: Boston Redevelopment Authority

### Causeway Street- Crossroads Initiative, Bullfinch Triangle

The key goals of the Causeway Street project are to transform the corridor into a great pedestrian-oriented boulevard and reconnect the West End and North End neighborhoods. The design will improve traffic operations and safety, provide significant upgrades to existing bicycle accommodations, and improve pedestrian amenities and convenience.

Project Manager: Public Works Department

Status: Design

### Central Square, East Boston

The square includes vast expanses of pavement and an oval park in the center that is difficult to access. The redesigned square will reclaim much of the pavement for pedestrian use by narrowing the streets, expanding the park, and widening the sidewalks to create spaces for outdoor seating, cafes, and greenscape elements.

Project Manager: Boston Transportation Department

Status: Design

### Centre and South Streets, Jamaica Plain

Centre and South Streets form Jamaica Plain's primary small-business spine. New concept designs are proposed for Monument Square, Hyde Square and the Mozart Park area to widen sidewalks, create shorter crosswalks, and introduce greenery.

Project Manager: Boston Transportation Department

Status: Design

### Cummins Highway, Roslindale

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Cummins Highway from Washington Street (Roslindale Square) to Harding Road will be fully reconstructed including the installation of new sidewalks, roadway resurfacing, a new traffic signal at Brown Avenue, new tree plantings, and bike lanes.

Project Manager: Boston Public Works

Status: Completed

Frederick Douglass Street Improvements, South End/Roxbury

Streets in the Frederick Douglass neighborhood will be reconstructed with new sidewalks, a new street lighting system with LED lights, and new tree plantings

Project Manager: Boston Public Works

Status: Completed

Existing mitigation measures and their status are summarized in Table 31.

| <b>Table 31 - Boston Existing Mitigation Measures</b>                                |                     |   |                                     |
|--|---------------------|---|-------------------------------------|
| <b>Type</b>  | <b>Area Covered</b> | <b>Effectiveness/ Implementation</b>                          | <b>Improvements/ Changes Needed</b> |
| <b>MULTIPLE HAZARDS</b>  |                     |   |                                     |
| 1) Emergency Operations Plan (EOP)   | City-wide           | Effective   | Update annually                     |
| 2) Massachusetts State Building Code   | City-wide           | Effective   | None                                |
| 3) Evacuation and Emergency Preparation guides; preparedness information             | City-wide           | Effective   | None                                |
| 4) Communications Equipment-- Phone alert system, reverse 911, Alert Boston, twitter | City-wide           | Effective   | None                                |
| 5) Criteria for City CIP projects include "mitigates an environmental hazard"        | City-wide           | Effective   | None                                |
| 6) Fire Marine Unit moves the boat to the dam locks if a hurricane is forecast       | Boston Harbor       | Effective   | None                                |
| 7) Boston Police Harbor Patrol relocated to Pier 10                                  | Boston Harbor       | New Pier and Security Gates. Former Dry Dock turned into park | None                                |
| 8) PWD requires non-conductive covers on all manholes                                | City-wide           | Effective   | None                                |
| 9) Local Emergency Planning Committee (LEPC)   | City-wide           | Effective   | None                                |
| <b>FLOOD HAZARDS</b>   |                     |   |                                     |



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| <b>Table 31 - Boston Existing Mitigation Measures</b>  |  |                                      |                                       |
|--|--|--------------------------------------|---------------------------------------|
| <b>Type</b>  | <b>Area Covered</b>  | <b>Effectiveness/ Implementation</b> | <b>Improvements/ Changes Needed</b>   |
| 10) BWSC 3-year Capital Improvement Program (2011-13), coordinated with other agencies, updated annually   | City-wide  | Effective                            | Update annually                       |
| 11) Boston Water and Sewer Operations/ Maintenance Activities – catch basin, drain cleaning, street sweeping   | City-wide  | Effective                            | None                                  |
| 12) Pre-storm preparations (e.g. sandbags, inspections of key vulnerable sites)  | City-wide  | Effective                            | None                                  |
| 13) BWSC requirements for Erosion and Sediment Control and Storm Water plans   | City-wide  | Effective                            | None                                  |
| 14) Various low-lying areas around the City have been protected from development and provide flood storage capacity.   | Emerald Necklace, Boston Urban Wilds, Neponset River wetlands, parcel along Bussey Brook leased by Arnold Arboretum; Boston State Hospital site at Boston Nature Center; 100-foot buffer on Canterbury Bk. | Effective                            | None                                  |
| 15) Inflow/ Infiltration (I/I) Removal projects -- BWSC undertook flow analysis and sewer system evaluations to determine I/I sources. This led to rehabilitation work and projects for I/I removal. | City-wide  | Effective                            | None                                  |
| 16) Floodplain Overlay District (Article 25)   | Areas identified on FIRM maps  | Effective                            | Integration of climate change effects |
| 17) MEPA and Article 80 development review   | City-wide  | Effective                            | None                                  |
| 18) Green building zoning requirements, encourage low impact development techniques  | City-wide  | Effective                            | None                                  |

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**Table 31 - Boston Existing Mitigation Measures**

| <b>Type</b>  | <b>Area Covered</b>  | <b>Effectiveness/ Implementation</b>                      | <b>Improvements/ Changes Needed</b> |
|--|--|---|-------------------------------------|
| 19) Article 29 (Greenbelt Protection Overlay District) requires open space preservation  | Designated districts   | Effective   | None                                |
| 20) Conservation Protection Subdistricts and Article 80 review   | Designated districts (total of 34)                                   | Site plan required in Conservation Protection Subdistrict | None                                |
| 21) Grow Boston Greener - goal of 100,000 trees by 2020  | City-wide  | Effective   | None                                |
| 22) Underground electric utility protection.   | City-wide  | Effective   | None                                |
| 23) Public information— BWSC website, newsletters and Mayor’s Office provide information on flood prevention, and stormwater mitigation and snow and ice removal from catch basins | City-wide  | Effective   | None                                |
| 24) Mitigating health and safety impacts after flooding—ISD will order electricity shut off and condemn food   | City-wide  | Effective   | None                                |
| 25) Combined Sewer Separation Projects   | Dorchester, Stony Brook, Fort Point Channel, Morrissey Blvd. Conduit | All completed   | None                                |
| 26) Muddy River Flood Control, Water Quality and Habitat Enforcement and Historic Landscape Preservation Project   | Muddy River watershed  | Project is underway                                       | Complete project                    |
| 27) Charlesgate area in Boston dredged   | Muddy River watershed  | Effective   | None                                |

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| <b>Table 31 - Boston Existing Mitigation Measures</b>  |                                 |   |                                     |
|--|---------------------------------|---|-------------------------------------|
| <b>Type</b>  | <b>Area Covered</b>             | <b>Effectiveness/ Implementation</b>                          | <b>Improvements/ Changes Needed</b> |
| 28) Muddy River maintenance (DCR removes leaves spring and fall; DCR and City street sweeping, catch basin cleaning) | Muddy River watershed           | Effective   | None                                |
| 29) Remote monitoring of Stony Brook conduit water levels (new SB at Parker St and old SB at Northeastern)           | Muddy River watershed           | Effective   | None                                |
| 30) Risk Assessment for Boston Fire Alarm building's perimeter security  | Boston Fire Alarm building site | Rear and side security installed                              | Fencing to be installed.            |
| 31) Longwood Area BWSC study of locations that experience flooding   | Longwood Medical Area           | Study has been completed                                      | Drainage improvements are underway  |
| 32) DCR maintenance of Storrow Drive pumps, pipes, and catch basins  | Storrow Drive area              | Effective   | None                                |
| 33) Storrow Drive Reconstruction Project   | Storrow Drive area              | Project is in design and permitting phase                     | Implement the project               |
| 34) St. Botolph Street BWSC storm system   | St. Botolph St. area, Back Bay  | Project Completed   | None                                |
| 35) Archdale Area, Roslindale—maintaining natural flood storage capacity   | Archdale Area                   | Effective   | None                                |
| 36) Archdale Area, Roslindale—Ravine provides flood storage, releases to Bussey Brook                                | Archdale Area                   | Effective   | None                                |
| 37) Archdale Area, Roslindale—MWRA connection to Stony Brook   | Archdale Area                   | Has been used 5 times since construction (in 2008); effective | None                                |
| 38) Canterbury Brook, Mattapan—DCAM mitigation project   | Canterbury Brook                | TBD   | TBD                                 |
| 39) Neponset River Area, Dorchester—natural land   | Neponset River Area             | Effective   | None                                |

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**Table 31 - Boston Existing Mitigation Measures**

| <b>Type</b>   | <b>Area Covered</b>  | <b>Effectiveness/ Implementation</b>                         | <b>Improvements/ Changes Needed</b> |
|---|--|--|-------------------------------------|
| protected, provides flood storage   |  |  |                                     |
| 40) Neponset River Area, Dorchester—sediment has been removed from river to increase capacity   | Neponset River Area  | Effective  | None                                |
| 41) Neponset River -- DCR studying impacts of removing Tilestone and Hollingsworth Dams and Baker dams for ecological restoration and creation of fish ladder | Neponset River, Dorchester area                                  | USACE Aquatic Ecosystem Restoration Program -- Ongoing study | Implement findings of study         |
| 42) Pine Neck Creek – BWSC installed rip-rap, restored salt marsh   | Pine Neck Creek between I-93 and Port Norfolk                    | Effective  | None                                |
| 43) Day Boulevard, South Boston—DCR repaired M Street seawall   | Day Boulevard  | DCR completed seawall restoration                            | None                                |
| 44) Belle Isle Marsh—DCR flood control project. State designation as Area of Critical Environmental Concern   | Belle Isle Marsh, Jefferies Point, and Orient Heights, E. Boston | Flood control and dredging on-going                          | Continued implementation of project |
| 45) East Boston Greenway Corridor—Bremen Street park will preserve flood storage capacity   | East Boston Greenway Corridor                                    | Effective  | None                                |
| 46) East Boston Greenway Corridor storm water system  | East Boston Greenway   | Effective  | None                                |
| 47) Havre Street, East Boston sewer relief project  | East Boston  | Under construction   | Complete project                    |
| 48) Centre Terrace, Wedgemere—BWSC improvements for up to 10 year storm   | Centre Terrace area  | Effective  | None                                |
| 49) Centre Terrace, Wedgemere—BWSC inspects grates  | Centre Terrace area  | Effective  | None                                |
| 50) Centre Terrace, Wedgemere, West Roxbury— Detention basin built in private development   | Centre Terrace area  | Effective, designed for 50-year storm                        | None                                |

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| <b>Table 31 - Boston Existing Mitigation Measures</b>   |                           |  |   |
|---|---------------------------|--|---|
| <b>Type</b>   | <b>Area Covered</b>       | <b>Effectiveness/ Implementation</b>           | <b>Improvements/ Changes Needed</b>                   |
| 51) George Wright Golf Course, Hyde Park— inspections of catch basins                         | George Wright Golf Course | Effective                                      | None  |
| 52) Engine 20, Dorchester: Elevation of new boiler and relocated to same level as generator   | Dorchester                | Sump pump maintenance; BWSC built holding tank | Additional floodproofing of buildings may be required |
| 53) Charlestown Underpass Stormwater Drainage Improvements                                    | Charlestown               | Effective                                      | Monitor roadway conditions                            |
| 54) DCR raises and lowers water level at Charles River Dam based on weather forecast.         | Charles River Dam area    | Effective                                      | None  |
| 55) BWSC can open gate at Fens Gatehouse when water levels are high to bypass conduit         | Fens area                 | Effective                                      | None  |
| 56) DCR Dam Safety Regulations  | State-wide                | Effective                                      | None  |
| 57) Parks and Recreation Flood Mitigation Sustainable Design Guidelines                       | City-wide                 | Adopted March 2011                             | None  |
| 58) Sewer Lateral Financial Assistance Program  | City-wide                 | Effective                                      | None  |
| 59) Expanded capacity for remote monitoring of water levels in streams and major trunk lines. | City-Wide                 | Effective                                      | None  |
| 60) Davenport Creek – Adams Village drainage improvements                                     | Adams Village             | Effective                                      | None  |
| 61) Drainage improvements at American Legion Highway at Wilmot St, near Stop and Shop         | Roslindale                | Effective                                      | None  |
| 62) Business Street – improve stormwater drainage and backflow valves                         | Hyde Park                 | Effective                                      | None  |
| <b>WIND HAZARDS</b>   |                           |  |   |

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| <b>Table 31 - Boston Existing Mitigation Measures</b>  |                     |                                      |                                     |
|--|---------------------|--------------------------------------|-------------------------------------|
| <b>Type</b>  | <b>Area Covered</b> | <b>Effectiveness/ Implementation</b> | <b>Improvements/ Changes Needed</b> |
| 63) Parks and Rec. Dept. regular tree maintenance  | City-wide           | Effective                            | None                                |
| 64) NSTAR clearing of downed wires   | City-wide           | Effective                            | None                                |
| 65) ISD regular inspections of construction sites  | City-wide           | Effective                            | None                                |
| 66) Underground lights systems; street lights rated for high winds                               | City-wide           | Effective                            | None                                |
| <b>WINTER HAZARDS</b>  |                     |                                      |                                     |
| 67) Traffic plan during snow storms  | City-wide           | Effective                            | None                                |
| 68) Regulations requiring sidewalk clearing by abutter and parking bans                          | City-wide           | Effective                            | None                                |
| 69) City contract with vendor for snow melters on emergency basis                                | City-wide           | Effective                            | None                                |
| 70) Snow plowing strategy  | City-wide           | Effective                            | None                                |
| 71) Fire hydrant locations are recorded with GPS and flagged for snow removal                    | City-wide           | Effective                            | None                                |
| 72) Public education on frozen pipes, snow loads on roofs, and keeping ventilation clear of snow | City-wide           | Effective                            | None                                |
| 73) Building Code requires new roofs to be designed to handle snow loads                         | City-wide           | Effective                            | None                                |
| 74) ISD can order building owners to remove icicles or cordon off area                           | City-wide           | Effective                            | None                                |
| 75) Emergency Operations Center can be used as back-up storm control center                      | City-wide           | Effective                            | None                                |
| 76) Snow Common Operational Picture (SNOWCOP) - Snow removal GPS mitigation tracking             | City-wide           | Effective                            | None                                |
| 77) Pre-treat streets in advance of icing conditions   | City-wide           | Effective                            | None                                |

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| <b>Table 31 - Boston Existing Mitigation Measures</b>  |  |  |   |
|--|--|--|---|
| <b>Type</b>  | <b>Area Covered</b>  | <b>Effectiveness/ Implementation</b>                       | <b>Improvements/ Changes Needed</b>                       |
| 78) PWD Coordinates with City Agencies to Identify Snow Dumps  | City-wide  | Effective  | None  |
| 79) PWD Coordinates with State on Clearing Snow off Bridges  | City-wide  | Effective  | None  |
| 80) Acquired new closed loop Salting Equipment for more effective salting using less salt (500 lbs/lane per mile). | City-wide  | Effective  | None  |
| <b>GEOLOGIC HAZARDS</b>  |  |  |   |
| 81) State Building Code addresses earthquake standards   | City-wide  | Effective  | None  |
| 82) Communications in Police Headquarters secured to withstand earthquake. Back-up at Frontage Road.               | Police HQ and Frontage Road                                | Effective  | None  |
| 83) Three police stations rebuilt or renovated to modern building standards  | Districts 3, 5, 7  | Effective  | None  |
| <b>COASTAL DAMAGE</b>  |  |  |   |
| 84) Long Island—Boston Property and Construction Management is stabilizing SW part of island                       | Long Island  | TBD  | TBD   |
| 85) Moon Island—Seawall inspections and assessment   | Moon Island  | Completed  | Repair Granite Seawall                                    |
| 86) East Eagle Street, East Boston—USACE study in 1989   | East Eagle Street  | A portion of the site conveyed to NSTAR for implementation | None  |
| 87) MWRA/DCAM land, East Boston—PWD is working to address erosion  | Western shore of East Boston                               | DCAM and USACE completed mitigation work                   | None  |
| 88) Reserved Channel—sewer separation under design. Debris being cleaned.  | Reserved Channel   | In construction, completion due 2015                       | None  |
| 89) Boston Harbor: USACE and MASSPORT are studying the feasibility and environmental impact of                     | Boston Harbor: main shipping channel, Reserved Channel and | Ongoing feasibility study and dredging analysis            | Federal funding authorization required for implementation |

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**Table 31 - Boston Existing Mitigation Measures**

| <b>Type</b>   | <b>Area Covered</b>                | <b>Effectiveness/ Implementation</b>                  | <b>Improvements/ Changes Needed</b>           |
|---|------------------------------------|---|---|
| deepening the main shipping channel and Reserved Channel                            | approach to Navy dry dock          |   |   |
| 90) Participation in the National Flood Insurance Program (NFIP)                    | Areas identified on the FIRM maps. | There are 1,101 policies in force.                    | Consider applying for Community Rating System |
| 91) RiskMAP Updated   | Flood Plain Expansion              | Effective   | None  |
| 92) Morrissey Boulevard, Dorchester—tide gates have been updated                    | Dorchester                         | DCR - Design Underway                                 | Complete project                              |
| 93) Dorchester- Dr. Rev. Bill Loesch Park Drainage Improvements                     | Dorchester                         | Effective - Completed and Rededicated August 11, 2012 | None  |
| 94) Dorchester- Franklin Park Drainage Improvements                                 | Dorchester                         | To be scheduled                                       | Implementation of project                     |
| 95) Hyde Park—George Wright Drainage Improvements                                   | Hyde Park                          | Ongoing program                                       | None  |
| 96) Jamaica Plain – South Street Mall Drainage Improvements                         | Jamaica Plain                      | Completed in 2010                                     | None  |
| 97) Mattapan – Almont Park / Hunt’s Playground Infrastructure Drainage Improvements | Mattapan                           | Completed June 2013                                   | None  |
| 98) Mattapan – Erie Ellington Park Drainage Improvements                            | Mattapan                           | Completed   | None  |
| 99) North End- DeFilippo Wall Infrastructure Drainage Improvements                  | North End                          | In design   | Implementation of project                     |
| 100) Roxbury- Franklin Park Site Drainage Improvements and Ventilation              | Roxbury                            | Completed September 2013                              | None  |
| 101) Mattapan- Walker Playground Drainage infrastructure                            | Mattapan                           | Completed June 2011                                   | None  |
| 102) South End – Statler Park Infrastructure Drainage Improvements                  | South End                          | Completed   | None  |



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| <b>Table 31 - Boston Existing Mitigation Measures</b>   |                     |   |  |
|---|---------------------|---|--|
| <b>Type</b>   | <b>Area Covered</b> | <b>Effectiveness/ Implementation</b>                              | <b>Improvements/ Changes Needed</b>  |
| 103) West Roxbury- Hynes Field Drainage Improvements  | West Roxbury        | Complete  | None   |
| 104) West Roxbury- Billings Field Drainage Improvements   | West Roxbury        | In construction- BWSC contract #221 issued on Oct. 19, 2011       | None   |
| 105) North Dorchester Bay CSO Project   | Dorchester          | Completed by MWRA   | None   |
| 106) Lawrence Avenue, Dorchester pipe enlargement   | Dorchester          | Project awarded for \$350K, to be completed 2013                  | None   |
| 107) Back Street Sewer and Storm Drain Project Groundwater Restoration  | Back Bay            | Completed   | None   |
| 108) Newmarket Square Storm Drains, Sewer Separation and Water Mains  | Newmarket Square    | In construction; to be completed in 2014                          | None   |
| 109) City of Boston Utility Coordination Software (COBUCS) Utility Coordination Measure   | City-wide           | Effective   | None   |
| 110) PWD Operations Center at Frontage Rd.; Coordination of PWD Assets and Resources during an incident.  | City-wide           | Effective   | None   |
| 111) MassDEP has 6-8 Emergency Oil Boom Trailers to mitigate hazardous spills in Boston Harbor. BPD Truck Team, BPD HAZMAT Unit, and BPD Harbor Patrol Unit can transport Oil Boom Trailers to site of disaster | City-wide           | Effective   | None   |
| 112) Health in All Policies ensure that equitable health impacts and climate change considerations are factored into City decision-making   | City-wide           | BPHC in partnership with multiple agencies and community partners | A pilot rapid Health Impact Assessment was completed for a BPHC property scheduled for redevelopment, partner agencies meet regularly; two |

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| <b>Table 31 - Boston Existing Mitigation Measures</b>  |                                |   |                                     |
|--|--------------------------------|---|-------------------------------------|
| <b>Type</b>  | <b>Area Covered</b>            | <b>Effectiveness/ Implementation</b>  | <b>Improvements/ Changes Needed</b> |
|  |                                |   | workshops were conducted.           |
| 113) Community outreach and education on emergency preparedness to grow resilient communities able to cope with natural hazards  | City-wide                      | Effective/Partial Implementation by BPHC – Public Health Preparedness (PHP)   | Complete implementation             |
| 114) Partnership with UMass Boston on two emergency management professional development certificate programs: (1) Inclusive Emergency Planning and (2) All Hazards Protection and Response. DelValle and UMass Courses focus on socially vulnerable populations.   | City-wide                      | Effective / Ongoing implementation by BPHC – Public Health Preparedness (PHP) | Effective, fully implemented        |
| 115) Boston Medical Reserve Corps (BMRC) Recruitment, Development, and Preparedness to support PHP in its role as the Emergency Support Function 8 (Public Health and Medical Services) Coordinator for the City of Boston. This mitigation measure will reduce the public health consequences of emergencies. | City-wide                      | Effective, implemented by BPHC – Public Health Preparedness (PHP)             | None                                |
| 116) Response to flooding at 201-211 River Street, Mattapan – repairs and upgrade sump pump capacity   | 201-211 River Street, Mattapan | Completed by BPHC and effective – no flooding last year                       | None                                |
| 117) Surveillance for new or emerging infectious diseases that pose a threat to public health: effective using multiple streams of data. Feedback provided to partners so they can take  | City-wide                      | Effective / Ongoing implementation by BPHC – Communicable disease             | None                                |

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| <b>Table 31 - Boston Existing Mitigation Measures</b>  |                     |   |                                     |
|--|---------------------|---|-------------------------------------|
| <b>Type</b>  | <b>Area Covered</b> | <b>Effectiveness/ Implementation</b>                              | <b>Improvements/ Changes Needed</b> |
| appropriate steps to reduce spread of disease.   |                     |   |                                     |
| 118) Public education on how to reduce disease risk: materials for the public and for health care providers to share with the public. Fact sheets, educational sessions. | City-wide           | Effective / Ongoing implementation by BPHC – Communicable disease | None                                |
| 119) Information and clinical guidance provided to healthcare providers. Health alerts. Use of existing health care contacts.  | City-wide           | Effective / Ongoing implementation by BPHC – Communicable disease | None                                |
| 120) Vaccine distribution on a limited basis in situations where that may be indicated.  | City-wide           | Effective / Ongoing implementation by BPHC – Communicable disease | None                                |
| 121) Community Emergency Response Teams (CERT) Preparedness Fairs  | City-wide           | Effective / Ongoing implementation by OEM                         | None                                |

**Implementation Progress on the Previous Plan**

During the planning process, City staff reviewed mitigation measures identified in the 2008 Metro-Boston Multi-Hazard Mitigation Plan Boston Annex and determined whether measures had been implemented, deferred, or were still in process. All in-process measures are carried forward into the 2014 plan update. Deferred measures were deleted or carried forward into the 2014 plan update based on an assessment of the continued relevance or effectiveness of the measure and the cause of the deferral. The status of these mitigation measures is shown in Table 32 below.

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| <b>Table 32<br/>Status of Proposed Mitigation Measures from the 2008 Plan</b> |                 |   |  |
|---|-----------------|---|--|
| <b>Mitigation Measures</b>  | <b>Priority</b> | <b>Implementation Responsibility</b>                                | <b>2013 Status</b>   |
| Muddy River Restoration   | High            | Fed., State, City, Town of Brookline<br>Boston Parks and Recreation | Phase I construction began 2013  |
| Protect Fire Alarm Building   | High            | Fire Dept.  | The Boston Property and Construction Management Dept. has filed a Notice of Intent with the Conservation Commission for site improvements                                |
| Storrow Drive and Bowker Overpass continued maintenance                       | High            | DCR and MassDOT   | In process: on-going maintenance   |
| Storrow Drive and Bowker Overpass reconstruction                              | High            | DCR and MassDOT   | In-Process - reconstruction work has begun   |
| Rebuild Charlestown – Rutherford Avenue Underpass tunnel                      | High            | BTD and MassDOT   | In process; public review process  |
| Conduct earthquake study  | High            | OEM, NESEC, HAZUS-MH and DPW  | HAZUS study complete—conceptual design   |
| Purchase fire boat  | High            | Fire Dept.  | Dive Boat purchased– Oct. 2010<br>69 Fire Boat purchased Sept. 2011  |
| Rehabilitate Long Island Bridge   | High            | Public Works Department   | Bridge has been demolished and will be replaced  |
| Acquire snow melting technology   | High            | DPW and MASSPORT  | Pilot testing with MASSPORT Logan<br>Did not receive HMGP funding  |
| Improve communications system   | High            | Multiple Depts.<br>UASI Public Safety                               | Upgrades on-going<br>UASI Grants for update  |
| Canterbury Brook Dredging   | Medium          | DCAM, BWSC, MWRA  | DCAM to complete dredging  |
| Long term solution to stabilize bank at East Eagle Street                     | Medium          | Public Facilities- PCM  | Permanent access and utility easement of 338 East Eagle Street<br>Conveyance to NSTAR on Feb 10, 2011.<br>Land 16,808 square feet; Permanent easement 13,742 square feet |
| Stabilize bank or establish new bank at Columbia Point                        | Medium          | UMass and DCAM  | Preliminary feasibility study in design  |

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Beyond the mitigation measures proposed in the 2008 Hazard Mitigation Plan, the City has since then proceeded with a number of other measures, summarized in Table 33.

| <b>Table 33<br/>Status of Other Mitigation Measures Not Included in the 2008 Plan</b>                      |   |
|--|---|
| <b>Mitigation Measures</b>   | <b>2013 Status</b>                                      |
| Establish larger primary emergency operations center   | Identified new location                                 |
| Purchase generators for fire stations without one  | Three phase installation program complete by early 2014 |
| Portable generators for City departments/ facilities   | Boston DOE LEAP Study                                   |
| Maintain and update Emergency Operations Plan (EOP), evacuation plans, other relevant plans and protocols. | OEM Updated plan  |
| Move the Police Harbor Patrol site   | Completed   |
| Retrofit man-hole covers with non conductive covers  | Ongoing replacement program                             |
| Colleges of Fenway project to restudy and map Muddy River Watershed  | USACE working on Phase 1 RFP                            |
| Sediment removal and dam operations on Neponset River in Dorchester  | Neponset River Greenway                                 |
| Expand capacity to monitor water levels remotely   | Completed real-time monitoring automated rain gauge     |
| Moon Island: implement recommendations from the Assessment   | Designer selected; project schedule TBD                 |
| Erie Street, Dorchester – new larger storm drain with easement on Erie St.                                 | Completed by Boston Water and Sewer Commission          |

**Regional and Inter-Community Considerations**

Some of Boston’s hazard mitigation issues are inter-community issues that involve cooperation between two or more municipalities, or are regional issues involving a state, regional, or federal agency.

The City of Boston has been working with Brookline on flood mitigation efforts in the Muddy River. As mitigation issues are identified for other rivers in the border areas of the City, particularly as climate change results in new hazard profiles for these waterways, the City will look for opportunities to partner with neighboring communities.

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The drainage systems that serve Boston and surrounding communities are a complex system of storm drains, roadway drainage structures, pump stations and other facilities owned and operated by a wide array of agencies including but not limited to the Boston Water and Sewer Commission, the Department of Conservation and Recreation (DCR), and Massachusetts Department of Transportation (MDOT), and in the case of combined sewer systems, the Massachusetts Water Resources Authority (MWRA). The planning, construction, operations, and maintenance of these structures are integral to the flood hazard mitigation efforts of all the communities. These agencies must be considered the City's regional partners in hazard mitigation. In the sections that follow, the plan identifies actions where cooperation with non-city agencies may be necessary.

### **Proposed Hazard Mitigation Measures**

#### Identification of Potential Mitigation Measures

The City of Boston solicited suggestions for mitigation measures from City officials and members of the Hazard Mitigation Executive Steering Committee because these individuals have the most comprehensive knowledge of local conditions. Mitigation measures from the 2008 plan that had not yet been completed were considered as well as new and modified mitigation measures not included in the previous plan. The Hazard Mitigation Executive Steering Committee reviewed and refined the list of proposed mitigation measures at its September 6, 2012 meeting and in subsequent review of the draft plan update. City officials provided the best available information on the mitigation measures, their estimated cost, and time frame for implementation.

This section describes new mitigation measures planned for the next five years. The proposed mitigation measures are listed in Table 34 below, along with priority, lead implementation, time frame, estimated cost, and potential funding source.

#### **Introduction to Table 34, Summary of Proposed Mitigation Measures**

Mitigation Measure – A brief description of each mitigation measure is provided.

Priority – As described in the following section “Prioritization of Mitigation Activities” and shown in Table 34 below, the prioritization of mitigation measures is based on multiple factors that were considered in assigning an overall rank of high, medium, or low to each mitigation measure. The ranking of each mitigation measure is shown in column 2 of Table 34

Implementation Responsibility – The Executive Steering Committee designated implementation responsibility by City agency staff and department managers. It is likely that some mitigation measures will require that several departments work together and assigning staff is the 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

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design, or already designed and awaiting funding. Funding opportunities could affect the time frame for implementation.

Estimated Cost - The cost data, if available, represent current rough estimates only.

Potential Funding Sources – This column identifies likely sources of funding for each measure. Agencies with implementation responsibility in most cases will be responsible for pursuing funding opportunities. Funding sources may be internal or external to the City. Many measures may require several funding sources. Identification of a potential funding source does not guarantee that a project will be eligible for or selected for funding.

**Abbreviations Used in Table 34**

**Federal**

FEMA Mitigation Grants includes:

FMA = Flood Mitigation Assistance Program.

HMGP = Hazard Mitigation Grant Program.

PDM = Pre-Disaster Mitigation Program

ACOE = U. S. Army Corps of Engineers

EPA = U.S. Environmental Protection Agency

NPS = National Park Service

USCG = US Coast Guard

USDA = United States Department of Agriculture

**State**

CZM = Coastal Zone Management

DCR = MA Department of Conservation and Recreation

DEP = MA Department of Environmental Protection (State Revolving Fund)

Mass DOT = Massachusetts Department of Transportation

MBTA = Massachusetts Bay Transit Authority

**City**

BFD = Boston Fire Department

BRA = Boston Redevelopment Authority

BPHC = Boston Public Health Commission

BWSC = Boston Water and Sewer Commission

EDIC = Boston Economic Development and Industrial Corporation

ISD = Boston Inspectional Services Department

OEM = Mayor's Office of Emergency Management

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| <b>Table 34 - Proposed Mitigation Measures</b>   |                 |   |                   |                           |                                     |
|--|-----------------|---|-------------------|---------------------------|-------------------------------------|
| <b>Mitigation Measure</b>  | <b>Priority</b> | <b>Lead Implementation</b>                            | <b>Time Frame</b> | <b>Estimated Cost</b>     | <b>Potential Funding Sources</b>    |
| <b>Flood Hazard Mitigation Measures</b>  |                 |   |                   |                           |                                     |
| 1) Muddy River Restoration – flood control   | HIGH            | Fed., State, Boston Parks and Rec., Town of Brookline | 2017              | \$92 M                    | Federal, state, and local funding   |
| 2) Storrow Drive reconstruction and drainage improvements  | HIGH            | DCR   | 2018              | \$45 – 135 M              | State, Federal transportation funds |
| 3) Charlestown Underpass –replace tunnel with urban boulevard and drainage improvements  | HIGH            | Boston Transportation Dept.                           | TBD               | \$100 M                   | Federal Highway Administration      |
| 4) Dredging to address Canterbury Brook flooding in Mattapan (DCAM)  | HIGH            | DCAM  | 2017              | > \$1 M                   | State, DCAM                         |
| 5) Morrissey Boulevard rehabilitation, including tidal flooding and drainage improvements  | HIGH            | DCR   | 2018              | \$25 M                    | State – DCR/Federal                 |
| 6) Longwood Medical Area drainage improvements   | MED             | BWSC  | 2014              | \$178,425                 | BWSC                                |
| 7) Floodproof basement and elevate utilities for Engine 20, Dorchester   | MED             | BFD   | 2016              | \$100 - \$250K            | City/BFD                            |
| 8) Assess the vulnerability of Central Artery and Mass. Pike to riverine and coastal flooding, particularly with climate change, in order to develop mitigation measures | HIGH            | MassDOT   | 2014-15           | Staff time for assessment | State/MassDOT                       |



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| <b>Table 34 - Proposed Mitigation Measures</b>   |                 |                            |                   |                           |                                  |
|--|-----------------|----------------------------|-------------------|---------------------------|----------------------------------|
| <b>Mitigation Measure</b>  | <b>Priority</b> | <b>Lead Implementation</b> | <b>Time Frame</b> | <b>Estimated Cost</b>     | <b>Potential Funding Sources</b> |
| 9) Assess the vulnerability of the MBTA system to coastal and riverine flooding and to heat waves, particularly with climate change in order to develop mitigation measures                              | HIGH            | MBTA                       | 2014-15           | Staff time for assessment | MBTA                             |
| 10) Assess vulnerability of the electrical grid, particular major distribution lines and substations to natural hazards likely to be increased by climate change in order to develop mitigation measures | HIGH            | Electric Utilities         | 2014-2016         | TBD                       | Electric Utilities               |
| 11) Assess Stormwater Management Drainage System in order to recommend Improvements to storm drains at the Uphams Corner, McKim and Lower Mills Branch Libraries   | MED             | BWSC                       | 2015              | Staff time for assessment | BWSC                             |
| 12) Assess Boston Marine Industrial Park Stormwater Management System and implement Improvements   | MED             | BRA                        | 2016-17           | \$1.5-2M                  | City/BRA                         |
| 13) Lawrence Street, Roxbury – construct large drain on easement   | MED             | BWSC                       | 2014              | \$350,000                 | BWSC                             |
| <b>Wind Hazard Mitigation Measures</b>   |                 |                            |                   |                           |                                  |
| 14) Assessment of mast arms for wind vulnerability at signalized intersections on State Major Arterials and Roadways   | LOW             | MassDOT                    | 2017              | Staff time for assessment | State-MassDOT                    |

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| <b>Table 34 - Proposed Mitigation Measures</b>  |                 |   |                   |                       |                                  |
|---|-----------------|---|-------------------|-----------------------|----------------------------------|
| <b>Mitigation Measure</b>   | <b>Priority</b> | <b>Lead Implementation</b>                                  | <b>Time Frame</b> | <b>Estimated Cost</b> | <b>Potential Funding Sources</b> |
| 15) Public education on Hurricane and Tornado Awareness, using Red Cross Tornado APP for iPhone and Android smart phones.                                     | MED             | OEM will develop outreach as part of ALERT BOSTON           | 2016              | Staff Cost            | City/OEM                         |
| 16) New street tree planting standards on spacing and soil volume to increase wind resilience   | MED             | ???   | 2016-17           | Staff cost            | City                             |
| <b>Geologic Hazard Mitigation Measures</b>  |                 |   |                   |                       |                                  |
| 17) Purchase Android-based mobile GPS Tablets for ISD Inspectors (60 units) (preparedness)  | MED             | ISD & DoIT  | 2015-16           | \$6,000               | City/ISD DoIT & Federal          |
| 18) Conduct Study for Retrofit of Unreinforced masonry buildings to improve earthquake resilience of municipal buildings                                      | MED             | Office of Property Management with various City Departments | 2015-18           | Less than \$10K       | City/OPM                         |
| 19) Add Quake Smart Program and Earthquake Alert APP (preparedness)   | MED             | OEM with various City Departments                           | 2015-18           | Staff time            | City/OEM                         |
| 20) Purchase ASA/DHS FINDER for Fire Dept. (Preparedness)   | HIGH            | Boston Fire Dept.   | 2017              | TBD once COTS         | Federal                          |
| 21) Increase public education on earthquakes using Red Cross Earthquake APP for iPhones and Android Smart Phones and participate in annual Northeast SHAKEOUT | MED             | OEM will develop outreach as part of ALERT BOSTON           |                   | Staff Cost            | 2015                             |

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| <b>Table 34 - Proposed Mitigation Measures</b>  |                 |   |                   |                                     |   |
|---|-----------------|---|-------------------|-------------------------------------|---|
| <b>Mitigation Measure</b>   | <b>Priority</b> | <b>Lead Implementation</b>  | <b>Time Frame</b> | <b>Estimated Cost</b>               | <b>Potential Funding Sources</b>                      |
| <b>Coastal Damage Mitigation Measures</b>   |                 |   |                   |                                     |   |
| 22) Moon Island seawall rehabilitation to mitigate coastal hazards  | MED             | Property and Construction Management  | 2016              | \$1.5M                              | City  |
| 23) Stabilize bank or establish new bank at Columbia Point to mitigate coastal hazards  | MED             | UMass Boston, state   | 2016              | Less than \$1 M                     | State/UMASS/DCR and private funding                   |
| 24) Long term solution to stabilize bank at East Eagle Street to mitigate coastal hazards   | MED             | US Army Corps of Engineers  | 2016              | Less than \$1 M                     | Federal USACOE  |
| 25) Assess feasibility of strengthening seawalls and/or adding vegetation for shoreline stabilization along Morrissey Blvd. to mitigate coastal hazards | MED             | DCR   | 2016              | Staff time for assessment           | State/DCR   |
| 26) Stabilize coastal bank along the eastern side of Long Island, adjacent to the Public Health Commission's campus to mitigate coastal hazards         | MED             | Property and Construction Management  | 2017              | \$7,000 to \$10,000 per linear foot | City/PCM and State/DCR                                |
| 27) Assess Boston Harbor waterfront for additional sea and flood wall protection to mitigate coastal hazards  | MED             | Collaboration of BRA, EDIC, DCR, CZM, MassDOT, USCG, Navy, NPS TBHA, Businesses | 2017              | Staff time for assessment           | City/BRA/EDIC and State/DCR/CZM/DOT Federal/USGS/Navy |
| 28) Assess impact of tidal flooding at McCormack and Dever schools, 315 Mt. Vernon Street, Columbia Point, Dorchester to develop mitigate measures      | MED             | Property and Construction Management  | 2018              | Less than \$10K                     | City/PCM  |

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| <b>Table 34 - Proposed Mitigation Measures</b>  |                 |  |                   |  |                                  |
|---|-----------------|--|-------------------|--|----------------------------------|
| <b>Mitigation Measure</b>   | <b>Priority</b> | <b>Lead Implementation</b>                       | <b>Time Frame</b> | <b>Estimated Cost</b>  | <b>Potential Funding Sources</b> |
| <b>Extreme Heat Mitigation Measures</b>   |                 |  |                   |  |                                  |
| 29) Tree Planting program to mitigate extreme heat and stormwater impacts to mitigate extreme heat                                | HIGH            | Boston Parks and Recreation                      | 2014-18           | TBD  | City/BPR                         |
| 30) Cool Roofs Program – Green Roofs and White Roofs to mitigate extreme heat   | MED             | Boston Environment Dept.                         | 2014-18           | TBD  | City/Env. Dept.                  |
| <b>Fire Hazard Mitigation Measures</b>  |                 |  |                   |  |                                  |
| 31) Assess feasibility of NFPA FireWise Program for urban environmental education of homeowners on reducing brush and mulch fires | MED             | BFD, Fire Prevention Division                    | 2015              | Staff time   | City/BFD                         |
| 32) Boston Fire Prevention Programs (preparedness)  | MED             | BFD Fire Prevention Division                     | 2014-18           | Staff time   | City/BFD                         |
| 33) Boston Fire Life Safety Plan Program (preparedness)   | HIGH            | Boston Fire Dept., Office of Field Services      | 2014-18           | Staff time   | City/BFD                         |
| 34) Boston Fire LEPC Tier II Manager (preparedness)   | HIGH            | Boston Fire Dept., Office of Field Services LEPC | 2014-18           | License and Staff time   | City/BFD State                   |
| <b>Solar Storm Mitigation Measures</b>  |                 |  |                   |  |                                  |
| 35) Inventory equipment vulnerable to Solar Storm EMPs  | MED             | OEM Logistics                                    | 2014-15           | Staff time   | City/OEM                         |
| 36) Build Faraday Cages to store and protect redundant radio and communication equipment, lap tops, and batteries.                | MED             | OEM and City Departments                         | 2014-15           | Cage without redundant equipment \$40 - \$50,000<br>Cages with equipment \$500,000 | City/OEM                         |

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| <b>Table 34 - Proposed Mitigation Measures</b>   |                 |  |                   |  |  |
|--|-----------------|--|-------------------|--|--|
| <b>Mitigation Measure</b>  | <b>Priority</b> | <b>Lead Implementation</b>               | <b>Time Frame</b> | <b>Estimated Cost</b>  | <b>Potential Funding Sources</b>         |
| <b>Other Hazard Mitigation Measures</b>  |                 |  |                   |  |  |
| 37) Prevent outbreaks of West Nile Virus and Eastern Equine Encephalitis by treating catch basins with mosquito larvacides   | MED             | BPHC and Suffolk County Mosquito Control | 2014-18           | \$35,954 for materials per treatment, plus staff time (ISD, BHA, BPHC, DCR & Zoo NE) for application | BPHC and Suffolk County Mosquito Control |
| 38) Assess the risk of water-reactive chemicals stored in flood-prone buildings to mitigate flood hazards  | LOW             | BFD HAZMAT and BFD LEPC                  | 2015              | Staff time for assessment  | City/BFD                                 |
| 39) Monitor Outbreak of Invasive Species and Eradicate Asian Longhorned Beetle treating host trees with imidacloprid   | MED             | USDA                                     | 2014-16           | \$55,000 per year  | Federal –USDA APHIS                      |
| <b>Multi-Hazard Mitigation Measures</b>  |                 |  |                   |  |  |
| 40) Participate in the Community Rating System   | MED             | Boston Environment Dept.                 | 2015              | Staff time   | City/Env. Dept.                          |
| 41) Update Storm Ready Certification with NWS  | MED             | Boston OEM                               | 2016              | Staff time   | City/OEM                                 |
| 42) Adopt a tree retention ordinance to preserve existing trees or equally compensate for the loss of the tree's caliper (mitigation for both flooding and extreme heat) | HIGH            | TBD                                      | 2014-15           | Staff time   | City                                     |
| 43) Community Preparedness Workshops and Outreach (preparedness)   | HIGH            | OEM                                      | 2014-18           | Staff time   | City/OEM                                 |

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| <b>Table 34 - Proposed Mitigation Measures</b>   |                 |                                 |                   |                                    |                                  |
|--|-----------------|---------------------------------|-------------------|------------------------------------|----------------------------------|
| <b>Mitigation Measure</b>  | <b>Priority</b> | <b>Lead Implementation</b>      | <b>Time Frame</b> | <b>Estimated Cost</b>              | <b>Potential Funding Sources</b> |
| 44) Establish a multi-cultural and multi-language public awareness program on natural hazards and mitigation   | HIGH            | OEM                             | 2016-18           | Staff time                         | City/OEM                         |
| 45) Conduct a survey of emergency generators at critical infrastructure facilities, municipal buildings, shelters and youth hostels                                      | HIGH            | OEM                             | 2016-18           | Staff time                         | City/OEM                         |
| 46) Evaluate feasibility of mobilizing passenger ferries for evacuation (preparedness)   | MED             | OEM                             | 2017              | Staff time                         | City/OEM                         |
| <b>Climate Change Adaptation Mitigation Measures</b>   |                 |                                 |                   |                                    |                                  |
| 47) Convene a Cabinet level <i>Climate Preparedness Task Force</i> to review current activities and policies and provide guidance for further development (preparedness) | HIGH            | Climate Preparedness Task Force | 2014-15           | Staff time for review and guidance | City                             |
| 48) Identify ways for institutions and businesses to reduce their vulnerability to climate change and for the City of Boston to support those efforts                    | HIGH            | Green Ribbon Commission         | 2014-15           | Staff time for Commission support  | City                             |
| 49) Survey the preparedness of existing buildings and other assets (e.g. MBTA stations) for climate change (preparedness)  | HIGH            | Boston Redevelopment Authority  | 2014-15           | Staff time for survey              | City/BRA                         |

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| <b>Table 34 - Proposed Mitigation Measures</b>  |                 |  |                   |   |                                  |
|---|-----------------|--|-------------------|---|----------------------------------|
| <b>Mitigation Measure</b>   | <b>Priority</b> | <b>Lead Implementation</b>   | <b>Time Frame</b> | <b>Estimated Cost</b>                                       | <b>Potential Funding Sources</b> |
| 50) Include climate change preparedness in Article 80 Development Review to enhance flood mitigation  | HIGH            | Boston Redevelopment Authority                                       | 2014-15           | Staff time for drafting Article 80 guidelines and checklist | City/BRA                         |
| 51) Adopt a Wetlands Ordinance that includes sea-level rise and develop new floodplain maps that incorporate projected climate change to mitigate flood hazards | MED             | Boston Conservation Commission                                       | 2014-15           | Staff time for drafting ordinance and preparing maps        | City/BCC                         |
| 52) Develop guidelines and prioritization for better enforcement of flood proofing standards to mitigate flood hazards  | MED             | Inspectional Services Department and Boston Public Health Commission | 2014-15           | Staff time for drafting guidelines                          | City/ISD/BPHC                    |
| 53) Review emergency operation planning for storms and flooding (preparedness)  | HIGH            | Office of Emergency Management                                       | 2014-15           | Staff time for assessment                                   | City/OEM                         |

**Prioritization of Mitigation Activities**

The last step in developing the mitigation strategy is to assign a level of priority to each mitigation measure. Prioritization is based on current estimates of the existing and potential hazard impacts and of the costs of action and inaction.

Prioritization of mitigation measures was conducted by members of the Boston Hazard Mitigation Steering Committee, as shown in Table 35. The priority of each mitigation measure represents the judgment of the Steering Committee based on multiple factors, including the hazard risk that the measure addresses, the geographic extent or criticality of the location affected by the measure, the potential benefit, and the estimated relative cost or complexity of the measure.

The estimated benefit created by a mitigation measure was based on a qualitative estimate based on local knowledge of hazard areas, the number of homes, businesses, or people served by the mitigation action and an estimate of the costs or damages avoided via implementation of the mitigation measure. Estimated costs were ranked in terms of High (greater than \$10,000,000), Medium (\$2,000,000 to \$10,000,000), or Low (less than \$2,000,000, or staff time). Based on these factors, each mitigation measure was assigned

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an overall priority (High, Medium or Low). The time frame for each mitigation measure is also indicated.

| <b>Table 35 - Prioritization of Proposed Mitigation Measures</b>                            |                          |                          |                       |                         |                   |
|---|--------------------------|--------------------------|-----------------------|-------------------------|-------------------|
| <b>Mitigation Actions by Hazard Risk</b>  | <b>Geographic Extent</b> | <b>Estimated Benefit</b> | <b>Estimated Cost</b> | <b>Overall Priority</b> | <b>Time Frame</b> |
| <b>Flood Hazard Mitigation Measures</b>   |                          |                          |                       |                         |                   |
| 1) Muddy River Restoration-flood control  | Fenway                   | High                     | High                  | <b>High</b>             | 2014-18           |
| 2) Storrow Drive reconstruction and drainage improvements                                   | Back Bay                 | High                     | High                  | <b>High</b>             | 2017              |
| 3)Charlestown Underpass – replace tunnel with urban boulevard and drainage improvements     | Charlestown              | High                     | Medium                | <b>High</b>             | 2018              |
| 4) Dredging to address Canterbury Brook flooding– (DCAM)                                    | Mattapan                 | Medium                   | Medium                | <b>High</b>             | 2015              |
| 5) Morrissey Blvd. rehabilitation, including tidal flooding and drainage improvements       | Dorchester               | High                     | Med/High              | <b>High</b>             | 2018              |
| 6) Longwood Medical Area drainage improvements –  | Fenway/LMA               | Medium                   | Low                   | <b>Medium</b>           | 2014              |
| 7) Floodproof basement and elevate utilities for Flood prevention for Engine 20, Dorchester | Dorchester               | Low                      | Medium                | <b>Low</b>              | 2016              |



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| <b>Table 35 - Prioritization of Proposed Mitigation Measures</b>   |                          |                          |                       |                         |                   |
|--|--------------------------|--------------------------|-----------------------|-------------------------|-------------------|
| <b>Mitigation Actions by Hazard Risk</b>   | <b>Geographic Extent</b> | <b>Estimated Benefit</b> | <b>Estimated Cost</b> | <b>Overall Priority</b> | <b>Time Frame</b> |
| 8) Assess the vulnerability of Central Artery and Mass. Pike to riverine and coastal flooding, particularly with climate change , in order to develop mitigation measures                                    | City-wide                | Medium                   | Low                   | <b>High</b>             | 2014-15           |
| 9) Assess the vulnerability of the MBTA system to coastal and riverine flooding and to heat waves, particularly with climate change in order to develop mitigation measures                                  | City-wide                | Medium                   | Low                   | <b>High</b>             | 2014-15           |
| 10) Assess the vulnerability of the electrical grid, particular major distribution lines and substations to natural hazards likely to be increased by climate change in order to develop mitigation measures | City-wide                | High                     | Medium                | <b>High</b>             | 2014-16           |
| 11) Assess Stormwater Management Drainage System in order to recommend improvements to storm drains at the Uphams Corner, McKim and Lower  | Dorchester               | Medium                   | Low                   | <b>Medium</b>           | 2015              |

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| <b>Table 35 - Prioritization of Proposed Mitigation Measures</b>  |                          |                          |                       |                         |                   |
|---|--------------------------|--------------------------|-----------------------|-------------------------|-------------------|
| <b>Mitigation Actions by Hazard Risk</b>  | <b>Geographic Extent</b> | <b>Estimated Benefit</b> | <b>Estimated Cost</b> | <b>Overall Priority</b> | <b>Time Frame</b> |
| Mills Branch Libraries  |                          |                          |                       |                         |                   |
| 12) Assess Boston Marine Industrial Park Stormwater Management System Assessment and implement Improvements         | South Boston             | Medium                   | Medium                | <b>Medium</b>           | 2016-2017         |
| 13) Lawrence Street, Roxbury – construct large drain on easement  | Roxbury                  | Medium                   | Medium                | <b>Medium</b>           | 2016              |
| <b>Wind Hazard Mitigation Measures</b>  |                          |                          |                       |                         |                   |
| 14) Assessment of mast arms for wind vulnerability at signalized intersections on Major Arterials on State Roadways | City-wide                | Medium                   | Low                   | <b>Low</b>              | 2016              |
| 15) Public Education on Hurricanes and Tornadoes, using Red Cross Tornado APP for iPhone and Android smart phones.  | City-wide                | Medium                   | Low                   | <b>Medium</b>           | 2015              |
| 16) New street tree planting standards on spacing and soil volume to increase wind resilience                       | City-wide                | Medium                   | Low                   | <b>Medium</b>           | 2015-16           |
| <b>Geologic Hazard Mitigation Measures</b>  |                          |                          |                       |                         |                   |
| 17) Purchase Android-based mobile GPS Tablets for ISD Inspectors  | City-wide                | Medium                   | Medium                | <b>Medium</b>           | 2015-16           |

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| <b>Table 35 - Prioritization of Proposed Mitigation Measures</b>  |                          |                          |                       |                         |                   |
|---|--------------------------|--------------------------|-----------------------|-------------------------|-------------------|
| <b>Mitigation Actions by Hazard Risk</b>  | <b>Geographic Extent</b> | <b>Estimated Benefit</b> | <b>Estimated Cost</b> | <b>Overall Priority</b> | <b>Time Frame</b> |
| (preparedness)  |                          |                          |                       |                         |                   |
| 18) Conduct study for retrofit of unreinforced masonry to improve earthquake resilience of municipal buildings  | City-wide                | Medium                   | Medium                | <b>Medium</b>           | 2014-18           |
| 19) Participate in the Quake Smart Program  | City-wide                | Medium                   | Medium                | <b>Medium</b>           | 2015-18           |
| 20) Purchase ASA/DHS FINDER for Fire Dept.(preparedness)  | City-wide                | High                     | TBD once COTS         | <b>High</b>             | 2017              |
| 21) Increase public education on earthquakes using Red Cross Earthquake APP for iPhones and Android Smart Phones and participate in annual Northeast SHAKEOUT | City-wide                | Medium                   | Medium                | <b>Medium</b>           | 2016              |
| <b>Coastal Damage Mitigation Measures</b>   |                          |                          |                       |                         |                   |
| 22) Moon Island seawall rehabilitation  | Moon Island              | Medium                   | Medium                | <b>Medium</b>           | 2017              |
| 23) Stabilize bank or establish new bank at Columbia Point to mitigate coastal hazards  | Columbia Point           | Medium                   | Low                   | <b>Medium</b>           | 2016              |
| 24) Long term solution to stabilize bank at East Eagle Street to mitigate coastal hazards   | East Boston              | Medium                   | Low                   | <b>Medium</b>           | 2016              |
| 25) Assess feasibility of strengthening seawalls and/or adding vegetation for shoreline stabilization   | Dorchester               | Medium                   | Low                   | <b>Medium</b>           | 2016              |

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| <b>Table 35 - Prioritization of Proposed Mitigation Measures</b>  |                          |                          |                       |                         |                   |
|---|--------------------------|--------------------------|-----------------------|-------------------------|-------------------|
| <b>Mitigation Actions by Hazard Risk</b>  | <b>Geographic Extent</b> | <b>Estimated Benefit</b> | <b>Estimated Cost</b> | <b>Overall Priority</b> | <b>Time Frame</b> |
| along Morrissey Blvd. to mitigate coastal hazards   |                          |                          |                       |                         |                   |
| 26) Stabilize coastal bank along the eastern side of Long Island, adjacent to the Public Health Commission's campus to mitigate coastal hazards | Long Island              | Medium                   | Medium                | <b>Medium</b>           | 2017              |
| 27) Assess Boston Harbor waterfront for additional sea and flood wall protection to mitigate coastal hazards                                    | Boston Harbor coastline  | Medium                   | Medium                | <b>Medium</b>           | 2017              |
| 28) Assess impact of tidal flooding at McCormack and Dever public schools, 315 Mt. Vernon St, Dorchester to develop mitigation actions          | Columbia Pt, Dorchester  | Medium                   | Low                   | <b>Medium</b>           | 2017              |
| <b>Extreme Heat Mitigation Measures</b>   |                          |                          |                       |                         |                   |
| 29) Tree Planting program to mitigate extreme heat and stormwater impacts   | City-wide                | High                     | High                  | <b>High</b>             | 2014-18           |
| 30) Cool Roofs Program – Green Roofs and White Roofs to mitigate extreme heat   | City-wide                | Medium                   | Low                   | <b>Medium</b>           | 2014-18           |
| <b>Fire Hazard Mitigation Measures</b>  |                          |                          |                       |                         |                   |
| 31) Assess feasibility of NFPA FireWise Program for urban environmental   | City-wide                | Medium                   | Low                   | <b>Medium</b>           | 2016              |

**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**

| <b>Table 35 - Prioritization of Proposed Mitigation Measures</b>   |                          |                          |                       |                         |                   |
|--|--------------------------|--------------------------|-----------------------|-------------------------|-------------------|
| <b>Mitigation Actions by Hazard Risk</b>   | <b>Geographic Extent</b> | <b>Estimated Benefit</b> | <b>Estimated Cost</b> | <b>Overall Priority</b> | <b>Time Frame</b> |
| education of homeowners on reducing brush and mulch fires  |                          |                          |                       |                         |                   |
| 32) Boston Fire Prevention Programs (preparedness)   | City-Wide                | Medium                   | Low                   | <b>Medium</b>           | 2015              |
| 33) Life Safety Plan Program (preparedness)  | City-Wide                | High                     | Low                   | <b>High</b>             | 2014-18           |
| 34) Boston Fire LEPC Tier II Manager (preparedness)  | City-Wide                | High                     | Low                   | <b>High</b>             | 2014-18           |
| <b>Solar Storm Mitigation Measures</b>   |                          |                          |                       |                         |                   |
| 35) Inventory equipment vulnerable to Solar Storm EMPs   | City-wide                | High                     | Low                   | <b>Medium</b>           | 2014-15           |
| 36) Build Faraday Cages to protect redundant radio and communication equipment, lap tops, and batteries.                   | City-wide                | High                     | Medium                | <b>Medium</b>           | 2014-15           |
| <b>Other Hazard Mitigation Measures</b>  |                          |                          |                       |                         |                   |
| 37) Prevent outbreaks of West Nile Virus and Eastern Equine Encephalitis by treating catch basins with mosquito larvacides | City-wide                | Medium                   | Low                   | <b>Medium</b>           | 2014-18           |
| 38) LEPC Assess the risk of water-reactive chemicals stored in flood-prone buildings to mitigate flood hazards             | City-wide                | Low                      | Low                   | <b>Low</b>              | 2015              |

**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
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| <b>Table 35 - Prioritization of Proposed Mitigation Measures</b>   |                          |                          |                       |                         |                   |
|--|--------------------------|--------------------------|-----------------------|-------------------------|-------------------|
| <b>Mitigation Actions by Hazard Risk</b>   | <b>Geographic Extent</b> | <b>Estimated Benefit</b> | <b>Estimated Cost</b> | <b>Overall Priority</b> | <b>Time Frame</b> |
| 39) Monitor Outbreak of Invasive Species and Eradicate Asian Longhorned Beetle treating host trees with imidacloprid   | City-Wide                | Medium                   | Low                   | <b>Medium</b>           | 2015              |
| <b>Multi-Hazard Mitigation Measures</b>  |                          |                          |                       |                         |                   |
| 40) Participate in the Community Rating System   | City-wide                | Medium                   | Low                   | <b>Medium</b>           | 2015              |
| 41) Update Storm Ready Certification with NWS  | City-wide                | Medium                   | Low                   | <b>Medium</b>           | 2016              |
| 42) Adopt a tree retention ordinance to preserve existing trees or equally compensate for the loss of the tree's caliper (mitigation for both flooding and extreme heat) | City-wide                | High                     | Low                   | <b>High</b>             | 2014-15           |
| 43) Community Preparedness Workshops and Outreach (preparedness)   | City-wide                | High                     | Low                   | <b>High</b>             | 2014-18           |
| 44) Establish a multi-cultural and multi-language public awareness program on natural hazards and mitigation   | City-wide                | High                     | Medium                | <b>High</b>             | 2015-17           |
| 45) Conduct a survey of emergency generators at critical infrastructure facilities, municipal buildings, shelters  | City-wide                | Medium                   | Low                   | <b>Medium</b>           | 2015-16           |

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| <b>Table 35 - Prioritization of Proposed Mitigation Measures</b>   |                          |                          |                       |                         |                   |
|--|--------------------------|--------------------------|-----------------------|-------------------------|-------------------|
| <b>Mitigation Actions by Hazard Risk</b>   | <b>Geographic Extent</b> | <b>Estimated Benefit</b> | <b>Estimated Cost</b> | <b>Overall Priority</b> | <b>Time Frame</b> |
| and youth hostels In order to upgrade as needed  |                          |                          |                       |                         |                   |
| 46) Evaluate feasibility of mobilizing passenger ferries for evacuation (preparedness)   | Waterfront               | Medium                   | Low                   | <b>Medium</b>           | 2016              |
| <b>Climate Change Adaptation Mitigation Measures</b>   |                          |                          |                       |                         |                   |
| 47) Convene a Cabinet level <i>Climate Preparedness Task Force</i> to review current activities and policies and provide guidance for further development (preparedness) | City-wide                | High                     | High                  | <b>High</b>             | 2014-15           |
| 48) Identify ways for institutions and businesses to reduce their vulnerability to climate change and for the City of Boston to support those efforts                    | City-wide                | High                     | High                  | <b>High</b>             | 2014-15           |
| 49) Survey the preparedness of existing buildings and other assets (e.g. MBTA stations) for climate change (preparedness)  | City-wide                | High                     | Medium                | <b>High</b>             | 2014-15           |
| 50) Include climate change preparedness in Article 80 Development Review to enhance flood mitigation   | City-wide                | High                     | Low                   | <b>High</b>             | 2014-15           |

**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
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| <b>Table 35 - Prioritization of Proposed Mitigation Measures</b>  |                          |                          |                       |                         |                   |
|---|--------------------------|--------------------------|-----------------------|-------------------------|-------------------|
| <b>Mitigation Actions by Hazard Risk</b>  | <b>Geographic Extent</b> | <b>Estimated Benefit</b> | <b>Estimated Cost</b> | <b>Overall Priority</b> | <b>Time Frame</b> |
| 51) Adopt a Wetlands Ordinance that includes sea-level rise and develop new floodplain maps that incorporate projected climate change to mitigate flood hazards | City-wide                | High                     | Low                   | <b>High</b>             | 2014-15           |
| 52) Develop guidelines and prioritization for better enforcement of flood proofing standards to mitigate flood hazards  | City-wide                | High                     | Low                   | <b>High</b>             | 2014-15           |
| 53) Review emergency operation planning for storms and flooding (preparedness)  | City-wide                | High                     | Low                   | <b>High</b>             | 2014-15           |



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## **VII. PLAN ADOPTION AND MAINTENANCE**

### **Plan Adoption**

The Boston Hazard Mitigation Plan 2014 Update was adopted by the Boston City Council on September 16, 2015. See Appendix H for documentation. The plan was approved by FEMA on January 8, 2016 for a five-year period that will expire on January 8, 2021.

### **Plan Maintenance**

Although many of the recommended mitigation measures from the City's previous Hazard Mitigation Plan have been implemented, since that plan was adopted in 2008 there has not been a formal local process to guide implementation of the plan or integrate it with other City plans and programs. Such a process is needed over the next five years for the implementation of this plan update, and will be structured as described below.

The Boston Hazard Mitigation Steering Committee oversaw the preparation of this plan update. This group will continue to meet on an as-needed basis to function as the Local Hazard Mitigation Implementation Group, and maintain and update the plan in accordance with the City's policies and procedures as described below. The City will continue public participation during the next 5-year planning cycle. Yearly reviews of the plan as well as the Five Year Comprehensive Update (as described below under policy # OEM-2012-005), will be publicly noticed in accordance with City and state open meeting laws, and the current plan will be available to the public on the City's website. Any comments received will be reviewed and considered by the Hazard Mitigation Steering Committee.

### **Implementation Schedule**

The Boston Office of Emergency Management's (OEM) Emergency Management Plans Maintenance Policy (OEM-2011-001, effective December 9, 2011, as revised by OEM 2011-001-REV A, revision date August 6, 2011) establishes the following policy for plan maintenance:

#### **3. POLICY**

- a. Emergency management plans contain information on policies, roles, and responsibilities, operational procedures, and several other topics involved in the planning and response to incidents. These plans are "living documents" that involve the coordination of multiple City departments and the information contained in the plans will become obsolete as department roles and standard operating procedures (SOP's) change.

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- b. Roles and Responsibilities
  - i. Boston Emergency Management Advisory Council (BEMAC): Responsible for final review and approval of the City’s Emergency Operation Plan.
  - ii. Office of Emergency Management: The OEM is charged with maintenance of emergency management plans and keeping annexes, appendices, attachments, and figures current. Plan revisions will be coordinated by the OEM Director who will ensure that an annual review is conducted for each plan in accordance with the schedule listed in this policy.
  - iii. City Departments: City of Boston Departments Offices, and Commissions that have a role in any of the plans covered by this policy will be responsible for reviewing and updating the plan in accordance with the schedule listed in this policy.
  - iv. External Agencies: Any outside agency with a role in any of the plans covered by this policy is responsible for reviewing and updating the pan when requested.
- c. Each plan will be reviewed annually according to the following schedule:

Hazard Mitigation – June 1

Each plan will also be reviewed following any exercise or activation of the plan that identifies potential improvements.

4. PROCEDURE

- a. Plans will be reviewed according to a specified procedure which is outlined below:
  - v. Hazard Mitigation Plan – This plan will be reviewed in accordance with OEM’s Hazard Mitigation Program Policy (policy # OEM-2012-005)

The above referred policy, OEM’s Hazard Mitigation Program Policy (OEM-2012-005, effective April 15, 2012) specifies a Hazard Mitigation Plan Review procedure at Section 3c, as follows:

- i. Yearly Review: the City of Boston, through the direction of the Boston Hazard Mitigation Steering Committee, will perform an annual review of its Hazard Mitigation Plan. This comprehensive examination will include: a prioritization and re-evaluation of mitigation project; a re-prioritization of projects, as appropriate; an assessment of each project’s current status; and recommendations for improvements and/or changes. The Boston Hazard Mitigation Steering Committee will produce an annual Hazard Mitigation Status Report that represents the results of the annual review

## **CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN 2014 UPDATE**

- ii. Five Year Comprehensive Update: Per Federal Emergency Management Agency (FEMA) regulations, the Hazard Mitigation Plan will undergo a comprehensive review and update every five years. The Plan will be forwarded first to the Massachusetts Emergency Management Agency and the Massachusetts Department of Conservation and Recreation for initial review; then to FEMA for final approval, and lastly to the Boston City Council for adoption

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 Hazard Mitigation Steering Committee will begin the process by the end of Year 3.

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

Upon approval of the Boston Hazard Mitigation Plan 2014 Update by FEMA, the Local Hazard Mitigation Implementation 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 Hazard Mitigation Executive Steering Committee will review and discuss the plan with the following departments:

- Office of Emergency Management
- Boston Water and Sewer Commission
- Boston Public Works Department
- Boston Redevelopment Authority
- Boston Public Health Commission
- Boston Fire Department
- Boston Police Department
- Boston Conservation Commission
- Boston Parks and Recreation

Other groups that will be coordinated with include large institutions, Chamber of Commerce, land conservation organizations and watershed groups. The plan will also be posted on the City’s website after reviewing it 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.

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**VIII. LIST OF REFERENCES**

*Capital Improvement Program*, Boston Water and Sewer Commission

*Boston Fire Alarm Risk Assessment and Protective Measures Plan*, URS Corporation.  
March 7, 2006.

*Infrastructure Systems, Services and Climate Change: Integrated Impacts and Response Strategies for the Boston Metropolitan Area*. Also referred to as “CLIMB”. Tufts University, University of Maryland, Center for Transportation Studies, and MAPC  
August 13, 2004.

*Massachusetts State Hazard Mitigation Plan*. Commonwealth of Massachusetts, 2013.

*Supplemental Final Environmental Impact Report. Phase I Muddy River Flood Control, Water Quality and Habitat Enhancement and Historic Preservation Project*. EOEA #11865. February 2005. Prepared by CDM for the City of Boston and Town of Brookline.

“Massachusetts: Confronting Climate Change in the Northeast,” Union of Concerned Scientists, 2007

“Boston, Massachusetts: Identifying and Becoming More Resilient to Impacts of Climate Change” (July 2011) National Resources Defense Council

*When It Rains It Pours – Global Warming and the Increase in Extreme Precipitation*, Environment America Research and Policy Center, July 2012

MA Coastal Hazards Commission, *Preparing For the Storm: Recommendations for Management of Risk from Coastal Hazards in Massachusetts*, May 2007

FEMA, *Flood Insurance Rate Maps for Boston, MA*, 2010

Massachusetts StormSmart Coasts, website: <http://ma.stormsmartcoasts.org/>

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

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

U. S. Census, 2010

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*The following were also consulted regarding specific categories of hazards:*

**CLIMATE CHANGE PROCESS METHODOLOGY**

Dr. Thomas Webler and Dr. Seth Tuler, Social and Environmental Research Institute, City of Boston –SERI Diagramming Climate Change-Related Vulnerability-Consequence Adaptation Planning Scenarios (VCAPS).

**HAZUS-MH: EARTHQUAKE, FLOOD, HURRICANE STUDIES OF BOSTON**

Edward S. Fratto, Executive Director Northeast States Emergency Consortium

**CIVIL ENGINEERING AND SOIL LIQUEFACTION**

Dr. Laurie Baise, Civil Engineer, Tufts University Department of Civil and Environmental Engineering – Recent Study completed on Soil Liquefaction on the City of Boston. Follow-on Study on mapping soil typing into NEHRP categories.

**EARTHQUAKES**

Dr. John Ebel, Weston Observatory – BC Earth and Environmental Sciences  
Justin Starr - Weston Observatory – BC Earth and Environmental Sciences  
Dr. James Kaklamanos, Merrimack College, Dept. of Civil and Environmental Engineering – Recent Seismic Study on Boston

**EXTREME SEASONAL WEATHER – STORM READY**

Glenn A. Field, Warning Coordination Meteorologist, NOAA NWS-Taunton

**EXTREME HEAT**

Tufts University Department of Urban and Environmental Policy and Planning.  
“Preparing for Heat Waves in Boston: A Cool Way to Attack Global Warming” May 7, 2010 (student paper).

**FLOOD HYDROLOGY**

Dr. Ellen Marie Douglas, Assistant Professor of Hydrology, UMASS-Boston Coastal Sea Level Rise in Boston Harbor

**GROUNDWATER MONITORING and RECHARGE**

Elliott Laffer, Executive Director, Boston Groundwater Trust  
Christian Simonelli, BGwT Technical and Recharge Coordinator  
B.F. Thomas and R.M. Vogel Department of Civil and Environmental Engineering, Tufts University, “The Impact of Stormwater Recharge Practices on Boston Groundwater Levels,”

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Brankman, Charles M. and Lauri G. Baise. "Liquefaction Susceptibility Mapping in Boston, Massachusetts" Environmental and Engineering Geoscience, Vol.XIV, No.1, February 2008, pp. 1-16.

Barkan, Roy. Department of Geophysics and Planetary Sciences, Tel Aviv University; Uri S. ten Brink, U.S. Geological Survey, Woods Hole, MA. and Jian Lin, Department of Geology and Geophysics, Woods Hole Oceanographic Institution, Woods Hole, MA. "Far Field Tsunami Simulations of the 1755 Lisbon Earthquake: Implications for Tsunami Hazard to the U.S. East Coast and the Caribbean." Marine Geology 264 (2009) 109-122.

Chaytor, Jason D., David C. Twichell, and Uri S. ten Brink. "A Reevaluation of the Munson-Nygren-Retriever Submarine Landslide Complex, Georges Bank Lower Slope, Western North Atlantic" U.S. Geological Survey, USGS Woods Hole Coastal and Marine Science Center, Wood Hole, MA. 1-10.

Douglas, Ellen M. Paul H. Kirshen, Michael Paolisso, Chris Watson, Jack Wiggin, Ashley Enrici and Matthias Ruth. "Coastal Flooding, Climate Change and Environmental Justice: Identifying Obstacles and Incentives for Adaptation in Two Metropolitan Boston Massachusetts Communities." Mitigation and Adaptation Strategies for Global Change, October 21, 2011. pp. 1-42.

Dutzik, Tony. Frontier Group. "In the Path of the Storm: Weather-Related Disasters, Extreme Precipitation, and the Implications for New England and the U.S. in a Warming World." Presentation to EPA Region 1, September 12, 2012. PowerPoint pp. 1-34.

Fratto, Edward S. "Independent HAZUS-MH Analysis for Riverine Flooding, Hurricane Winds and Earthquakes in the City of Boston." Northeast States Emergency Consortium (NESEC). 2010-2012.

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Fratto, Edward S. “Identification of Unreinforced Masonry Buildings (URM) in the Northeast – Pilot Study Validation City of Boston, November 2012.” and “HAZUS-MH Hazard Screening of City of Boston Housing Authority (BHA) Facilities.” Northeast States Emergency Consortium. July 2012.

Hansen, James., Makiko Sato and Reto Ruedy. “The New Climate Dice: Public Perception of Climate Change”. Science Briefs. NASA. July 2012. pp. 1-6.

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Kirshen, Paul., Chris Watson, Ellen Douglas, Allen Gontz, Jawon Lee and Yong Tian. “Coastal Flooding in the Northeastern United States due to Climate Change.” Mitigation Adaptation Strategies Global Change (2008) 13:437-451 DOI 10.1007/s11027-007-9130-5. Springer Science and Business Media B.V. 2007.

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Ward, Steven N. Institute of Geophysics and Planetary Physics, University of California, Santa Cruz, CA and Simon Day, Benfield Greig Hazard Research Centre, Department of Geological Sciences, University College, London, U.K. "Cumbre Vieja Volcano – Potential Collapse and Tsunami at La Palma, Canary Islands." *American Geophysical Union* 2001. 1-4.

Whitmore, Paul. Uri S. ten Brink, Michael Caropolo, Victor Huerfano-Moreno, William Knight, William Sammler, and Al Sandrik. "NOAA/West Coast and Alaska Tsunami Warning Center Atlantic Ocean Response Criteria" *Science of Tsunami Hazards*, Vol. 28, No. 2 pp.86- 107 (2009)

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**APPENDIX A**

**Boston Redevelopment Authority  
Climate Change Preparedness and Resiliency Checklist for  
New Construction**

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## CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN 2014 UPDATE

### Climate Change Preparedness and Resiliency Checklist for New Construction

In November 2013, in conformance with the Mayor's 2011 Climate Action Leadership Committee's recommendations, the Boston Redevelopment Authority adopted policy for all development projects subject to Boston Zoning Article 80 Small and Large Project Review, including all Institutional Master Plan modifications and updates, are to complete the following checklist and provide any necessary responses regarding project resiliency, preparedness, and to mitigate any identified adverse impacts that might arise under future climate conditions.

For more information about the City of Boston's climate policies and practices, and the 2011 update of the climate action plan, *A Climate of Progress*, please see the City's climate action web pages at <http://www.cityofboston.gov/climate>

In advance we thank you for your time and assistance in advancing best practices in Boston.

### Climate Change Analysis and Information Sources:

1. Northeast Climate Impacts Assessment ([www.climatechoices.org/ne/](http://www.climatechoices.org/ne/))
2. USGCRP 2009 (<http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts/>)
3. Army Corps of Engineers guidance on sea level rise (<http://planning.usace.army.mil/toolbox/library/ECs/EC11652212Nov2011.pdf>)
4. Proceeding of the National Academy of Science, "Global sea level rise linked to global temperature", Vermeer and Rahmstorf, 2009 (<http://www.pnas.org/content/early/2009/12/04/0907765106.full.pdf>)
5. "Hotspot of accelerated sea-level rise on the Atlantic coast of North America", Asbury H. Sallenger Jr\*, Kara S. Doran and Peter A. Howd, 2012 ([http://www.bostonredevelopmentauthority.org/planning/Hotspot\\_of\\_Accelerated\\_Sea-level\\_Rise\\_2012.pdf](http://www.bostonredevelopmentauthority.org/planning/Hotspot_of_Accelerated_Sea-level_Rise_2012.pdf))
6. "Building Resilience in Boston": Best Practices for Climate Change Adaptation and Resilience for Existing Buildings, Linnean Solutions, The Built Environment Coalition, The Resilient Design Institute, 2103 ([http://www.greenribboncommission.org/downloads/Building\\_Resilience\\_in\\_Boston\\_SML.pdf](http://www.greenribboncommission.org/downloads/Building_Resilience_in_Boston_SML.pdf))

### Checklist

Please respond to all of the checklist questions to the fullest extent possible. For projects that respond "Yes" to any of the D.1 – Sea-Level Rise and Storms, Location Description and Classification questions, please respond to all of the remaining Section D questions.

Checklist responses are due at the time of initial project filing or Notice of Project Change and final filings just prior seeking Final BRA Approval. A PDF of your response to the Checklist should be submitted to the Boston Redevelopment Authority via your project manager.

**Please Note:** When initiating a new project, please visit the BRA web site for the most current [Climate Change Preparedness & Resiliency Checklist](#).

# CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN 2014 UPDATE

## *Climate Change Resiliency and Preparedness Checklist*

---

### A.1 - Project Information

|   |  |
|---|--|
| Project Name:   |  |
| Project Address Primary:                                  |  |
| Project Address Additional:                               |  |
| Project Contact (name / Title / Company / email / phone): |  |

### A.2 - Team Description

|                              |  |
|------------------------------|--|
| Owner / Developer:           |  |
| Architect:                   |  |
| Engineer (building systems): |  |
| Sustainability / LEED:       |  |
| Permitting:                  |  |
| Construction Management:     |  |
| Climate Change Expert:       |  |

### A.3 - Project Permitting and Phase

At what phase is the project – most recent completed submission at the time of this response?

|                               |  |                    |                              |
|-------------------------------|--|--------------------|------------------------------|
| PNF / Expanded PNF Submission | Draft / Final Project Impact Report Submission | BRA Board Approved | Notice of Project Change     |
| Planned Development Area      | BRA Final Design Approved                      | Under Construction | Construction just completed: |

### A.4 - Building Classification and Description

|                                   |  |
|-----------------------------------|--|
| List the principal Building Uses: |  |
| List the First Floor Uses:        |  |

What is the principal Construction Type – select most appropriate type?

|            |         |             |          |
|------------|---------|-------------|----------|
| Wood Frame | Masonry | Steel Frame | Concrete |
|------------|---------|-------------|----------|

Describe the building?

|   |              |   |                              |
|---|--------------|---|------------------------------|
| Site Area:  | <i>SF</i>    | Building Area:  | <i>SF</i>                    |
| Building Height:                                    | <i>Ft.</i>   | Number of Stories:                                    | <i>Flrs.</i>                 |
| First Floor Elevation (reference Boston City Base): | <i>Elev.</i> | Are there below grade spaces/levels, if yes how many: | <i>No / Number of Levels</i> |

# CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN 2014 UPDATE

## A.5 - Green Building

Which LEED Rating System(s) and version has or will your project use (by area for multiple rating systems)?

|                        |                  |               |            |          |
|------------------------|------------------|---------------|------------|----------|
| Select by Primary Use: | New Construction | Core & Shell  | Healthcare | Schools  |
|                        | Retail           | Homes Midrise | Homes      | Other    |
| Select LEED Outcome:   | Certified        | Silver        | Gold       | Platinum |

Will the project be USGBC Registered and / or USGBC Certified?

|             |          |            |          |
|-------------|----------|------------|----------|
| Registered: | Yes / No | Certified: | Yes / No |
|             |          |            |          |

## A.6 - Building Energy

What are the base and peak operating energy loads for the building?

|  |                     |          |            |
|--|---------------------|----------|------------|
| Electric:  | (kW)                | Heating: | (MMBtu/hr) |
| What is the planned building Energy Use Intensity: | (kbut/SF or kWh/SF) | Cooling: | (Tons/hr)  |

What are the peak energy demands of your critical systems in the event of a service interruption?

|           |      |          |            |
|-----------|------|----------|------------|
| Electric: | (kW) | Heating: | (MMBtu/hr) |
|           |      | Cooling: | (Tons/hr)  |

What is nature and source of your back-up / emergency generators?

|                                  |                   |              |                                |
|----------------------------------|-------------------|--------------|--------------------------------|
| Electrical Generation:           | (kW)              | Fuel Source: |                                |
| System Type and Number of Units: | Combustion Engine | Gas Turbine  | Combine Heat and Power (Units) |

## B - Extreme Weather and Heat Events

Climate change will result in more extreme weather events including higher year round average temperatures, higher peak temperatures, and more periods of extended peak temperatures. The section explores how a project responds to higher temperatures and heat waves.

### B.1 - Analysis

What is the full expected life of the project?

|                          |          |          |          |          |
|--------------------------|----------|----------|----------|----------|
| Select most appropriate: | 10 Years | 25 Years | 50 Years | 75 Years |
|--------------------------|----------|----------|----------|----------|

What is the full expected operational life of key building systems (e.g. heating, cooling, ventilation)?

|                          |          |          |          |          |
|--------------------------|----------|----------|----------|----------|
| Select most appropriate: | 10 Years | 25 Years | 50 Years | 75 Years |
|--------------------------|----------|----------|----------|----------|

What time span of future Climate Conditions was considered?

|                          |          |          |          |          |
|--------------------------|----------|----------|----------|----------|
| Select most appropriate: | 10 Years | 25 Years | 50 Years | 75 Years |
|--------------------------|----------|----------|----------|----------|

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Analysis Conditions - What range of temperatures will be used for project planning - Low/High?

|   |      |
|---|------|
| / | Deg. |
|---|------|

What Extreme Heat Event characteristics will be used for project planning - Peak High, Duration, and Frequency?

|      |      |              |
|------|------|--------------|
| Deg. | Days | Events / yr. |
|------|------|--------------|

What Drought characteristics will be used for project planning - Duration and Frequency?

|      |              |
|------|--------------|
| Days | Events / yr. |
|------|--------------|

What Extreme Rain Event characteristics will be used for project planning - Seasonal Rain Fall, Peak Rain Fall, and Frequency of Events per year?

|              |        |              |
|--------------|--------|--------------|
| Inches / yr. | Inches | Events / yr. |
|--------------|--------|--------------|

What Extreme Wind Storm Event characteristics will be used for project planning - Peak Wind Speed, Duration of Storm Event, and Frequency of Events per year?

|           |       |              |
|-----------|-------|--------------|
| Peak Wind | Hours | Events / yr. |
|-----------|-------|--------------|

## B.2 - Mitigation Strategies

What will be the overall energy performance, based on use, of the project and how will performance be determined?

Building energy use below code: 

|   |
|---|
| % |
|---|

How is performance determined:

What specific measures will the project employ to reduce building energy consumption?

Select all appropriate:

|                                   |                                      |                       |                                |
|-----------------------------------|--------------------------------------|-----------------------|--------------------------------|
| High performance building envelop | High performance lighting & controls | Building day lighting | EnergyStar equip. / appliances |
| High performance HVAC equipment   | Energy recovery ventilation          | No active cooling     | No active heating              |

Describe any added measures:

What are the insulation (R) values for building envelop elements?

|             |           |                                |           |
|-------------|-----------|--------------------------------|-----------|
| Roof:       | R =       | Walls / Curtain Wall Assembly: | R =       |
| Foundation: | R =       | Basement / Slab:               | R =       |
| Windows:    | R = / U = | Doors:                         | R = / U = |

What specific measures will the project employ to reduce building energy demands on the utilities and infrastructure?

|                                      |                             |                                |                         |
|--------------------------------------|-----------------------------|--------------------------------|-------------------------|
| On-site clean energy / CHP system(s) | Building-wide power dimming | Thermal energy storage systems | Ground source heat pump |
| On-site Solar PV                     | On-site Solar Thermal       | Wind power                     | None                    |

Describe any added measures:

Will the project employ Distributed Energy / Smart Grid Infrastructure and /or Systems?

Select all appropriate:

|   |                                   |  |                                  |
|---|-----------------------------------|--|----------------------------------|
| Connected to local distributed electrical | Building will be Smart Grid ready | Connected to distributed steam, hot, chilled water | Distributed thermal energy ready |
|---|-----------------------------------|--|----------------------------------|



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Will the building remain operable without utility power for an extended period?

|                                   | Yes / No | If yes, for how long: | Days |
|-----------------------------------|----------|-----------------------|------|
| If Yes, is building "Islandable?" |          |                       |      |
| If Yes, describe strategies:      |          |                       |      |

Describe any non-mechanical strategies that will support building functionality and use during an extended interruption(s) of utility services and infrastructure:

|                              |   |  |                              |                                   |
|------------------------------|---|--|------------------------------|-----------------------------------|
| Select all appropriate:      | Solar oriented – longer south walls           | Prevailing winds oriented                  | External shading devices     | Tuned glazing,                    |
|                              | Building cool zones                           | Operable windows                           | Natural ventilation          | Building shading                  |
|                              | Potable water for drinking / food preparation | Potable water for sinks / sanitary systems | Waste water storage capacity | High Performance Building Envelop |
| Describe any added measures: |   |  |                              |                                   |

What measures will the project employ to reduce urban heat-island effect?

|                            |                                  |                      |                                |                 |
|----------------------------|----------------------------------|----------------------|--------------------------------|-----------------|
| Select all appropriate:    | High reflective paving materials | Shade trees & shrubs | High reflective roof materials | Vegetated roofs |
| Describe other strategies: |                                  |                      |                                |                 |

What measures will the project employ to accommodate rain events and more rain fall?

|                            |                                   |                                |                                 |                 |
|----------------------------|-----------------------------------|--------------------------------|---------------------------------|-----------------|
| Select all appropriate:    | On-site retention systems & ponds | Infiltration galleries & areas | vegetated water capture systems | Vegetated roofs |
| Describe other strategies: |                                   |                                |                                 |                 |

What measures will the project employ to accommodate extreme storm events and high winds?

|                            |  |  |  |  |
|----------------------------|--|--|--|--|
| Select all appropriate:    | Hardened building structure & elements | Buried utilities & hardened infrastructure | Hazard removal & protective landscapes | Soft & permeable surfaces (water infiltration) |
| Describe other strategies: |  |  |  |  |

### C - Sea-Level Rise and Storms

Rising Sea-Levels and more frequent Extreme Storms increase the probability of coastal and river flooding and enlarging the extent of the 100 Year Flood Plain. This section explores if a project is or might be subject to Sea-Level Rise and Storm impacts.

#### C.1 - Location Description and Classification:

Do you believe the building to be susceptible to flooding now or during the full expected life of the building?

|          |
|----------|
| Yes / No |
|----------|

Describe site conditions?

|                                   |                              |
|-----------------------------------|------------------------------|
| Site Elevation – Low/High Points: | Boston City Base Elev.( Ft.) |
|-----------------------------------|------------------------------|

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Building Proximity to Water:

Is the site or building located in any of the following?

Coastal Zone:

Velocity Zone:

Flood Zone:

Area Prone to Flooding:

Will the 2013 Preliminary FEMA Flood Insurance Rate Maps or future floodplain delineation updates due to Climate Change result in a change of the classification of the site or building location?

2013 FEMA Prelim. FIRMs:

Future floodplain delineation updates:

What is the project or building proximity to nearest Coastal, Velocity or Flood Zone or Area Prone to Flooding?

*If you answered YES to any of the above Location Description and Classification questions, please complete the following questions. Otherwise you have completed the questionnaire; thank you!*

### C - Sea-Level Rise and Storms

This section explores how a project responds to Sea-Level Rise and / or increase in storm frequency or severity.

#### C.2 - Analysis

How were impacts from higher sea levels and more frequent and extreme storm events analyzed:

Sea Level Rise:

Frequency of storms:

#### C.3 - Building Flood Proofing

Describe any strategies to limit storm and flood damage and to maintain functionality during an extended periods of disruption.

What will be the Building Flood Proof Elevation and First Floor Elevation:

Flood Proof Elevation:

First Floor Elevation:

Will the project employ temporary measures to prevent building flooding (e.g. barricades, flood gates):

If Yes, to what elevation

If Yes, describe:

What measures will be taken to ensure the integrity of critical building systems during a flood or severe storm event:

|  |                              |                                  |                                  |
|--|------------------------------|----------------------------------|----------------------------------|
| Systems located above 1 <sup>st</sup> Floor. | Water tight utility conduits | Waste water back flow prevention | Storm water back flow prevention |
|--|------------------------------|----------------------------------|----------------------------------|

Were the differing effects of fresh water and salt water flooding considered:

Will the project site / building(s) be accessible during periods of inundation or limited access to transportation:

If yes, to what height above 100 Year Floodplain:

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Will the project employ hard and / or soft landscape elements as velocity barriers to reduce wind or wave impacts?

|          |
|----------|
| Yes / No |
|----------|

If Yes, describe:

|  |
|--|
|  |
|--|

Will the building remain occupiable without utility power during an extended period of inundation:

|          |
|----------|
| Yes / No |
|----------|

If Yes, for how long:

|      |
|------|
| days |
|------|

Describe any additional strategies to addressing sea level rise and or sever storm impacts:

|  |
|--|
|  |
|--|

**C.4 - Building Resilience and Adaptability**

Describe any strategies that would support rapid recovery after a weather event and accommodate future building changes that respond to climate change:

Will the building be able to withstand severe storm impacts and endure temporary inundation?

Select appropriate:

|          |  |  |   |
|----------|--|--|---|
| Yes / No | Hardened /<br>Resilient Ground<br>Floor Construction | Temporary<br>shutters and or<br>barricades | Resilient site<br>design, materials<br>and construction |
|----------|--|--|---|

Can the site and building be reasonably modified to increase Building Flood Proof Elevation?

Select appropriate:

|          |  |   |                                 |
|----------|--|---|---------------------------------|
| Yes / No | Surrounding site<br>elevation can be<br>raised | Building ground<br>floor can be<br>raised | Construction been<br>engineered |
|----------|--|---|---------------------------------|

Describe additional strategies:

|  |
|--|
|  |
|--|

Has the building been planned and designed to accommodate future resiliency enhancements?

Select appropriate:

|          |  |  |   |
|----------|--|--|---|
| Yes / No | Solar PV<br><br>Potable water<br>storage | Solar Thermal<br><br>Wastewater<br>storage | Clean Energy /<br>CHP System(s)<br><br>Back up energy<br>systems & fuel |
|----------|--|--|---|

Describe any specific or  
additional strategies:

|  |
|--|
|  |
|--|

Thank you for completing the Boston Climate Change Resilience and Preparedness Checklist!

For questions or comments about this checklist or Climate Change Resiliency and Preparedness best practices, please contact: [John.Dalzell.BRA@cityofboston.gov](mailto:John.Dalzell.BRA@cityofboston.gov)

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**APPENDIX B**

**Results of the Boston  
Vulnerability Consequences Adaptation Scenarios**

**By the  
Social and Environmental Research Institute**

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**Results from Participatory Hazard Mitigation  
and Climate Change Adaptation Planning  
Workshops in Boston Massachusetts**



*The Social and Environmental Research Institute*

# CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN 2014 UPDATE

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## ABOUT SOCIAL AND ENVIRONMENTAL RESEARCH INSTITUTE (SERI)

SERI conducts research on a broad range of social and environmental issues, while emphasizing topics related to participatory and discursive approaches to environmental policy. The Institute conducts applied research projects that realize the practical gains provided by theory and that provide concrete benefits to individuals, society, and the environment. SERI is a non-profit 501(c)(3) institute founded in 1995 and located in Greenfield Massachusetts.

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## CREDITS

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bottom: Muddy River, Fenway. Credit: Thomas Webler.

*Results from participatory hazard mitigation and climate change adaptation planning workshops in Boston, MA*

SERI



## Introduction

Boston is the economic, social, and cultural heart of New England. The greater metropolitan area is home to over 3.2 million people and 99 municipalities. Like most coastal communities, Boston, Massachusetts has experienced extreme weather events, including severe coastal storms and heat waves. Although the City is protected from strong seas by the Boston Harbor Islands, it sits at the confluence of three rivers, which makes it more vulnerable to floodwaters from inland storms. Because much of Boston is built on landfill, flooding and saturated soils can cause serious problems and collateral damage.



Photo: Satellite view of Boston.  
Credit: Public domain.

Flooding is already a major problem and it is likely to get worse. Snowfall and ice accumulations from winter storms are significant, threatening the structural integrity of buildings, disrupting traffic and normal economic operations. In the summertime, heat waves present a problem for the metropolitan area. They compromise air quality, magnify fire risks, threaten people's health, and drive people

to seek comfort at parks, pools, and beaches.

Expectations are that the City will face increased exposure to sea level rise and extreme weather, such as coastal storms, winter storms, and heat waves, in years to come from changes in the climate. These weather hazards pose profound risks to the economy, public health, coastal resources, natural features, water systems, and infrastructure.

To better understand and mitigate the impacts of extreme weather events city officials in Boston began updating the City's hazard mitigation plan (HMP) in 2010. Hazard mitigation plans are typically revised every 5 years. Normally the HMP is based on past events and trends to forecast future impacts. But the City decided it was important to consider projected increases in the severity of storms, sea level rise, and heat due to global climate change.

From January through May 2012, the Social and Environmental Research Institute (SERI), with funding from MIT Sea Grant, facilitated five meetings to discuss the implications of climate change for weather-related hazards in Boston. The Massachusetts Emergency Management Agency (MEMA) encourages a regional planning methodology and awarded the Metropolitan Area Planning Council

This report was prepared by the Social and Environmental Research Institute.

The statements, findings and conclusions in this report do not necessarily reflect those of the City of Boston, the MAPC, MIT Sea Grant, or NOAA.

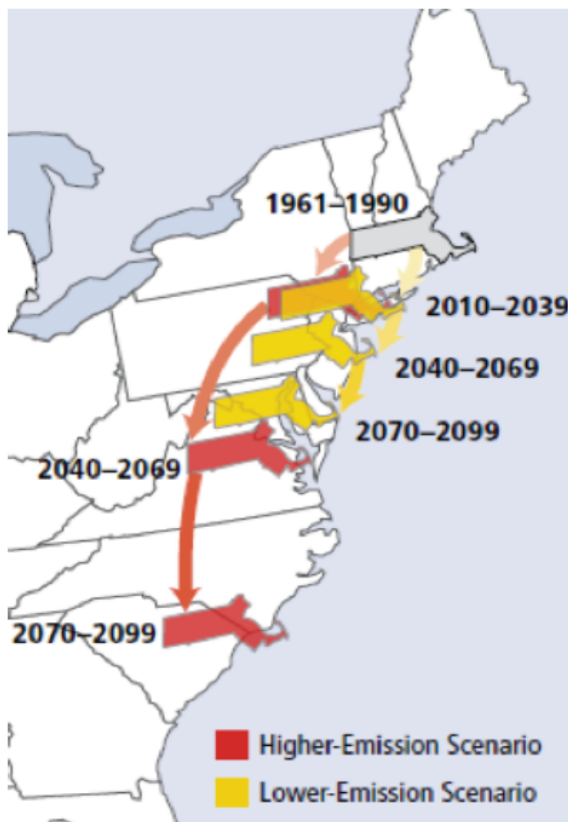
(MAPC) a planning grant to update the City's HMP, which is part of a seven inner core city effort. The Office of Emergency Management coordinated the inter-governmental stakeholder collaboration and organized the meetings. Multiple stakeholders, including city and state officials, representatives from non-profits, major institutions, non-governmental organizations and others participated in these meetings. The meetings combined reviews of climate models and data for the region with discussion of local expertise on flooding, winter storm and extreme heat impacts to commerce, vulnerable populations, coastal infrastructure and the City in general.

Using a mediated modeling process called the Vulnerability and Consequences Adaptation Planning Scenarios (VCAPS)

process SERI staff documented the vulnerability of Boston to extreme weather events, exacerbated by future climate change, and identified actions that the City is undertaking to increase its resilience. Stakeholders at the meetings were asked to describe the fundamental cause-effect relationships linking weather events, such as severe coastal storms and heat waves. SERI staff diagrammed the stakeholders' understandings of how these weather-related hazards created damaging consequences. City and state stakeholders provided input about specific management actions that could mitigate the impacts associated with these weather events. SERI developed the VCAPS process with funding from the National Oceanic and Atmospheric Administration (NOAA) and MIT Sea Grant. The results of the workshops are presented here in both diagram and narrative-formats.

### Climate Change Impacts Expected for Boston

The climate in Boston is changing and will continue to over the coming decades, barring significant global effort to reduce carbon emissions. Temperatures will increase, sea level will rise, and more frequent and severe storms will impact the City (Massachusetts Executive Office of Energy and Environmental Affairs 2011, Frumhoff et al. 2006). By the year 2050, the Intergovernmental Panel for Climate Change (IPCC) reports that under a high emissions scenario the ambient global temperature will increase by 5 to 10<sup>0</sup>F (IPCC 2007, 2012). The way such impacts might be experienced in Massachusetts under three different scenarios is shown in the Tables, which are reprinted from the



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| Parameter   | Current Conditions (1961–1990) | Predicted Range of Change by 2050 | Predicted Range of Change by 2100 |
|---|--------------------------------|-----------------------------------|-----------------------------------|
| Annual temperature <sup>1</sup> (°C/°F)   | 8/46                           | 2 to 3 / 4 to 5                   | 3 to 5/5 to 10**                  |
| Winter temperature <sup>1</sup> (°C/°F)   | -5/23                          | 1 to 3 / 2 to 5                   | 2 to 5 / 4 to 10                  |
| Summer temperature <sup>1</sup> (°C/°F)   | 20/68                          | 2 to 3 / 4 to 5                   | 2 to 6 / 4 to 10                  |
| Over 90 °F (32.2 °C) temperature <sup>2</sup> (days/yr)   | 5 to 20                        | —                                 | 30 to 60                          |
| Over 100 °F (37.7° C) temperature <sup>2</sup> (days/yr)  | 0 to 2                         | —                                 | 3 to 28                           |
| Ocean pH <sup>3,4</sup>   | 7 to 8                         | —                                 | -0.1 to -0.3*                     |
| Annual sea surface temperature (°C/°F)  | 12/53 <sup>5</sup>             | 2/3 (in 2050) <sup>5</sup>        | 4/8                               |
| Annual precipitation <sup>1</sup>   | 103/41 cm/in.                  | 5% to 8%                          | 7% to 14%**                       |
| Winter precipitation <sup>1</sup>   | 21/8 cm/in.                    | 6% to 16%                         | 12% to 30%**                      |
| Summer precipitation <sup>1</sup>   | 28/11 cm/in.                   | -1% to -3%                        | -1% to 0%**                       |
| Streamflow—timing of spring peak flow <sup>1</sup><br>(number of calendar days following January 1) | 85                             | -5 to -8                          | -11 to -13**                      |
| Droughts lasting 1–3 months <sup>1</sup> (#/30 yrs)   | 13                             | 5 to 7                            | 3 to 10**                         |
| Snow days (number of days/month) <sup>1</sup>   | 5                              | -2                                | -2 to -4**                        |
| Length of growing season <sup>1</sup> (days/year)   | 184                            | 12 to 27                          | 29 to 43                          |

**Table 1: Changes in Massachusetts' Climate**

Sources: 1-Hayhoe et al., 2006; 2-Frumhoff et al., 2007; 3-IPCC, 2007; 4-MWRA, unpublished; 5-Nixon et al., 2004  
 Note: All numbers have been rounded to the nearest whole number. Unless otherwise indicated, the predictions for the year listed as 2050 are for the period between 2035–2064. \* Global data; \*\*Predictions for period between 2070-2099

| Source                                  | Projections by 2050 |                | Projections by 2100 |               |                |
|---|---------------------|----------------|---------------------|---------------|----------------|
|   | Low Emissions       | High Emissions | Low Emissions       | Mid Emissions | High Emissions |
| Pfeffer et al 2008                      | —                   | —              | 78/31               | 83/33         | 201/79         |
| Rahmstorf 2007                          | 20/8                | 40/16          | 50/20               | 80/32         | 140/55         |
| IPCC 2007                               | —                   | —              | 18/7                | 48/19         | 59/23          |
| Current sea-level trend (A1F1 scenario) | 16/6                |                | 29/11               |               |                |

**Table 2: Projected Sea Level Rise (centimeters/inches)**  
 Note: All numbers have been rounded to the nearest whole number.

*Massachusetts climate change adaptation report*, by the Climate Change Adaptation Advisory Committee (Massachusetts Executive Office of Energy and Environmental Affairs 2011, pgs 13 and 16).

Boston could see the annual number of days over 90°F rise from the historical 5-20 to an estimated 30-60. By 2050 Boston may

be experiencing the present day weather of Philadelphia.

Annual precipitation could increase 5-8%, with most of it falling in winter. What are presently 100-year flood events will occur every 2-3 years by 2050 due to this increase in precipitation. Winter precipitation could rise as much as 16%.

Forecasts for sea level rise (SLR) are contingent on what happens with Greenland's ice cap and future emissions, but conservative estimates are that Boston will see 8-16" of SLR by 2050.

### Background on the Hazard Mitigation Planning (HMP) Process

The Federal Disaster Mitigation Act of 2000 established a framework for municipalities to create plans for managing hazards. Plans must be updated every five years to ensure eligibility for Federal Emergency Management Agency (FEMA) funded hazard mitigation grant projects. The Disaster Mitigation Act came in response to impacts of severe storms, coastal erosion, and flooding events during the last decades and amended the Robert T. Stafford Disaster and Emergency Assistance Act, in accordance with 44 CFR Part 201. The new Act requires that state, local and tribal entities coordinate mitigation actions and projects.

Boston has become a leader in climate change adaptation planning and thus is thoroughly addressing climate change hazards in all its governmental efforts. The City of Boston is exceeding federal standards by including climate change in the HMP.

### Boston's Hazard Mitigation Planning Process

The City of Boston's Hazard Mitigation Plan is written by the Metropolitan Area Planning Council (MAPC), while the Office of Emergency Management is responsible for coordination of intergovernmental stakeholder collaboration. In 2010, the City of Boston established a multi-agency

Hazard Mitigation Executive Leadership Steering Committee to oversee the process of updating the HMP. The co-chairs of the Leadership Committee are the Mayor's Cabinet Chiefs and Directors of the Office of Office of Emergency Management and the Office of Energy and Environment.

HMPs usually project future disasters from an inventory of past events. The City decided a more accurate plan incorporates scientific knowledge about projected climatic changes to arrive at a more accurate forecast of future weather-related events. Boston is a leader in hazard mitigation, climate change adaptation, and climate change mitigation planning. The Climate Action Leadership Committee authored a report in April 2010 called *Sparkling Boston's Climate Revolution* and followed this up a year later with *A Climate of Progress*, which was an update to the climate action plan (Climate Action Leadership Committee and Community Advisory Committee 2010, Climate Action Leadership Committee and Community Advisory Committee 2012).

On August 5, 2010, the Mayor's Office of Emergency Management formally requested approval from the state director of the Massachusetts Emergency Management Agency and was granted permission to have an independent hazard risk analysis conducted on the City of Boston. The Northeast States Emergency Consortium (NESEC) Emergency Management Risk Assessment Center conducted a HAZUS MH-Level II analysis of the City's vulnerabilities to floods, hurricanes, and earthquakes.

As part of the effort to integrate climate change adaptation planning with hazard mitigation planning MAPC and the City

organized with SERI the series of five meetings using VCAPS. The Office for Emergency Management's Interagency Coordinator invited participants to multi-stakeholder meetings to discuss local hazards and presented the findings of NESEC's analysis. MAPC gave an introductory presentation at the start of each meeting. Brief overviews of predictions about climate change in the region were also presented. Due to the experimental nature of this effort, MAPC and the City decided to use climate projections only to characterize three types of hazards: flooding, winter storms, and heat waves.

### The VCAPS Process

The VCAPS (Vulnerability and Consequences Adaptation Planning Scenarios) process combines structured discussion with interactive concept mapping to create visual summaries of local knowledge about vulnerability and resilience. It helps government staff and stakeholders depict how a community is impacted by weather related hazards and the actions that could help reduce those impacts.

A typical VCAPS process begins by identifying a small set of concerns or hazards that the community would like to explore. This focuses and defines the boundaries of the discussion, ensuring that the exercise is relevant to decisions. The discussion centers on one concern at a time. During the discussion, a VCAPS diagram is constructed by the research team while listening to the facilitated dialogue in the room.

The participants at a meeting choose which hazards to focus upon. Groups

sometime define the hazards quite broadly (e.g. super storms) or quite narrowly (e.g. coastal erosion).

After selecting the hazard VCAPS diagramming progresses to trace pathways that describe how that hazard affects the community and its environment. A pathway model is made that documents the sequence of steps that lead to harmful consequences. For example, precipitation causes run-off, which leads to storm sewer overflows, which leads to flooding of underground transformers, which leads to electrocution. Each box in this diagram is called an "intermediary outcome." There are normally many intermediary outcomes in a pathway.



Photo: Signal box near Museum of Fine Arts  
Credit: T. Webler 2012

At some point, the pathway of outcomes ends in a consequence. A consequence is an outcome for which it is not necessary to

ask the question, “Why do we care if this happens?” To take the example above about runoff, it is not obvious why we should care about run-off, the mobilization of debris, the clogging of a sewer drain, or flooding of basements. But if flooding leads to electrocution, then electrocution is a consequence, because it is obvious that we all care about loss of life.

Management actions are also identified in the diagram. These are actions that can be taken to change the way the stressor affects the community. VCAPS differentiates between actions taken by private individuals and groups and actions taken by public organizations or government. The diagrams can include actions that are already in place or those that are proposed by the participants.

Contextual factors are the final component in the VCAPS diagram. These are specific qualities associated with an intermediary outcome or consequences that amplify the effect of the hazard. For instance, the mobilization of debris by run-off is made worse when there is more debris on the streets, therefore an amplifying contextual factor might be: “time since last street sweeping.”

### VCAPS in Boston

Five meetings were held with different groups of City employees and NGO representatives from January through May 2012, focusing on three weather related hazards:

- flooding from precipitation and storm surges,
- winter storms and
- extreme heat.



Photo: Boston sewer drain cover near Museum of Fine Arts. Credit: T. Webler 2012.

### Organization of the five collaborative stakeholder working group meetings

To make meeting size reasonable and still involve a cross-section of City employees at each meeting, we organized five meetings around the following focus groups:

- Water and Sewer
- Infrastructure
- Regulatory
- Building and Facilities
- Public Safety

The first meeting was largely among members of the Boston Water and Sewer Commission, but the subsequent meetings involved representatives from numerous government agencies and private groups, such as: Ground Water Trust, Homeless Services Bureau, Environment Department, Historic Preservation, Housing Authority, Boston Public Health Commission, Massachusetts Water Resource Authority, Northeast States Emergency Consortium, Coastal Zone Management, Massport-Logan IAP, Inspectional Services, Boston Public

Library, Northeast Document Conservation Center, Massachusetts Board of Library Commissioners, University of Massachusetts Boston, Department of Neighborhood Development, Police and Fire Departments, among others.

The meetings began with presentations on climate change and historical HAZUS-MH Level II hazard data for Boston.

Participants then broke into small groups to discuss the City's vulnerabilities to flooding, winter storms and extreme heat. By design, the focus of each meeting was to consider these hazards from the different management sectors, and each meeting began where the last one left off by asking participants to continue revising and elaborating details in the VCAPS diagrams. SERI and MAPC facilitators worked to make sure all outcomes and consequences were considered. To aid in this task, they developed a list of types of outcomes and consequences: commerce, health and safety, governance, ecology, property, communication systems, transportation systems, power grid, and water treatment. The variety of perspectives at the meetings provided not only broad spectrum and in-depth expertise, but also priorities for hazard mitigation and climate change adaptation management actions.

During the discussions, SERI diagrammed the causal pathways and added contextual factors and management actions to the diagrams as participants mentioned them. The remainder of this report will be a summary of those results. VCAPS diagrams that relate to these abbreviated narratives are attached to this report as Appendices.

## Flooding

Boston participants identified two climate stressors responsible for flooding: increased precipitation and sea level rise (SLR). People mentioned that flooding is already a problem in areas of the city and recognized that this will become more frequent and worse. SLR is already noticeable by the increasing frequency with which the piers flood near the Aquarium.

Morrissey Boulevard was identified as an area with cyclical, repetitive flooding, due to astronomically high tides. Flooding here is important because the road is a major arterial and is a primary evacuation route. Raising roadways was mentioned as a mitigation action of high priority to maintain safe evacuation routes, as was installing riprap and building natural ecosystem-based buffers with native vegetation.

Several roadways rely on pumps to clear floodwaters. The reliability of these pumps and their electricity supply are essential. Participants noted several locations where pumps will need to be installed as flooding increases.



Photo: Flooding at Long Wharf during Sandy. 2012.  
Credit: Matt Conti (Creative Commons 3.0 license).  
Original source material at: [NorthEndWaterfront.com](http://NorthEndWaterfront.com)

Public housing complexes near the coast are already susceptible to flooding in basements and rely heavily on sump pumps to keep the basements dry. The public housing department recognized a need to relocate important utilities from basements to higher floors of some buildings.

Run-off from soils, pavements, and roofs can be blocked at catch basins by roadway debris and leaves. This leads to localized flooding or “ponding” in the roadways. Where curb heights are low, this water can migrate into basements of nearby buildings. Public health is impacted from mold that grows as a result of this flooding as the air quality in homes declines. Cleaning catch basins, which is done by staff of the Boston Water and Sewer Commission (BWSC) is a mitigation action that can prevent further hazards in that chain of consequences. Another mitigation action is encouraging property owners to install sump pumps to clear out flooding in basements. The VCAPS diagrams differentiate upstream and downstream actions clearly and this provides officials with an easy-to-understand anatomy of mitigation actions to prevent unwanted consequences.

While progress continues to be made in separating stormwater and sanitary wastewater systems, there are still places where they connect. Stormwater that enters the groundwater can infiltrate into sanitary wastewater lines at those intersections or through cracks in drainage pipes all throughout the system. This is a problem during storms because it increases the amount of sanitary wastewater that needs to be treated by Massachusetts Water Resources Authority (MWRA) at Deer Island.

Rising groundwater that comes from storms and SLR can help ensure that historical wooden pilings are protected from rotting, but too much groundwater in the wrong places can cause serious problems. First, it can mobilize pollutants that are presently stable. Second, it can come into contact with district heating pipes, resulting in explosions. Third, it can flood the subway.

One of the worse scenarios that the group discussed is if sea levels rises enough to overwhelm the Charles River dam. This would lead to flooding of Back Bay, creating numerous problems for the City.

As part of the discussion about flooding participants focused on short and long-range consequences and management actions. Managing long-range issues such as sea level rise’s impact on Deer Island Sewage Treatment Plant seemed outside the range considered for this plan. However, members of MWRA did discuss the vulnerability of the system due to pipes of a certain size and elevation above sea level. Some of this hardware will need to be replaced. These discussions of long-term hazards were crucial, not only to meet FEMA’s request to include long-range impacts, but also for the city and state officials to develop plans for a quite different coastline only a few decades in the future.

### Winter Storms

Winter storms deposit heavy snow and ice on roofs, sidewalks, utility lines/poles, trees, and roads. Weight of snow on roofs can cause buildings to collapse. If utility lines come down, electricity and communication services are disrupted.



Snow and ice accumulation may also disrupt the transportation system in multiple ways. First, traffic can be impeded by illegally parked cars, roads narrowed by snow and plowed snow, falling trees and tree limbs, and traffic accidents. Roads blocked by private vehicles can disrupt the public transportation system.

Second, falling trees and limbs can damage utility lines and poles, disrupting power and disabling traffic signals. Public buses and trolleys that rely on electricity for power will be stranded, exposing riders to harsh conditions.

Third, snow or ice followed by rain can cause flooding of low-lying areas, blocking roads. Flooding can also occur when catch basins and drainage are blocked from plowed snow.



Photo: Snow storm buried cars on Beacon Hill, January 2005. Credit: Nat Tarbox (Creative Commons 2.0 license). Original at: <http://www.flickr.com/photos/nattarbox/1792406300/>

Emergency advisories to leave work early have caused “super rush hours.” A consequence can be that people become stranded, as snow builds up while people are stuck in vehicles as they attempt to return home. Abandoned vehicles can block roads, making emergency response

more difficult and further disrupting the transportation system.

Sidewalks are also compromised by winter storms. When sidewalks, ramps, etc. are blocked, mobility of pedestrians is impaired. People may resort to walking in streets, which can lead to injuries from falls or vehicular accidents. Others may be afraid or unable to leave home.

Homebound people may run out of food or medications. Fire hydrants can be inaccessible.

In Boston property owners are mandated to clear sidewalks, to help clear fire hydrants and are asked to check on and assist their neighbors. The MBTA also asks people to assist clearing bus stops. However, it is illegal to put snow back on roads.

Structures may collapse or be damaged. If public buildings are damaged, important government services may be disrupted. Commercial activity basically shuts down during extreme winter storms.

Mitigation measures in relation to winter storms were categorized into pre, during and post event. The pre-event category included all prevention actions such as improving communication systems to treating roads.

## Heat Waves

Heat waves threaten human health for acute periods of time, but they can happen repeatedly over the summer. To mitigate heat, people rely on air conditioning and fans, which stresses the power grid, leading to electricity disruptions.

Loss of power disables cooling systems, but also threatens human health in other

ways. For instance, more and more people are receiving health care at home. Loss of power can render inoperative medical devices and alarms. Evacuations from buildings without electricity or air-conditioning are crucial to avoid heat stress, at work and at home.

Transportation systems suffer with the loss of electricity. With traffic signals out transport can be disrupted and dangerous. This makes it harder for people to reach cooling centers. Moreover, people can be stranded far from home on trains and subways.

Heat waves disproportionately affect the elderly and people with respiratory diseases, such as emphysema. Over time, poor air quality increases asthma rates.

Cooling centers may be stressed to capacity. As crowding within shelters increases both those seeking shelter and staff can experience severe stress. In worst case scenarios personal safety may be an issue. This can be a particular problem within shelters with “blended” populations (e.g., ethnic groups, elderly, children, addicts, disabled).

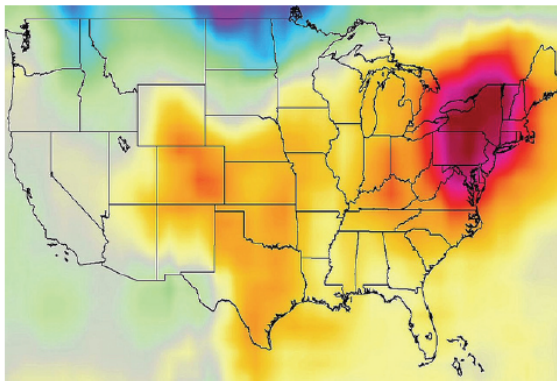


Photo: National temperature map June 2012  
Credit: Public domain (Jet Propulsion Lab)

Heat waves can impact economic activity, cultural artifacts, and governance

functions, particularly when electrical and transport systems are disrupted. For instance, historical documents in public libraries are vulnerable to harm from humidity.

People seek relief from heat at cooling centers or public beaches and pools. Heat can promote bacteria growth leading to the closure of beaches. Illegally open fire hydrants can have serious implications for fire suppression because of decreases in water pressure.

Heat events can also result in damage to infrastructure. For example, it can cause rail lines and bridges to expand. Public transportation may be disrupted if this happens.

### Further Discussion

The following crosscutting issues arose during the meetings.

#### Interactions across sectors

The three weather-related hazards have complex impacts, can result in collateral damage, and yet many outcomes and consequences appear in all three hazards. To simplify the complexity, we identified seven sub-systems that are central to the city’s functionality. These are:

- Buildings
- Communication
- Ecosystems
- Electricity
- Emergency shelters
- Transportation
- Water treatment

By producing diagrams for each of these sub-systems, SERI was able to capture the key ideas without having too much repetition in the diagrams.

### Regional Coordination

Throughout the VCAPS process, stakeholders regularly addressed the importance of mitigating the impacts of different weather events. In some cases these issues are most effectively addressed with regionally coordinated strategies. The reason for this is that watersheds cross municipal boundaries. Consideration of hydrology at the level of the watershed can help identify regional strategies that will most effectively address these shared concerns.

### Vulnerable Populations

Participants in the VCAPS meetings emphasized the impacts of weather-related stressors on vulnerable populations, which include the elderly, homeless, those receiving medical care at home, disabled, and those in public housing. Flooding from sea level rise and from heavy rain events already occurs in the coastal public housing complexes. Vacating first floors and raising all furnaces and transformers from public housing basements were identified as possible solutions. Communication systems in extreme heat and intense rains may fail which will cut off elderly from important information and perhaps from assistance.

### Discussion of Management Actions

As part of the diagramming of flooding, winter storm, and severe heat hazards, SERI and MAPC encouraged the meeting participants to discuss management

actions that could be promoted now and that would increase resilience to storms events. A significant number of management actions was identified by the group.

The participants identified four general types of actions: actions taken as part of routine planning activities (preparatory actions), actions taken in response to specific threats or events (pre-storm/event actions), actions taken during an event (during storm/event actions), and actions taken to recover from the impacts of storms (post-storm/event actions). An example of a pro-active preparatory action is the City's hazard mitigation planning process. The participants also indicated whether the action was already being done, was a new strategy worthy of further consideration, or has already been implemented.

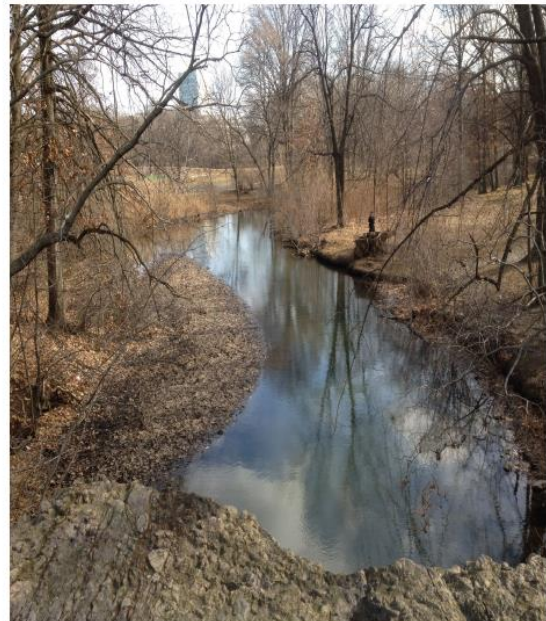


Photo: The Muddy River. 2012  
Credit: T. Webler.

This information provides a picture of the full range of management actions that can be taken by the City, either separately or together. In some cases, coordination among City departments, between the City and other municipalities, or between the City and other regional entities is necessary to tackle hazards.

### Conclusion

Examination of local hazards with city and state officials, interested citizens and members of the private sector can illuminate vulnerabilities and highlight potential mitigation projects for municipalities to adopt.

VCAPS is one approach to help elicit and organize this knowledge in a format that can empower local action. The five meetings sponsored by the City of Boston, the Metropolitan Area Planning Commission, and SERI drew upon local experience to document vulnerabilities and mitigation actions.

Like other municipalities across the country, the City of Boston will continue to experience increased exposure to extreme weather. The state, county, and city systems that are in place to manage, cope, and adapt to this weather can be improved upon and will need to innovate more efficient and effective systems to prepare for weather related hazards and to restore services. Such systems ought to be informed with the knowledge and experience of city employees and local stakeholders. VCAPS is one tool to bring this is to fruition.

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**APPENDIX C  
HAZARD MAPPING**

The MAPC GIS (Geographic Information Systems) Lab produced a series of maps for the City of Boston depicting the location of multiple natural hazard zones and critical facilities. . 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.

Due to the large amount of data, all of the hazard information could not be compiled onto a single map. In order to clearly show the data, the data is displayed on a series of seven maps that depict the following.

1. Population Density
2. Developable Land
3. Flood Zones
4. Earthquakes/Landslides
5. Hurricanes/Tornados
6. Average Snowfall
7. Composite Natural Hazards

Reduced-scale copies of this map series are included in this Appendix for general reference. Full sized higher resolution PDF's of the maps can be downloaded from the MAPC File Transfer Protocol (FTP) website at:

[ftp://ftp.mapc.org/Hazard\\_Mitigation\\_Plans/PDM-2R/Boston/Boston\\_maps\\_city\\_wide](ftp://ftp.mapc.org/Hazard_Mitigation_Plans/PDM-2R/Boston/Boston_maps_city_wide)

In order to make the detailed mapped data more usable for the City, the map series was further divided into nine geographic areas that cover the following neighborhoods:

- 1 Harbor Islands
- 2 Charlestown, East Boston
- 3 Bay Village, Beacon Hill, Leather District, Chinatown, Downtown, North End
- 4 Back Bay, Fenway, Longwood Medical Area
- 5 Allston, Brighton
- 6 South Boston, South Boston Waterfront, South End
- 7 Jamaica Plain, Mission Hill, Roxbury
- 8 Dorchester, Mattapan
- 9 Hyde Park, Roslindale, West Roxbury

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With these nine areas having seven maps each, there are a total of 63 maps in the series. Due to their large size, printed copies these larger scale maps are not included in this report. Electronic (PDF file) versions are on file with the City of Boston. Reduced “tabloid” page-sized (11x17 inch) copies of the maps can be printed from these PDF files. The City also has on file the original GIS files for the map series, which can be used for printing full sized (36 inch) copies of the maps, as well as for conducting GIS analysis in conjunction with other map layers. A description of the map series follows.

The sources of data and general description of each of these themes follows:

**Population Density** – This map uses the US Census block data for 2010 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.

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

**Earthquakes and Landslides** – This information came from NESEC and from Tufts University. For most communities, there was no data for earthquakes because only the epicenters of an earthquake are mapped. Mapping of areas susceptible to liquefaction was provided by William Lettis and Associates, Inc. and Tufts University. Liquefaction means that loosely packed, water-logged sediments lose strength and therefore move in large masses or lose bearing strength. This map was prepared using geological maps and soil borings.

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/pp1183/pp1183.html>.

**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 and hurricane surge areas.



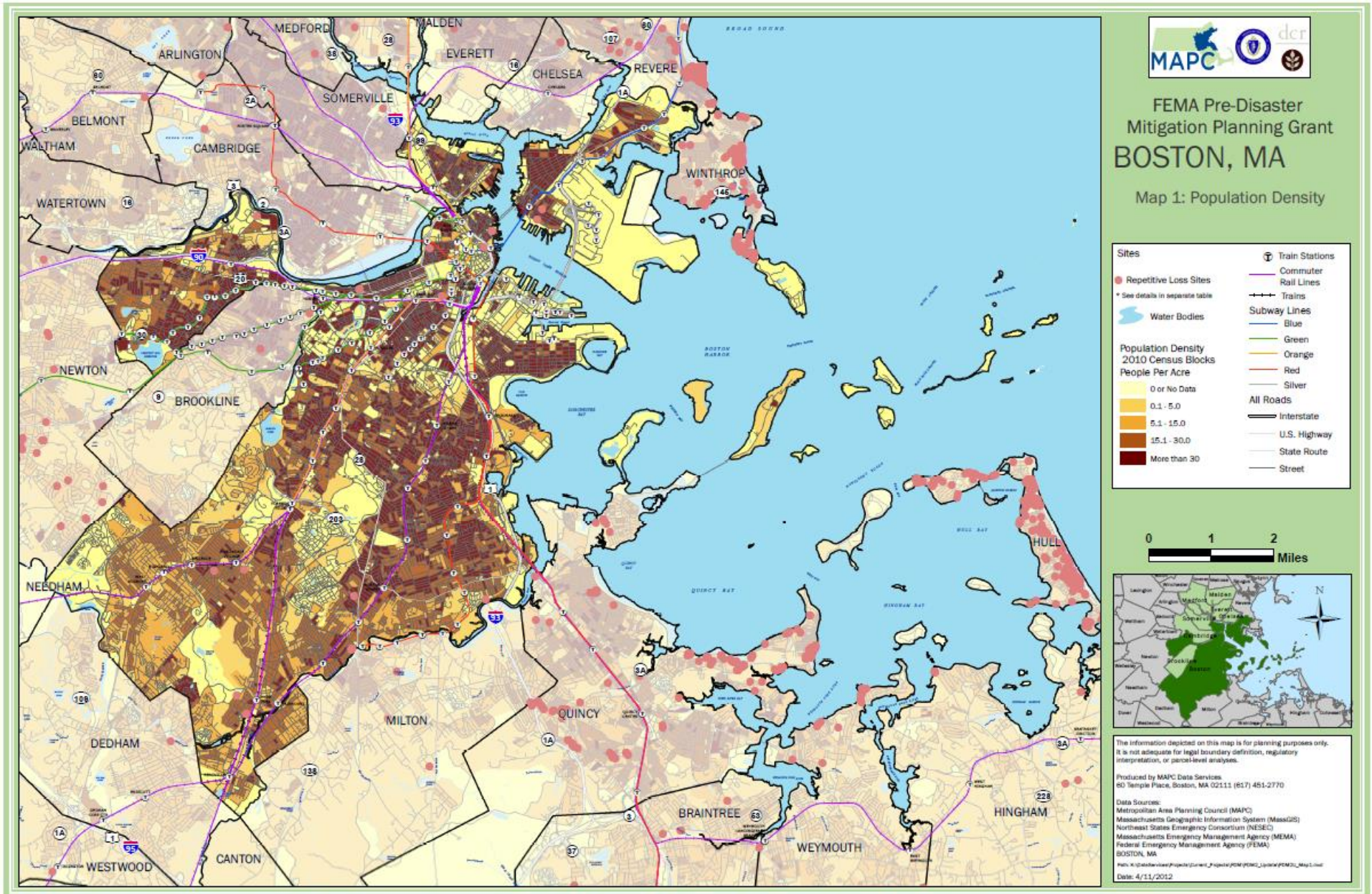
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Hurricane storm surge is an abnormal rise in sea level accompanying a hurricane or other intense storm. Along a coastline a hurricane will cause waves on top of the surge. Hurricane Surge is estimated with the use of a computer model called SLOSH. 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.

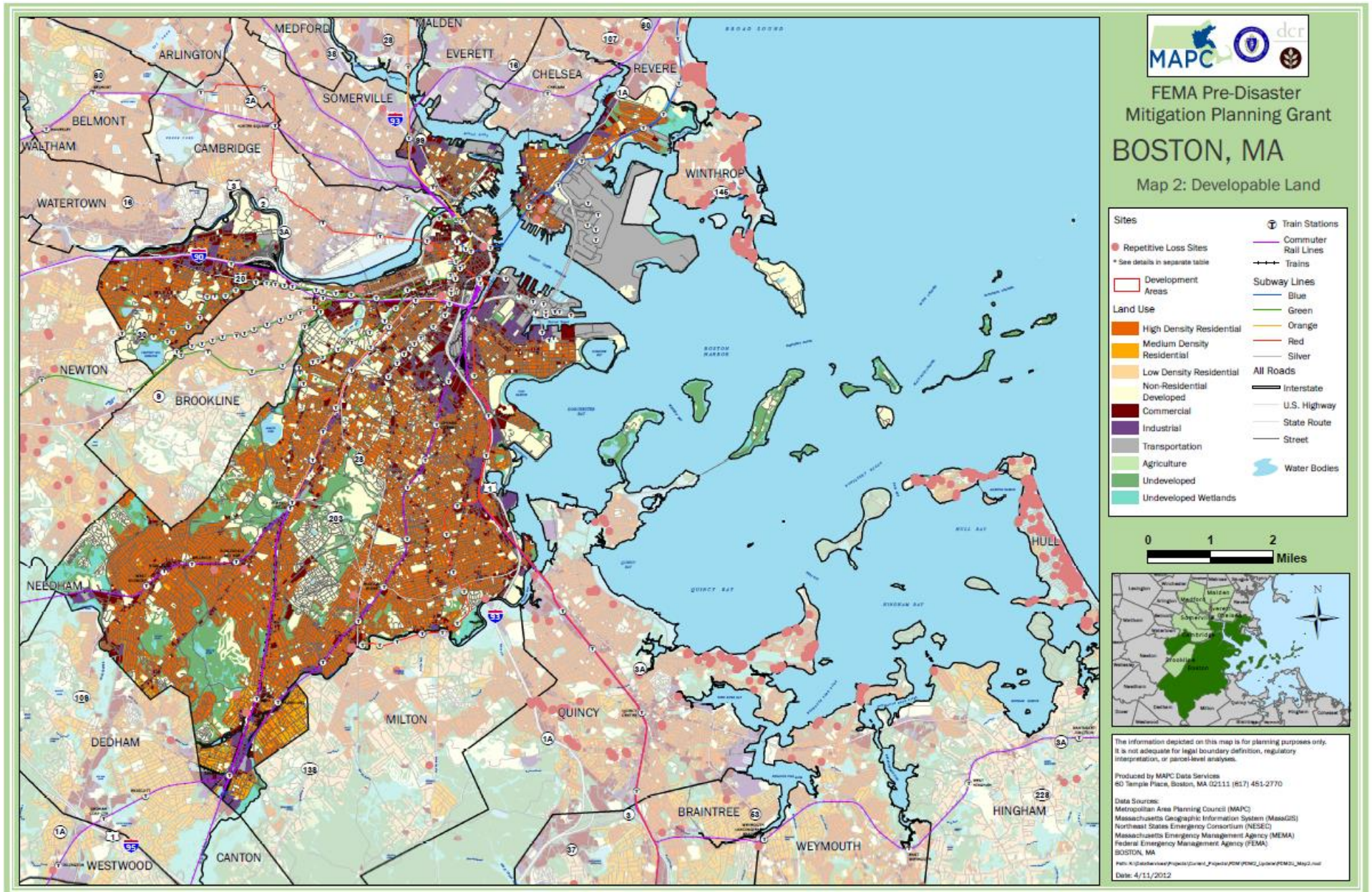
***Average Snowfall*** - - This map shows the average snowfall, repetitive loss structures and open space. It also shows storm tracks for nor'easters, if any storms tracked through the community.

***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.

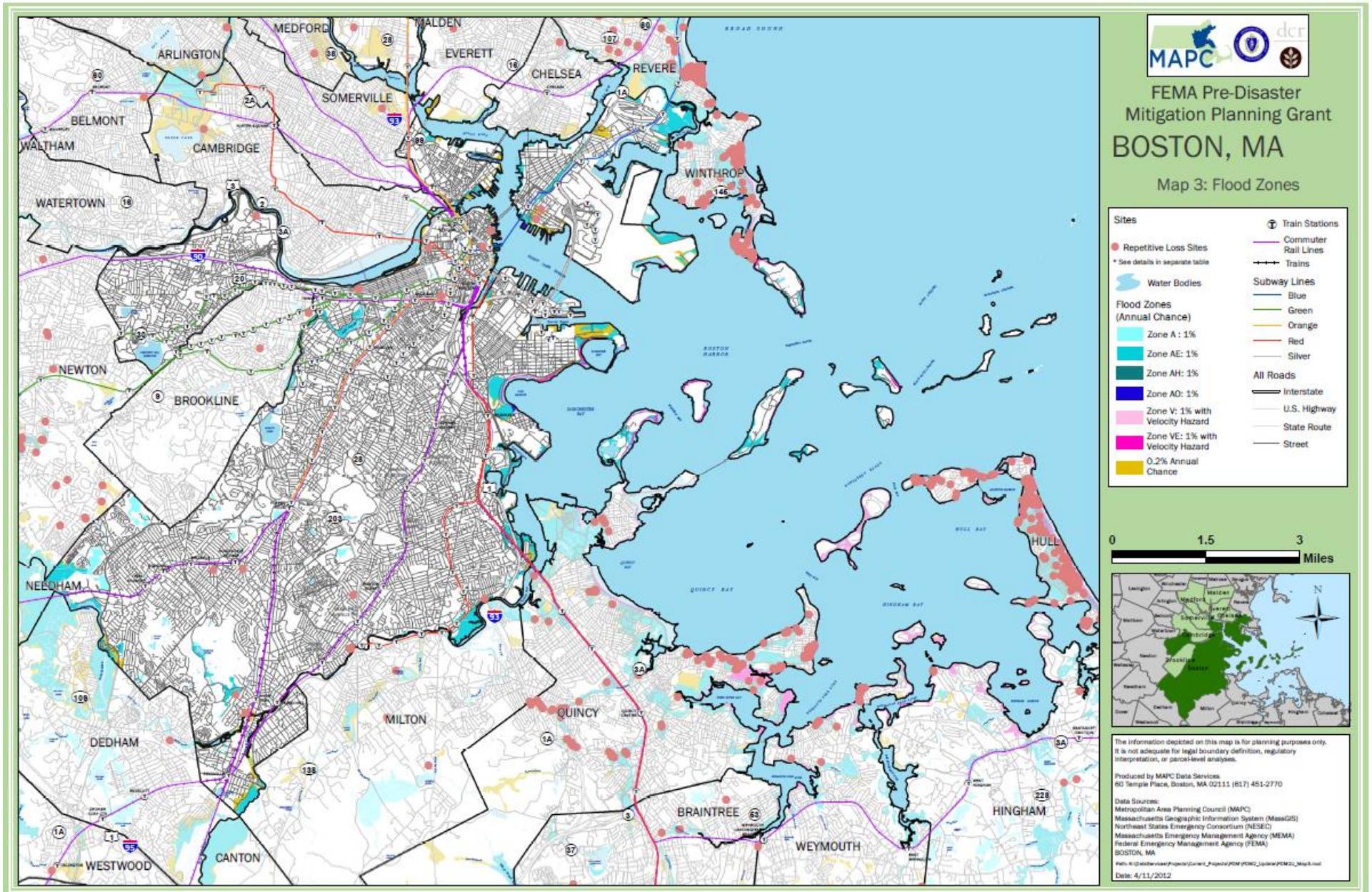
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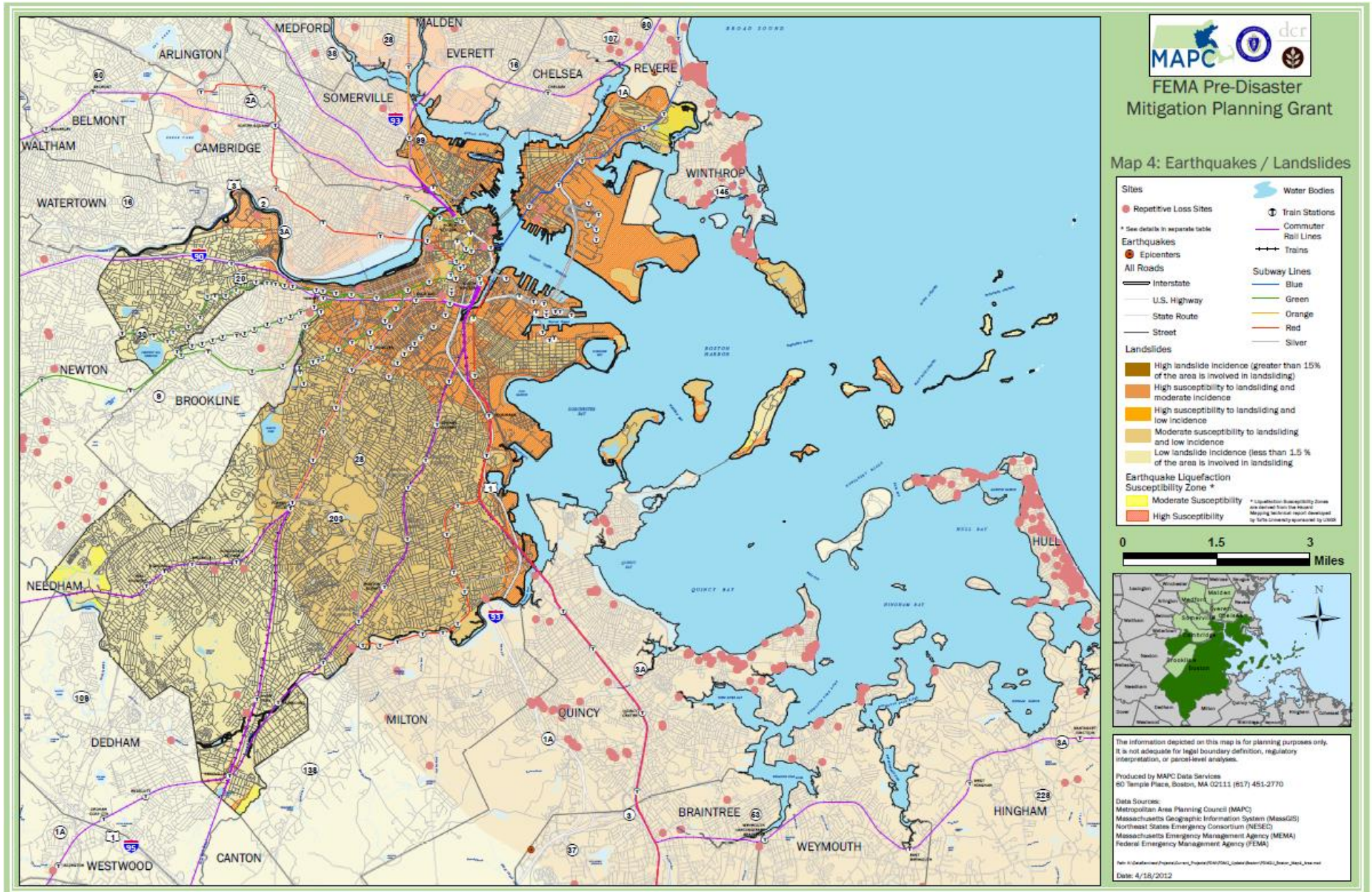
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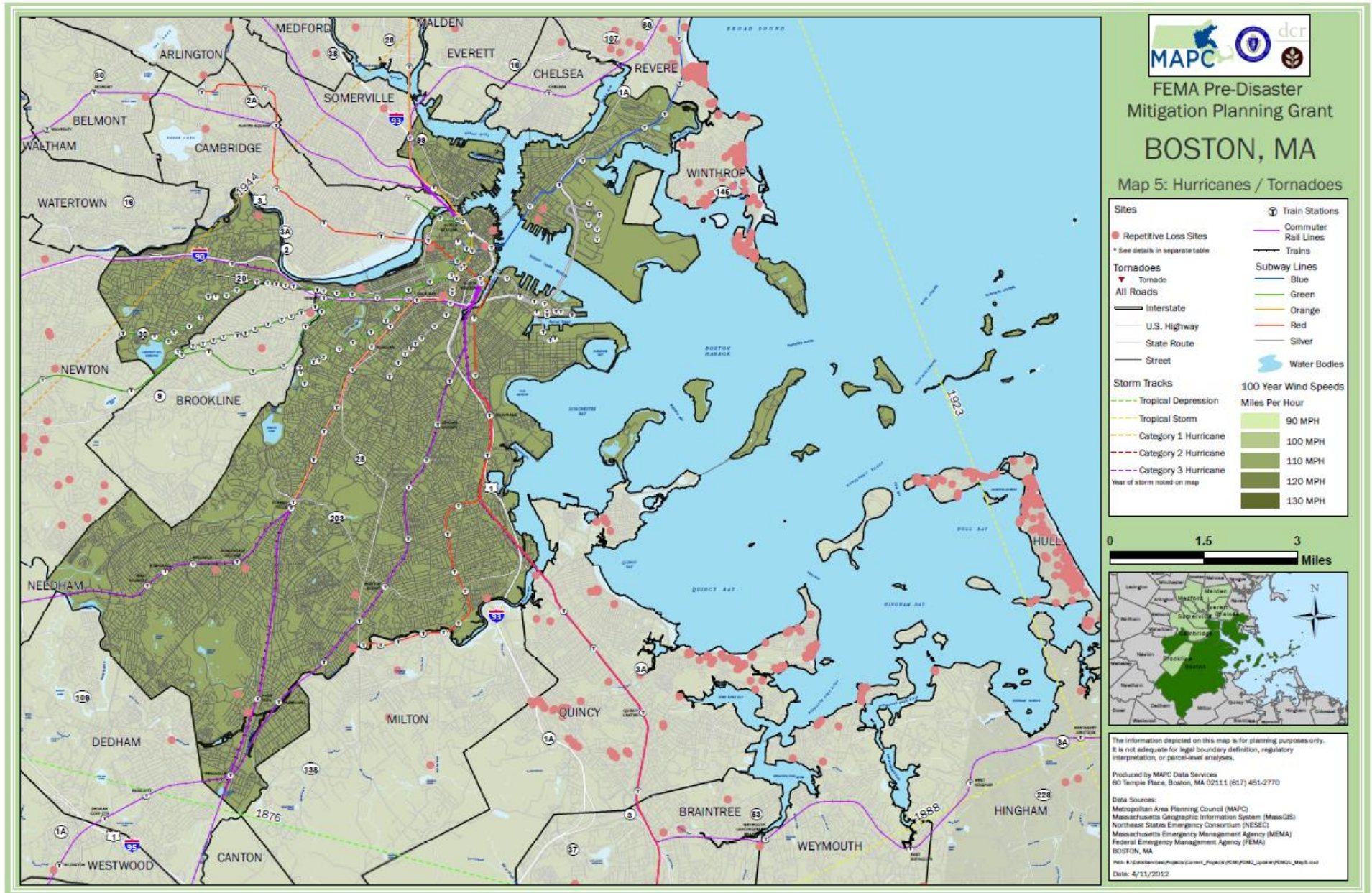
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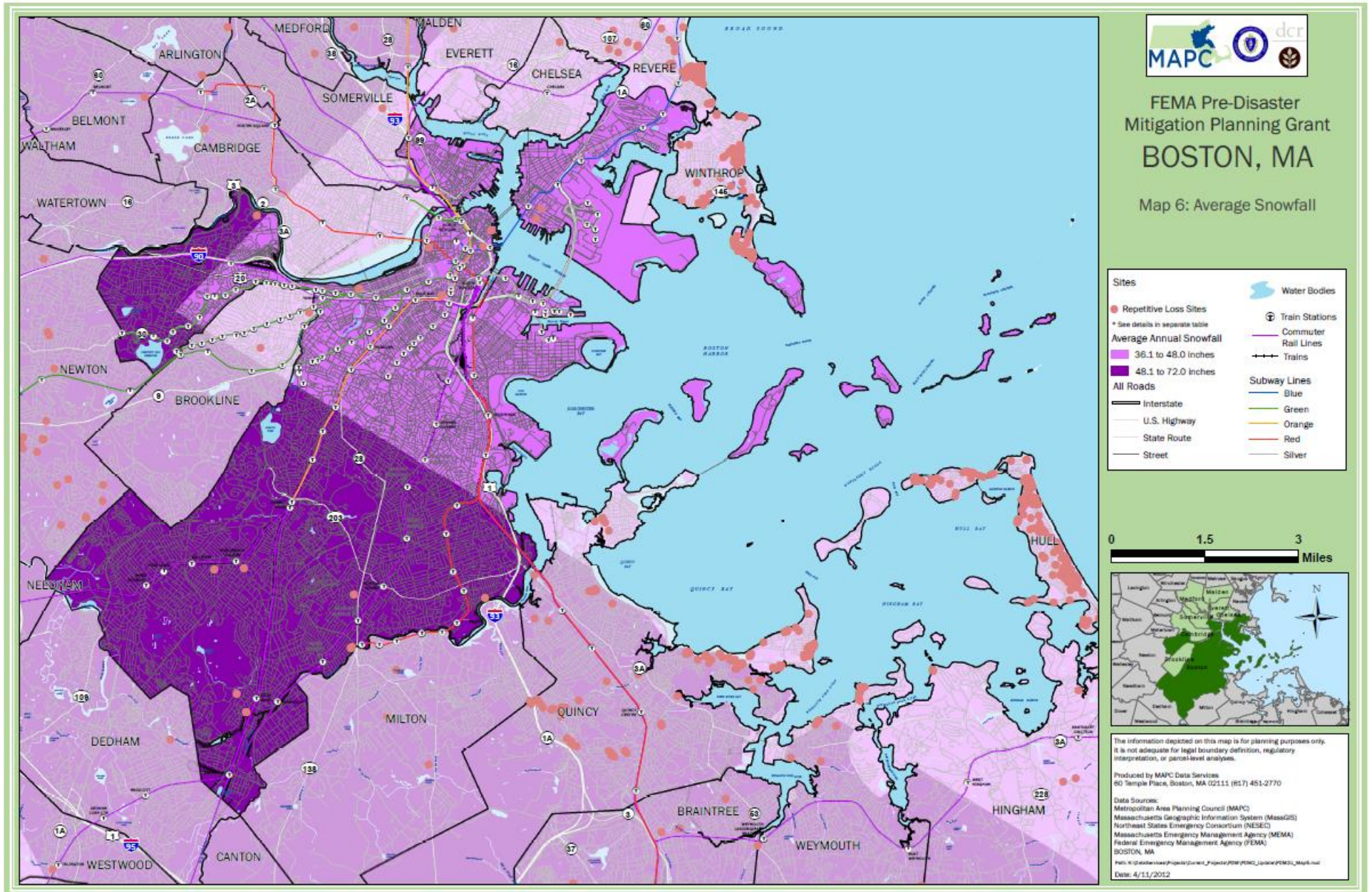
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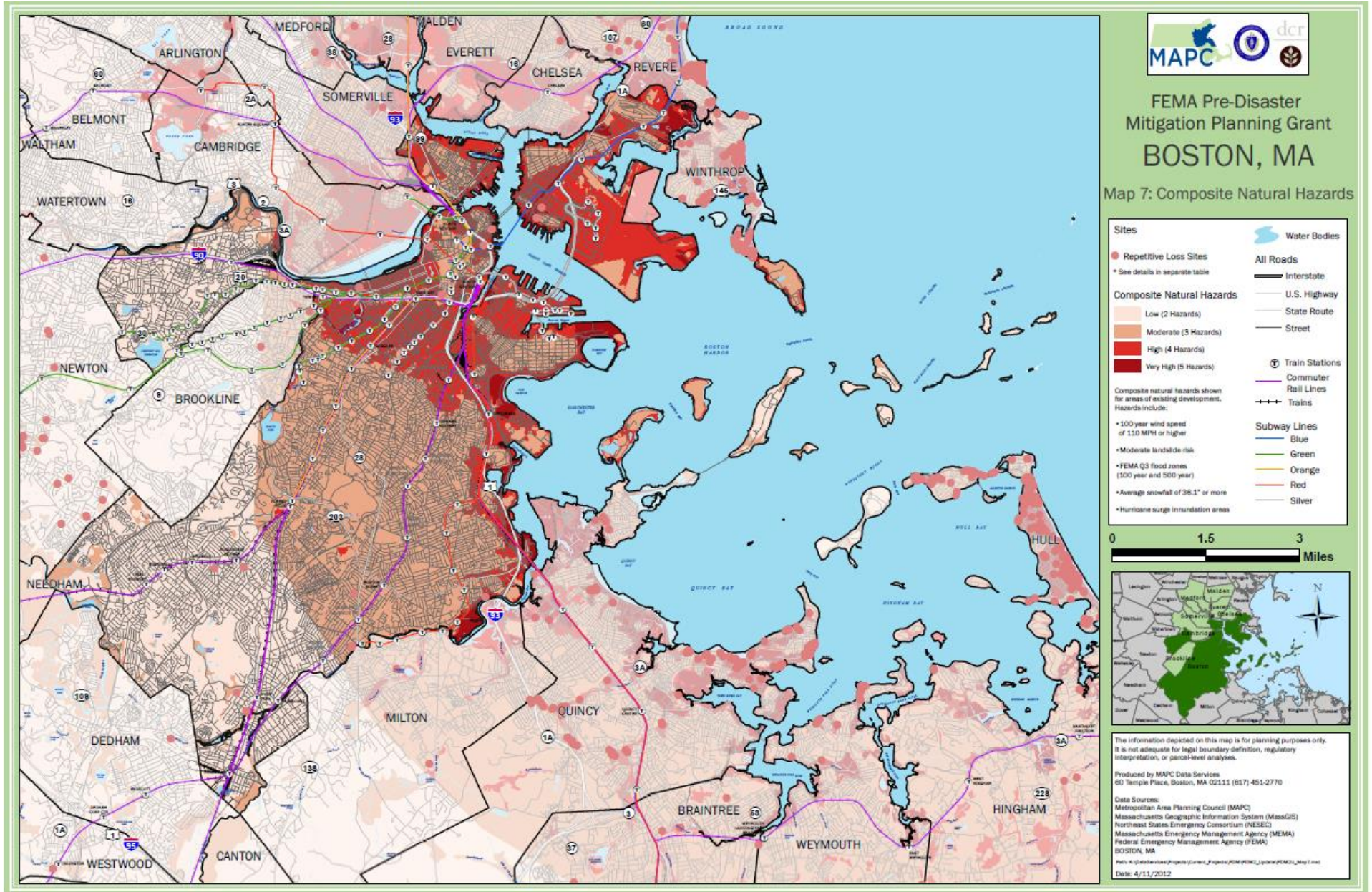
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**APPENDIX D  
Critical Facilities Inventory**

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## Explanation of Columns in the Critical Facilities Inventory Table

**Column 1: ID #:** Individual site ID number

**Column 2: Name:** Name of the site. This information was provided by the community.

**Column 3: Type of Facility:** Type of site. This information was provided by the community.

**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. For more information on how landslide susceptibility was mapped, refer to <http://pubs.usgs.gov/pp/p1183/pp1183.html>.

**Column 5: Flood Zone:** Risk of flooding, information based on the Flood Insurance Rate Maps (FIRM). If there is an entry in this column, it indicates the type of flood zone as follows:

**Zone A** (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: Snowfall Category:** Average annual snowfall data from NESEC.

Low category is 36 – 48 inches per year

High category is 48 – 72 inches per year.

**Column 7: Hurricane Surge Area:** Whether the site is located within a hurricane surge area and the potential degree of inundation during a hurricane. The following explanation of hurricane surge areas is taken from the U.S. Army Corps of Engineers web site:

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

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

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| <b>ID#</b> | <b>NAME</b>                     | <b>TYPE</b>                | <b>LANDSLIDE</b> | <b>FLOOD ZONE</b> | <b>SNOW FALL</b> | <b>HURR SURGE</b> |
|------------|---------------------------------|----------------------------|------------------|-------------------|------------------|-------------------|
| 1          | Emergency Operations Center     | Emergency Operation Center | Moderate         | No                | High             | 0                 |
| 2          | Water & Sewer Operations Center | Emergency Operation Center | Moderate         | No                | Low              | 2                 |
| 3          | Biranda -Creamer Building       | Emergency Operation Center | Moderate         | No                | Low              | 2                 |
| 4          | Police Headquarters             | Emergency Operation Center | Moderate         | No                | Low              | 0                 |
| 5          | Fire Alarm                      | Emergency Operation Center | Moderate         | No                | Low              | 2                 |
| 6          | City Hall                       | Emergency Operation Center | Moderate         | No                | Low              | 0                 |
| 7          | ENGINE CO. 2, 19                | Fire Stations              | Moderate         | No                | Low              | 0                 |
| 8          | ENGINE CO. 3                    | Fire Stations              | Moderate         | No                | Low              | 2                 |
| 9          | ENGINE CO. 4, 24                | Fire Stations              | Moderate         | No                | Low              | 0                 |
| 10         | ENGINE CO. 5                    | Fire Stations              | Moderate         | No                | Low              | 0                 |
| 11         | ENGINE CO. 7, 17                | Fire Stations              | Moderate         | No                | Low              | 0                 |
| 12         | ENGINE CO. 8, 1                 | Fire Stations              | Moderate         | No                | Low              | 0                 |
| 13         | ENGINE CO. 9, 2                 | Fire Stations              | Moderate         | No                | Low              | 1                 |
| 14         | ENGINE CO. 14, 4                | Fire Stations              | Moderate         | No                | Low              | 0                 |
| 15         | ENGINE CO. 16                   | Fire Stations              | Moderate         | No                | High             | 0                 |
| 16         | ENGINE CO. 17, 7                | Fire Stations              | Moderate         | No                | Low              | 0                 |
| 17         | ENGINE CO. 18, 6                | Fire Stations              | Moderate         | No                | High             | 0                 |
| 18         | ENGINE CO. 20                   | Fire Stations              | Moderate         | No                | High             | 2                 |
| 19         | ENGINE CO. 21                   | Fire Stations              | Moderate         | No                | Low              | 0                 |
| 20         | ENGINE CO. 22                   | Fire Stations              | Moderate         | No                | Low              | 2                 |
| 21         | ENGINE CO. 24, 23               | Fire Stations              | Moderate         | No                | High             | 0                 |
| 22         | ENGINE CO. 29, 11               | Fire Stations              | Low              | No                | High             | 0                 |
| 23         | ENGINE CO. 30, 25               | Fire Stations              | Low              | No                | High             | 0                 |
| 24         | ENGINE CO. 32, 9                | Fire Stations              | Moderate         | No                | Low              | 2                 |
| 25         | ENGINE CO. 33, 15               | Fire Stations              | Moderate         | No                | Low              | 2                 |
| 26         | ENGINE CO. 37, 26               | Fire Stations              | Moderate         | No                | Low              | 2                 |
| 27         | ENGINE CO. 39, 18               | Fire Stations              | Moderate         | No                | Low              | 4                 |
| 28         | ENGINE CO. 41, 14               | Fire Stations              | Low              | No                | Low              | 0                 |
| 29         | ENGINE CO. 42                   | Fire Stations              | Moderate         | No                | High             | 0                 |

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| <b>ID#</b> | <b>NAME</b>                                  | <b>TYPE</b>     | <b>LANDSLIDE</b> | <b>FLOOD ZONE</b> | <b>SNOW FALL</b> | <b>HURR SURGE</b> |
|------------|--|-----------------|------------------|-------------------|------------------|-------------------|
| 30         | ENGINE CO. 48, 28                            | Fire Stations   | Low              | No                | High             | 0                 |
| 31         | ENGINE CO. 49                                | Fire Stations   | Low              | No                | High             | 0                 |
| 32         | ENGINE CO. 50                                | Fire Stations   | Moderate         | No                | Low              | 0                 |
| 33         | ENGINE CO. 51                                | Fire Stations   | Low              | No                | High             | 0                 |
| 34         | ENGINE CO. 52, 29                            | Fire Stations   | Moderate         | No                | High             | 0                 |
| 35         | ENGINE CO. 53, 16                            | Fire Stations   | Low              | No                | High             | 0                 |
| 36         | ENGINE CO. 55                                | Fire Stations   | Low              | No                | High             | 0                 |
| 37         | ENGINE CO. 56, 21                            | Fire Stations   | Moderate         | No                | Low              | 4                 |
| 38         | ENGINE CO. 28, 10 (Division 2 Headquarters)  | Fire Stations   | Moderate         | No                | High             | 0                 |
| 39         | ENGINE CO. 10                                | Fire Stations   | Moderate         | No                | Low              | 0                 |
| 40         | AIR SUPPLY UNIT                              | Fire Stations   | Moderate         | No                | Low              | 2                 |
| 41         | BOSTON POLICE DEPARTMENT                     | Fire Stations   | Moderate         | VE                | Low              | 0                 |
| 42         | BOSTON POLICE DEPARTMENT DISTRICT E-18       | Police Stations | Low              | No                | High             | 0                 |
| 43         | BOSTON POLICE DEPARTMENT DISTRICT B3         | Police Stations | Moderate         | No                | High             | 0                 |
| 44         | BOSTON POLICE DEPARTMENT DISTRICT E-5        | Police Stations | Low              | No                | High             | 0                 |
| 45         | BOSTON POLICE DEPARTMENT DISTRICT C-11       | Police Stations | Moderate         | No                | High             | 4                 |
| 46         | BOSTON POLICE DEPARTMENT DISTRICT E-13       | Police Stations | Moderate         | No                | High             | 0                 |
| 47         | BOSTON POLICE DEPARTMENT DISTRICT B-2        | Police Stations | Moderate         | No                | Low              | 0                 |
| 48         | BOSTON POLICE DEPARTMENT - HEADQUARTERS      | Police Stations | Moderate         | No                | Low              | 0                 |
| 49         | BOSTON POLICE DEPARTMENT DISTRICT D-4        | Police Stations | Moderate         | No                | Low              | 2                 |
| 50         | BOSTON POLICE DEPARTMENT DISTRICT C-6        | Police Stations | Moderate         | No                | Low              | 0                 |
| 51         | BOSTON POLICE - HARBOR PATROL                | Police Stations | Moderate         | No                | Low              | 2                 |
| 52         | BOSTON POLICE DEPARTMENT DISTRICT D-14       | Police Stations | Low              | No                | High             | 0                 |
| 53         | Boston Police Department: District A-1       | Police Stations | Moderate         | No                | Low              | 0                 |
| 54         | MASSACHUSETTS STATE POLICE - BRIGHTON        | Police Stations | Low              | No                | High             | 0                 |
| 55         | BOSTON POLICE DEPARTMENT DISTRICT A-7        | Police Stations | Moderate         | No                | Low              | 2                 |
| 56         | MASS PORT AUTHORITY POLICE - BOSTON AUTOPORT | Police Stations | Moderate         | AE                | Low              | 2                 |
| 57         | Boston Police-Transportation                 | Police Stations | Moderate         | No                | Low              | 2                 |
| 58         | Question- BPD sign posted but unlisted site  | Police Stations | Moderate         | No                | Low              | 0                 |

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|------------|---|--------------------------|------------------|-------------------|------------------|-------------------|
| 59         | Replace Station E-5 MA000111 ID11 correction          | Police Stations          | Low              | No                | High             | 0                 |
| 60         | Boston Police Academy                                 | Police Stations          | Low              | No                | High             | 0                 |
| 61         | 55 Bunker Hill St Vine St Police Station 617 343 4888 | Police Stations          | Moderate         | No                | Low              | 2                 |
| 62         | Replace Station C-6 MA000028 ID9 correction           | Police Stations          | Moderate         | No                | Low              | 4                 |
| 63         | Station 6, Ambulance 6                                | EMS Facility Sites       | Moderate         | No                | Low              | 0                 |
| 64         | Station 1, Ambulance 1                                | EMS Facility Sites       | Moderate         | No                | Low              | 0                 |
| 65         | Station 5, Paramedic 5                                | EMS Facility Sites       | Low              | No                | High             | 0                 |
| 66         | Station 3, Ambulance 3                                | EMS Facility Sites       | Moderate         | No                | High             | 0                 |
| 67         | Station 7, Ambulance 7                                | EMS Facility Sites       | Moderate         | No                | Low              | 4                 |
| 68         | Station 23, Paramedic 3                               | EMS Facility Sites       | Moderate         | No                | High             | 0                 |
| 69         | Station 12  | EMS Facility Sites       | Moderate         | No                | High             | 0                 |
| 70         | Station 14, Ambulance 14                              | EMS Facility Sites       | Low              | No                | High             | 0                 |
| 71         | Station 16, Ambulance 16                              | EMS Facility Sites       | Moderate         | No                | Low              | 0                 |
| 72         | Station 13, Ambulance 13                              | EMS Facility Sites       | Moderate         | No                | High             | 0                 |
| 73         | Station 2, Ambulance 2                                | EMS Facility Sites       | Moderate         | No                | Low              | 0                 |
| 74         | Station 15, Ambulance 15                              | EMS Facility Sites       | Moderate         | No                | Low              | 1                 |
| 75         | Station 18, Ambulance 18                              | EMS Facility Sites       | Low              | No                | High             | 0                 |
| 76         | Station 11, Ambulance 11                              | EMS Facility Sites       | Moderate         | No                | High             | 4                 |
| 77         | Station 10  | EMS Facility Sites       | Moderate         | No                | Low              | 2                 |
| 78         | Tufts Station, Ambulance 4                            | EMS Facility Sites       | Moderate         | No                | Low              | 2                 |
| 79         | Special Operations                                    | EMS Facility Sites       | Moderate         | No                | High             | 0                 |
| 80         | Boston Health Care for the Homeless Program           | Community Health Centers | Moderate         | No                | Low              | 2                 |
| 81         | Bowdoin Street Health Center                          | Community Health Centers | Moderate         | No                | High             | 0                 |
| 82         | Brookside Community Health Center                     | Community Health Centers | Moderate         | No                | High             | 0                 |
| 83         | Codman Square Health Center                           | Community Health Centers | Moderate         | No                | High             | 0                 |
| 84         | Dimock Community Health Center                        | Community Health Centers | Moderate         | No                | High             | 0                 |
| 85         | Dorchester House Multi-Service Center                 | Community Health Centers | Moderate         | No                | Low              | 0                 |
| 86         | East Boston Neighborhood Health Center                | Community Health Centers | Moderate         | No                | Low              | 1                 |
| 87         | Fenway Community Health Center                        | Community Health Centers | Moderate         | No                | Low              | 2                 |

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|------------|--|--------------------------|------------------|-----------------------|------------------|-------------------|
| 88         | Geiger Gibson Community Health Center                    | Community Health Centers | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 2                 |
| 89         | Greater Roslindale Medical & Dental Center               | Community Health Centers | Low              | No                    | High             | 0                 |
| 90         | Harvard Street Adolescent Child Life Center              | Community Health Centers | Moderate         | No                    | High             | 0                 |
| 91         | Harvard Street Neighborhood Health Center                | Community Health Centers | Moderate         | No                    | High             | 0                 |
| 92         | Joseph M. Smith Community Health Center - Allston        | Community Health Centers | Low              | No                    | High             | 4                 |
| 93         | Martha Eliot Health Center                               | Community Health Centers | Moderate         | No                    | Low              | 0                 |
| 94         | Mattapan Community Health Center                         | Community Health Centers | Moderate         | No                    | High             | 0                 |
| 95         | MGH Charlestown HealthCare Center                        | Community Health Centers | Moderate         | No                    | Low              | 0                 |
| 96         | Neponset Health Center                                   | Community Health Centers | Moderate         | No                    | High             | 0                 |
| 97         | North End Community Health Center                        | Community Health Centers | Moderate         | No                    | Low              | 0                 |
| 98         | Roxbury Comprehensive Community Health Center            | Community Health Centers | Moderate         | No                    | Low              | 0                 |
| 99         | Sidney Borum Jr. Health Center                           | Community Health Centers | Moderate         | No                    | Low              | 0                 |
| 100        | South Boston Community Health Center - 386 W Broadway    | Community Health Centers | Moderate         | No                    | Low              | 0                 |
| 101        | South Boston Community Health Center - 409 W Broadway    | Community Health Centers | Moderate         | No                    | Low              | 0                 |
| 102        | South Cove Community Health Center                       | Community Health Centers | Moderate         | No                    | Low              | 0                 |
| 103        | South Cove Community Health Center - South Street Center | Community Health Centers | Moderate         | No                    | High             | 0                 |
| 104        | South End Associates                                     | Community Health Centers | Moderate         | No                    | Low              | 0                 |
| 105        | South End Community Health Center                        | Community Health Centers | Moderate         | No                    | Low              | 2                 |
| 106        | Southern Jamaica Plain Health Center                     | Community Health Centers | Moderate         | No                    | High             | 0                 |
| 107        | Upham's Corner Health Center - 415 Columbia Rd           | Community Health Centers | Moderate         | No                    | Low              | 0                 |
| 108        | Upham's Corner Health Center - 500 Columbia Rd           | Community Health Centers | Moderate         | No                    | Low              | 0                 |
| 109        | Upham's Corner Health Center - 636 Columbia Rd           | Community Health Centers | Moderate         | No                    | Low              | 0                 |
| 110        | Whittier Street Health Center                            | Community Health Centers | Moderate         | No                    | Low              | 0                 |
| 111        | Arbour Hospital  | Hospitals                | Moderate         | No                    | High             | 0                 |
| 112        | Franciscan Children's Hospital & Rehab Center            | Hospitals                | Moderate         | No                    | Low              | 0                 |
| 113        | Hebrew Rehabilitation Center                             | Hospitals                | Low              | No                    | High             | 0                 |
| 114        | Jewish Memorial Hospital                                 | Hospitals                | Moderate         | No                    | Low              | 0                 |



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|------------|---|------------------|------------------|-------------------|------------------|-------------------|
| 115        | Kindred Hospital  | Hospitals        | Low              | No                | Low              | 0                 |
| 116        | Lemuel Shattuck Hospital                                    | Hospitals        | Moderate         | No                | High             | 0                 |
| 117        | Radius Hospital   | Hospitals        | Moderate         | No                | Low              | 0                 |
| 118        | ShrinerÆs Burn Instituteá                                   | Hospitals        | Moderate         | No                | Low              | 0                 |
| 119        | Spaulding Rehabilitation Hospital                           | Hospitals        | Moderate         | No                | Low              | 2                 |
| 120        | Beth Isreal Deaconess medical Center - East Campus          | Hospitals        | Moderate         | No                | Low              | 0                 |
| 121        | Boston Medical Center - Menino Campus                       | Hospitals        | Moderate         | No                | Low              | 2                 |
| 122        | Brigham and Women's Hospital                                | Hospitals        | Moderate         | No                | Low              | 0                 |
| 123        | Carney Hospital   | Hospitals        | Moderate         | No                | High             | 0                 |
| 124        | Children's Hospital Boston                                  | Hospitals        | Moderate         | No                | Low              | 0                 |
| 125        | Dana-Farber Cancer Institute                                | Hospitals        | Moderate         | No                | Low              | 0                 |
| 126        | Faulkner Hospital   | Hospitals        | Low              | No                | High             | 0                 |
| 127        | Massachusetts Eye and Ear Infirmary                         | Hospitals        | Moderate         | No                | Low              | 2                 |
| 128        | Caritas St. Elizabeth's Hospital                            | Hospitals        | Low              | No                | High             | 0                 |
| 129        | Tufts Medical Center  | Hospitals        | Moderate         | No                | Low              | 2                 |
| 130        | VA Bos. Healthcare System - Jamaica Plain                   | Hospitals        | Moderate         | No                | Low              | 0                 |
| 131        | VA Bos. Healthcare System - W. Roxbury                      | Hospitals        | Low              | No                | High             | 0                 |
| 132        | Beth Israel Deaconess Medical Center - West Campus          | Hospitals        | Moderate         | No                | Low              | 0                 |
| 133        | Boston Medical Center - East Newton Campus                  | Hospitals        | Moderate         | No                | Low              | 2                 |
| 134        | New England Baptist Hospital                                | Hospitals        | Moderate         | No                | Low              | 0                 |
| 135        | BOSTON VETERAN CENTER                                       | Hospitals        | Moderate         | No                | Low              | 2                 |
| 136        | Veterans Affairs Boston Healthcare System Outpatient Clinic | Medical Facility | Moderate         | No                | Low              | 2                 |
| 137        | ERICH LINDEMANN MENTAL HEALTH CENTER                        | Hospitals        | Moderate         | No                | Low              | 0                 |
| 138        | URGENT CARE MEDICAL CLINIC                                  | Hospitals        | Moderate         | No                | Low              | 2                 |
| 139        | Beth Israel Deaconess Medical Center                        | Hospitals        | Moderate         | No                | Low              | 0                 |
| 140        | Arbour Hospital   | Hospitals        | Moderate         | No                | High             | 0                 |
| 141        | Question Simon C Fireman Research Center                    | Hospitals        | Moderate         | No                | Low              | 2                 |
| 142        | Children's Hospital Boston                                  | Hospitals        | Moderate         | No                | Low              | 0                 |
| 143        | Children's Hospital Boston                                  | Hospitals        | Moderate         | No                | Low              | 0                 |

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|------------|---|-------------|------------------|-------------------|------------------|-------------------|
| 144        | Children's Hospital Boston                          | Hospitals   | Moderate         | No                | Low              | 0                 |
| 145        | Dana-Farber Cancer Institute                        | Hospitals   | Moderate         | No                | Low              | 0                 |
| 146        | Children's Hospital Boston                          | Hospitals   | Moderate         | No                | Low              | 0                 |
| 147        | Dana-Farber Cancer Institute                        | Hospitals   | Moderate         | No                | Low              | 0                 |
| 148        | Children's Hospital Karp Family Research Lab        | Hospitals   | Moderate         | No                | Low              | 0                 |
| 149        | Beth Isreal Deaconess Medical West                  | Hospitals   | Moderate         | No                | Low              | 0                 |
| 150        | Children's Hospital Boston                          | Hospitals   | Moderate         | No                | Low              | 0                 |
| 151        | Dana-Farber Cancer Institute                        | Hospitals   | Moderate         | No                | Low              | 0                 |
| 152        | Dana-Farber Cancer Institute                        | Hospitals   | Moderate         | No                | Low              | 0                 |
| 153        | Boston Public Health Commission Medical Facilities  | Hospitals   | Moderate         | No                | Low              | 4                 |
| 154        | Boston Public Health Commission Medical Facilities  | Hospitals   | Moderate         | No                | Low              | 2                 |
| 155        | New England Plastic Surgical                        | Hospitals   | Low              | No                | High             | 0                 |
| 156        | MGH at the Navy Yard                                | Hospitals   | Moderate         | No                | Low              | 2                 |
| 157        | MGH Nessel Cancer Services                          | Hospitals   | Moderate         | No                | Low              | 2                 |
| 158        | Massachusetts General Hospital                      | Hospitals   | Moderate         | No                | Low              | 2                 |
| 159        | Question-Chinese Hospital?                          | Hospitals   | Low              | No                | Low              | 0                 |
| 160        | MGH Ruth Sleeper Hall                               | Hospitals   | Moderate         | No                | Low              | 2                 |
| 161        | MGH West End House                                  | Hospitals   | Moderate         | No                | Low              | 2                 |
| 162        | Tufts Medical Center                                | Hospitals   | Moderate         | No                | Low              | 0                 |
| 163        | Boston Medical Center - East Newton Campus          | Hospitals   | Moderate         | No                | Low              | 2                 |
| 164        | Boston Medical Center - East Newton Campus          | Hospitals   | Moderate         | No                | Low              | 4                 |
| 165        | Boston Medical Center - East Newton Campus          | Hospitals   | Moderate         | No                | Low              | 2                 |
| 166        | New England Medical Rehabilitation                  | Hospitals   | Moderate         | No                | Low              | 2                 |
| 167        | Tufts Medical Center                                | Hospitals   | Moderate         | No                | Low              | 2                 |
| 168        | Tufts Medical Center                                | Hospitals   | Moderate         | No                | Low              | 2                 |
| 169        | Question-Boston Medical Center - East Newton Campus | Hospitals   | Moderate         | No                | Low              | 2                 |
| 170        | Tufts Medical Center                                | Hospitals   | Moderate         | No                | Low              | 0                 |
| 171        | Brigham and Women's Hospital                        | Hospitals   | Moderate         | No                | Low              | 0                 |
| 172        | APAC Child And Family Service Ctr Child Care        | Child Care  | Low              | No                | Low              | 0                 |

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|------------|--|-------------|------------------|-------------------|------------------|-------------------|
| 173        | Bright Horizon's Children's Center-Allston                 | Child Care  | Low              | No                | Low              | 0                 |
| 174        | Brighton/Allston Afterschool Enrichment Prog.              | Child Care  | Low              | No                | Low              | 0                 |
| 175        | Fairy Tale Children's Center Inc.                          | Child Care  | Moderate         | No                | Low              | 0                 |
| 176        | HUNTINGTON AVE YMCA @ GARDNER PILOT ACADEMY                | Child Care  | Low              | No                | High             | 0                 |
| 177        | Jackson-Mann Community Center School-Afterschool           | Child Care  | Low              | No                | Low              | 0                 |
| 178        | Pine Village Preschool                                     | Child Care  | Low              | No                | High             | 0                 |
| 179        | Rivendell Child Care Center                                | Child Care  | Low              | No                | Low              | 0                 |
| 180        | Wonder Years, Inc.   | Child Care  | Low              | No                | Low              | 0                 |
| 181        | Allson Brighton St. Gabriel's Head Start                   | Child Care  | Low              | No                | Low              | 0                 |
| 182        | Edison After School Program                                | Child Care  | Low              | No                | High             | 0                 |
| 183        | Allston/Brighton APAC, Inc.                                | Child Care  | Low              | No                | Low              | 0                 |
| 184        | Leventhal-Sidman JCC/Brookline Preschool                   | Child Care  | Low              | No                | High             | 0                 |
| 185        | Oak Square YMCA @ Winship                                  | Child Care  | Low              | No                | High             | 0                 |
| 186        | Camp Connolly  | Child Care  | Low              | No                | High             | 0                 |
| 187        | Franciscan Family Child Care Center                        | Child Care  | Low              | No                | High             | 0                 |
| 188        | St. E's Children's Center                                  | Child Care  | Low              | No                | High             | 0                 |
| 189        | Yal-Day-New Day Care Center                                | Child Care  | Low              | No                | High             | 0                 |
| 190        | Acorn Center for Early Education/Care                      | Child Care  | Moderate         | No                | Low              | 2                 |
| 191        | ARC-EN-CIEL Day Care and Montessori School                 | Child Care  | Low              | No                | High             | 0                 |
| 192        | Blackstone's New Adventure                                 | Child Care  | Moderate         | No                | Low              | 2                 |
| 193        | Associated Early Care Education Inc. - Castle Square       | Child Care  | Moderate         | No                | Low              | 2                 |
| 194        | Boston University Children's Center                        | Child Care  | Moderate         | No                | Low              | 0                 |
| 195        | Bright Horizons @ Seaport                                  | Child Care  | Moderate         | No                | Low              | 2                 |
| 196        | Bright Horizons @ Seaport SACC Backup                      | Child Care  | Moderate         | No                | Low              | 2                 |
| 197        | Bright Horizons @125 Summer Street                         | Child Care  | Moderate         | No                | Low              | 0                 |
| 198        | Bright Horizons at One Financial Center                    | Child Care  | Moderate         | No                | Low              | 0                 |
| 199        | Bright Horizons Children's Center                          | Child Care  | Moderate         | No                | Low              | 2                 |
| 200        | Bright Horizons Children's Center at the Prudential Center | Child Care  | Moderate         | No                | Low              | 0                 |
| 201        | Bright Horizons Family Center at Landmark                  | Child Care  | Moderate         | AE                | Low              | 2                 |

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| 202        | Bright Horizons Family Solution @ Beacon Hill           | Child Care  | Moderate         | No                | Low              | 0                 |
| 203        | Buds and Blossoms Early Education and Care Center       | Child Care  | Moderate         | No                | Low              | 2                 |
| 204        | Children's Hospital Child Care Center                   | Child Care  | Moderate         | No                | Low              | 0                 |
| 205        | Children's Place at Goodwin Procter                     | Child Care  | Moderate         | No                | Low              | 2                 |
| 206        | Children's Quarters Charlestown Navy Yard               | Child Care  | Moderate         | No                | Low              | 2                 |
| 207        | Commonwealth Children's Center - RM 105A                | Child Care  | Moderate         | No                | Low              | 0                 |
| 208        | Eagle's Nest Learning Center                            | Child Care  | Moderate         | No                | Low              | 2                 |
| 209        | Early Childhood Learning Lab                            | Child Care  | Moderate         | No                | Low              | 2                 |
| 210        | Ellis Memorial Early Education and Care Program-STE 101 | Child Care  | Moderate         | No                | Low              | 2                 |
| 211        | Ellis Memorial Children's Center                        | Child Care  | Moderate         | No                | Low              | 2                 |
| 212        | Ellis Memorial SAP at Madison Park Village              | Child Care  | Moderate         | No                | Low              | 2                 |
| 213        | Families First Day Care                                 | Child Care  | Moderate         | No                | Low              | 2                 |
| 214        | Government Center Child Care                            | Child Care  | Moderate         | No                | Low              | 0                 |
| 215        | Government Center Child Care Corp - O'Neil Federal Bldg | Child Care  | Moderate         | No                | Low              | 2                 |
| 216        | Harborview Children's Center                            | Child Care  | Moderate         | No                | Low              | 1                 |
| 217        | Huntington Ave YMCA @ Hurley School                     | Child Care  | Moderate         | No                | Low              | 0                 |
| 218        | Huntington Ave Day Camp                                 | Child Care  | Moderate         | No                | Low              | 2                 |
| 219        | Infants and Other People                                | Child Care  | Moderate         | No                | Low              | 2                 |
| 220        | Kids Palace Learning Center, LLC.                       | Child Care  | Moderate         | No                | Low              | 2                 |
| 221        | Kinder Care Learning Center                             | Child Care  | Moderate         | No                | Low              | 2                 |
| 222        | Little Wonders Child Care Center                        | Child Care  | Moderate         | No                | High             | 0                 |
| 223        | MGH Back Up Children's Center - WARREN LOBBY SUITE 130  | Child Care  | Moderate         | No                | Low              | 2                 |
| 224        | Millenium Day Car II                                    | Child Care  | Moderate         | No                | Low              | 0                 |
| 225        | Millennium Day Care                                     | Child Care  | Moderate         | No                | Low              | 4                 |
| 226        | North End Children's Center @ North End Health Center   | Child Care  | Moderate         | No                | Low              | 0                 |
| 227        | North End Head Start                                    | Child Care  | Moderate         | No                | Low              | 0                 |
| 228        | Old South Preschool                                     | Child Care  | Moderate         | No                | Low              | 2                 |
| 229        | Park Street Kids, Inc.                                  | Child Care  | Moderate         | No                | Low              | 0                 |
| 230        | Pine Village Preschool                                  | Child Care  | Moderate         | No                | Low              | 2                 |

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| 231        | Roxbury YMCA @ Blackstone School                       | Child Care  | Moderate         | No                | Low              | 2                 |
| 232        | RTH Children's Center                                  | Child Care  | Moderate         | No                | Low              | 0                 |
| 233        | Russell J. Call Children's Center                      | Child Care  | Moderate         | No                | Low              | 2                 |
| 234        | Salvation Army After School Program                    | Child Care  | Moderate         | No                | Low              | 2                 |
| 235        | Soldiers Field Park Children's Center                  | Child Care  | Moderate         | No                | Low              | 2                 |
| 236        | South End Head Start                                   | Child Care  | Moderate         | No                | Low              | 0                 |
| 237        | Spruce Street Nursery School                           | Child Care  | Moderate         | No                | Low              | 0                 |
| 238        | Sunrise Learning Academy LLC                           | Child Care  | Moderate         | No                | Low              | 0                 |
| 239        | Sunshine Childcare                                     | Child Care  | Moderate         | No                | Low              | 2                 |
| 240        | Tartt's Day Care Center II                             | Child Care  | Moderate         | No                | Low              | 2                 |
| 241        | The Children's Center at Ropes & Gray                  | Child Care  | Moderate         | No                | Low              | 0                 |
| 242        | The Children's Place At                                | Child Care  | Moderate         | No                | Low              | 2                 |
| 243        | The Frances Jacobson Early Childhood Center            | Child Care  | Moderate         | No                | Low              | 0                 |
| 244        | Torit Language Center Montessori                       | Child Care  | Moderate         | No                | Low              | 0                 |
| 245        | Transportation Children's Center - RM 3330             | Child Care  | Moderate         | No                | Low              | 2                 |
| 246        | United South End Settlements Child Development Program | Child Care  | Moderate         | No                | Low              | 2                 |
| 247        | Wang YMCA of Chinatown - SACC                          | Child Care  | Moderate         | No                | Low              | 0                 |
| 248        | Youth Education Program (YEP)                          | Child Care  | Moderate         | No                | Low              | 2                 |
| 249        | Anchor After School Program NAVY YARD                  | Child Care  | Moderate         | No                | Low              | 2                 |
| 250        | Boys & Girls Club of Boston @ Charlestown Club         | Child Care  | Moderate         | No                | Low              | 0                 |
| 251        | Bright Horizons Children's Center at the Schraffts     | Child Care  | Moderate         | AE                | Low              | 1                 |
| 252        | Charlestown Cooperative Nursery School                 | Child Care  | Moderate         | No                | Low              | 0                 |
| 253        | Good Shepherd Preschool                                | Child Care  | Moderate         | No                | Low              | 0                 |
| 254        | J.F.K. Head Start and Day Care Program                 | Child Care  | Moderate         | No                | Low              | 2                 |
| 255        | Kent After School Program                              | Child Care  | Moderate         | No                | Low              | 4                 |
| 256        | MGH Children's Center - CAPTAINS QUARTERS              | Child Care  | Moderate         | No                | Low              | 2                 |
| 257        | A Child's View   | Child Care  | Moderate         | No                | Low              | 0                 |
| 258        | ABCD Walnut Grove Head Start                           | Child Care  | Moderate         | No                | High             | 0                 |
| 259        | ASPIRE After School Program / Alliance for inclusion & | Child Care  | Moderate         | No                | High             | 0                 |

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|            | Prevention   |                  |                  |                       |                  |                   |
| 260        | Au Co Preschool / Viet Aid After School Programs             | Child Care       | Low              | No                    | High             | 0                 |
| 261        | Basics Tutorial - Mather School                              | Child Care       | Moderate         | No                    | Low              | 0                 |
| 262        | Basics Tutorial - Thomas Kenny School                        | Child Care       | Moderate         | No                    | High             | 0                 |
| 263        | Basics Tutorial - William Monroe Trotter Sch.                | Child Care       | Moderate         | No                    | High             | 0                 |
| 264        | Bird Street After School Program @ Russell Elementary School | Child Care       | Moderate         | No                    | Low              | 0                 |
| 265        | Boys and Girls Clubs Of Dorchester                           | Child Care       | Moderate         | No                    | Low              | 0                 |
| 266        | Bradshaw Children's Learning Program                         | Child Care       | Moderate         | No                    | High             | 0                 |
| 267        | Citizen Schools, Inc; (McCormack)                            | Child Care       | Moderate         | No                    | Low              | 2                 |
| 268        | College Bound Dorchester Early Education at Little House     | Child Care       | Moderate         | No                    | Low              | 0                 |
| 269        | College Bound Dorchester Early Education at Log School       | Child Care       | Moderate         | No                    | High             | 0                 |
| 270        | College Bound Dorchester/Ruth Darling Child Cape Center      | Child Care       | Moderate         | No                    | Low              | 0                 |
| 271        | Columbia Point Infant Toddler Day Care                       | Child Care       | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 2                 |
| 272        | Crispus Attucks Children's Center                            | Child Care       | Moderate         | No                    | High             | 0                 |
| 273        | Dimock Headstart   | Child Care       | Moderate         | No                    | Low              | 0                 |
| 274        | Eagle's Nest @ Boston College High School                    | Child Care       | Moderate         | No                    | Low              | 4                 |
| 275        | ABCD EARLY HEADSTART   | Child Care       | Moderate         | No                    | High             | 0                 |
| 276        | Basics Tutorial - John Holland School                        | Child Care       | Moderate         | No                    | High             | 0                 |
| 277        | Huntington Avenue YMCA @ Everett School                      | Child Care       | Moderate         | No                    | Low              | 0                 |
| 278        | Huntington Avenue YMCA @ King K-8 School                     | Child Care       | Moderate         | No                    | Low              | 0                 |
| 279        | Huntington AvenueYMCA @Winthrop                              | Child Care       | Moderate         | No                    | Low              | 0                 |
| 280        | Murphy Community Center                                      | Community Center | Moderate         | No                    | High             | 2                 |
| 281        | Neponset Child Care  | Child Care       | Moderate         | No                    | High             | 0                 |
| 282        | Project Hope Children's Center                               | Child Care       | Moderate         | No                    | Low              | 0                 |
| 283        | Small Wonders Nursery School                                 | Child Care       | Moderate         | No                    | High             | 4                 |
| 284        | The Paul R. McLaughlin Center                                | Child Care       | Moderate         | No                    | Low              | 4                 |

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|------------|--|-----------------------|------------------|-------------------|------------------|-------------------|
| 285        | UCCC @ Bird Street Youth Center                            | Child Care            | Moderate         | No                | Low              | 0                 |
| 286        | Yawkey Konbit Kreyol Center                                | Child Care            | Moderate         | No                | High             | 0                 |
| 287        | Hyde Park YMCA @ E. Greenwood                              | Child Care            | Low              | No                | High             | 0                 |
| 288        | Hyde Park YMCA OST Program                                 | Child Care            | Low              | No                | High             | 0                 |
| 289        | Little Voices Early Care and Education                     | Child Care            | Low              | No                | High             | 0                 |
| 290        | South Side Head Start II                                   | Child Care            | Low              | No                | High             | 0                 |
| 291        | Basics Tutorial - Mattahunt School                         | Child Care            | Moderate         | No                | High             | 0                 |
| 292        | Galivan Community Center                                   | BCYF community center | Moderate         | No                | High             | 0                 |
| 293        | Grove Hall Child Development Center                        | Child Care            | Moderate         | No                | High             | 0                 |
| 294        | Hyde Park YMCA @ Chittick School                           | Child Care            | Low              | No                | High             | 0                 |
| 295        | Jubilee Academy Preschool                                  | Child Care            | Moderate         | No                | High             | 0                 |
| 296        | La Ronde De Marie Claire Early Learning Center             | Child Care            | Moderate         | No                | High             | 0                 |
| 297        | Marie Claire Quality Childcare Center Infant Palace        | Child Care            | Moderate         | No                | High             | 0                 |
| 298        | Mattapan Head Start  | Child Care            | Moderate         | No                | High             | 0                 |
| 299        | Mildred Ave Community Center ASP                           | BCYF community center | Moderate         | No                | High             | 0                 |
| 300        | NECUB - Day Care   | Child Care            | Moderate         | No                | High             | 0                 |
| 301        | Spark Center / Group and School Age Program                | Child Care            | Moderate         | No                | High             | 0                 |
| 302        | St.Paul's Victory Assembly of God Learning Resource Center | Child Care            | Moderate         | No                | High             | 0                 |
| 303        | The Tabitha House  | Child Care            | Moderate         | No                | High             | 0                 |
| 304        | Children's Learning Center                                 | Child Care            | Low              | No                | High             | 0                 |
| 305        | Alliance for Inclusion & Prevention Inc.                   | Child Care            | Low              | No                | High             | 0                 |
| 306        | Haley School & Boston Nature Center Afterschool Program    | Child Care            | Moderate         | No                | High             | 0                 |
| 307        | Little People's Playhouse                                  | Child Care            | Moderate         | No                | High             | 0                 |
| 308        | Little People's Playhouse SACC                             | Child Care            | Low              | No                | High             | 0                 |
| 309        | Roslindale Community Center After School                   | Child Care            | Low              | No                | High             | 0                 |
| 310        | Southside Head Start                                       | Child Care            | Low              | No                | High             | 0                 |
| 311        | The Hill School  | Child Care            | Low              | No                | High             | 0                 |
| 312        | Therapeutic After School Program (TASP)                    | Child Care            | Low              | No                | High             | 0                 |
| 313        | Village Preschool  | Child Care            | Low              | No                | High             | 0                 |

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|------------|---|-------------|------------------|-------------------|------------------|-------------------|
| 314        | West Roxbury YMCA @ Phineas Bates   | Child Care  | Low              | No                | High             | 0                 |
| 315        | West Roxbury YMCA@Sacred Heart Preschool & School Age                           | Child Care  | Low              | No                | High             | 0                 |
| 316        | ABCD Head Start   | Child Care  | Moderate         | No                | Low              | 0                 |
| 317        | ABCD Head Start @ Lenox Street  | Child Care  | Moderate         | No                | Low              | 0                 |
| 318        | Above & Beyond SACC Program @ Moreland Street                                   | Child Care  | Moderate         | No                | Low              | 0                 |
| 319        | Bird Street Before and After school Program @ Orchard Gardens                   | Child Care  | Moderate         | No                | Low              | 0                 |
| 320        | Bird Street Cmty Ctr. ASP@ Higginson-Lewis K2-8 Before and After School Program | Child Care  | Moderate         | No                | Low              | 0                 |
| 321        | Boys and Girls Clubs @ Yawkey Club  | Child Care  | Moderate         | No                | Low              | 0                 |
| 322        | Children's Services of Roxbury Early Care & Education Center                    | Child Care  | Moderate         | No                | Low              | 0                 |
| 323        | Dimock Early Headstart  | Child Care  | Moderate         | No                | High             | 0                 |
| 324        | Eliot Educational Center  | Child Care  | Moderate         | No                | Low              | 0                 |
| 325        | Goodwill Mellon Academy   | Child Care  | Moderate         | No                | Low              | 2                 |
| 326        | Hawthorne After School Program  | Child Care  | Moderate         | No                | Low              | 0                 |
| 327        | Huntington Avenue YMCA @ Mason School   | Child Care  | Moderate         | No                | Low              | 4                 |
| 328        | Paige Academy   | Child Care  | Moderate         | No                | Low              | 0                 |
| 329        | Paige Academy School Age Child Care   | Child Care  | Moderate         | No                | Low              | 0                 |
| 330        | Rosa Parks Day Care Center  | Child Care  | Moderate         | No                | Low              | 0                 |
| 331        | Roxbury Weston Programs Inc. SACC/CATCH   | Child Care  | Moderate         | No                | Low              | 0                 |
| 332        | Roxbury YMCA Child Care Center  | Child Care  | Moderate         | No                | Low              | 0                 |
| 333        | S.M.I.L.E Pre School Team   | Child Care  | Moderate         | No                | Low              | 0                 |
| 334        | Smile Preschool   | Child Care  | Moderate         | No                | Low              | 0                 |
| 335        | Sunnyside Day Nursery   | Child Care  | Moderate         | No                | Low              | 0                 |
| 336        | The Abantwana Learning Center   | Child Care  | Moderate         | No                | High             | 0                 |
| 337        | The Edgerley Family Community Children's Center                                 | Child Care  | Moderate         | No                | High             | 0                 |
| 338        | The Gate House Head Start Program   | Child Care  | Moderate         | No                | High             | 0                 |
| 339        | Twelfth Baptist Church After School Program                                     | Child Care  | Moderate         | No                | Low              | 0                 |
| 340        | UCCC @ Ellis  | Child Care  | Moderate         | No                | High             | 0                 |



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|------------|--|-------------|------------------|-------------------|------------------|-------------------|
| 341        | UCCC @ Emerson   | Child Care  | Moderate         | No                | Low              | 0                 |
| 342        | UCCC @ Nathan Hale                                       | Child Care  | Moderate         | No                | Low              | 0                 |
| 343        | Vine St. Community Centers - SACC Program                | Child Care  | Moderate         | No                | Low              | 0                 |
| 344        | Children's Happy Day School                              | Child Care  | Low              | No                | High             | 0                 |
| 345        | Kids Club Childcare and Preschool Center Inc             | Child Care  | Low              | No                | High             | 0                 |
| 346        | Kids Stop  | Child Care  | Low              | No                | High             | 0                 |
| 347        | May Behavioral Health Children's After Sch. Pro          | Child Care  | Low              | No                | High             | 0                 |
| 348        | Ohrenberger Community Center School Age Child Care       | Child Care  | Low              | No                | High             | 0                 |
| 349        | Parkway Preschool Center                                 | Child Care  | Low              | No                | High             | 0                 |
| 350        | Sunny Bear Academy                                       | Child Care  | Low              | No                | High             | 0                 |
| 351        | The Childrens House of Owls Head                         | Child Care  | Low              | No                | High             | 0                 |
| 352        | The Light House Early Learning Center                    | Child Care  | Low              | No                | High             | 0                 |
| 353        | Tot Spot Child Development Center                        | Child Care  | Low              | No                | High             | 0                 |
| 354        | W.Roxbury/Roslindale YMCA @ Joyce Kilmer                 | Child Care  | Low              | No                | High             | 0                 |
| 355        | Welcome Child Care & Preschool Center, Inc               | Child Care  | Low              | No                | High             | 0                 |
| 356        | West Roxbury YMCA @ Lyndon                               | Child Care  | Moderate         | No                | Low              | 0                 |
| 357        | Willow Path Childcare                                    | Child Care  | Low              | No                | High             | 0                 |
| 358        | Scamper Camp   | Child Care  | Low              | No                | High             | 0                 |
| 359        | East Boston - Head Start/Elbow                           | Child Care  | Moderate         | No                | Low              | 1                 |
| 360        | East Boston Head Start Social Center                     | Child Care  | Moderate         | No                | Low              | 1                 |
| 361        | East Boston Head Start St. Johns                         | Child Care  | Moderate         | No                | Low              | 0                 |
| 362        | East Boston Head Start-Bennington                        | Child Care  | Moderate         | No                | Low              | 0                 |
| 363        | East Boston Montessori School                            | Child Care  | Moderate         | No                | Low              | 2                 |
| 364        | East Boston YMCA @ Alighieri                             | Child Care  | Moderate         | No                | Low              | 2                 |
| 365        | East Boston YMCA @ Curtis Guild                          | Child Care  | Moderate         | No                | Low              | 0                 |
| 366        | East Boston YMCA @ Samuel Adams                          | Child Care  | Moderate         | No                | Low              | 0                 |
| 367        | East Boston YMCA Children's Center & O.S.T. @ Bremen St. | Child Care  | Moderate         | AE                | Low              | 1                 |
| 368        | East Boston YMCA O.S.T. @ Kennedy School                 | Child Care  | Moderate         | No                | Low              | 0                 |
| 369        | East Boston YMCA O.S.T. @ McKay                          | Child Care  | Moderate         | No                | Low              | 2                 |

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|------------|--|-----------------------|------------------|-------------------|------------------|-------------------|
| 370        | Harbor Area Early Childhood Service          | Child Care            | Moderate         | No                | Low              | 0                 |
| 371        | Jeffries Point Child Care                    | Child Care            | Moderate         | No                | Low              | 0                 |
| 372        | Oh Yes Orient Heights Young Explorers        | Child Care            | Moderate         | No                | Low              | 0                 |
| 373        | Shining Star Day Care                        | Child Care            | Moderate         | No                | Low              | 2                 |
| 374        | Swift Waters After School Programs           | Child Care            | Moderate         | No                | Low              | 0                 |
| 375        | Terri's Little Pumpkins II, Inc.             | Child Care            | Moderate         | No                | Low              | 4                 |
| 376        | YMCA East Boston @ Ashley Street Camp        | Child Care            | Moderate         | No                | Low              | 2                 |
| 377        | Citizen Schools @ The Gavin Middle School    | Child Care            | Moderate         | No                | Low              | 0                 |
| 378        | Condon Community Center                      | BCYF community center | Moderate         | No                | Low              | 0                 |
| 379        | Julie's Family Learning Program              | Child Care            | Moderate         | No                | Low              | 0                 |
| 380        | Old Colony Headstart                         | Child Care            | Moderate         | No                | Low              | 2                 |
| 381        | South Baptist Head Start                     | Child Care            | Moderate         | No                | Low              | 0                 |
| 382        | South Boston Clubhouse After School Day Care | Child Care            | Moderate         | No                | Low              | 0                 |
| 383        | South Boston Head Start                      | Child Care            | Moderate         | No                | Low              | 2                 |
| 384        | South Boston Head Start @ West Broadway      | Child Care            | Moderate         | No                | Low              | 0                 |
| 385        | South Boston Neighborhood House              | Child Care            | Moderate         | No                | Low              | 0                 |
| 386        | South Boston Neighborhood House Preschool    | Child Care            | Moderate         | No                | Low              | 2                 |
| 387        | ALEXANDER HAMILTON                           | Child Care            | Low              | No                | High             | 0                 |
| 388        | BOSTON CHILDREN'S SCHOOL ANNEX               | Child Care            | Moderate         | No                | Low              | 2                 |
| 389        | LITTLE PEOPLE'S PLAYHOUSE II                 | Child Care            | Low              | No                | High             | 0                 |
| 390        | BRIGHT BEGINNINGS PRESCHOOL                  | Child Care            | Moderate         | No                | High             | 0                 |
| 391        | NOTRE DAME MONTESSORI SCHOOL                 | Child Care            | Moderate         | No                | Low              | 4                 |
| 392        | BEACON HILL NURSERY SCHOOL                   | Child Care            | Moderate         | No                | Low              | 0                 |
| 393        | NAZARETH CHILD CARE CENTER                   | Child Care            | Moderate         | No                | High             | 0                 |
| 394        | LITTLE FOLKS COMMUNITY DAY CAR               | Child Care            | Moderate         | No                | Low              | 0                 |
| 395        | WESLEY CHILD CARE CENTER                     | Child Care            | Moderate         | No                | High             | 0                 |
| 396        | N.I.C.E. INC.                                | Child Care            | Moderate         | No                | High             | 0                 |
| 397        | TRANSPORTATION CHILDREN'S CENT               | Child Care            | Moderate         | No                | Low              | 0                 |
| 398        | GROVE HALL CHILD DEVELOPMENT C               | Child Care            | Moderate         | No                | High             | 0                 |

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|------------|---|------------------|------------------|-----------------------|------------------|-------------------|
| 399        | LITTLE SCHOLARS' WORKSHOP, INC                            | Child Care       | Moderate         | No                    | High             | 0                 |
| 400        | BOSTON CHILDREN'S SCHOOL                                  | Child Care       | Moderate         | No                    | Low              | 0                 |
| 401        | COOPER COMMUNITY CHILD DEVELOP                            | Child Care       | Moderate         | No                    | Low              | 0                 |
| 402        | BRIDGE CHILDREN'S CENTER                                  | Child Care       | Moderate         | No                    | Low              | 2                 |
| 403        | CHILDREN'S AIDS PROGRAM (SPARK)                           | Child Care       | Moderate         | No                    | High             | 0                 |
| 404        | CITY HALL DAY CARE  | Child Care       | Moderate         | No                    | Low              | 0                 |
| 405        | CITY OF BOSTON/ELLEN JACKSON                              | Child Care       | Moderate         | No                    | Low              | 0                 |
| 406        | CITY OF BOSTON/PERKIN COMM. CTR.                          | Child Care       | Moderate         | No                    | High             | 0                 |
| 407        | ELLEN JACKSON DAYCARE CTR.                                | Child Care       | Moderate         | No                    | Low              | 0                 |
| 408        | FANEUIL AFTER SCHOOL                                      | Child Care       | Low              | No                    | High             | 0                 |
| 409        | JAMAICA PLAIN FOR FOURS                                   | Child Care       | Low              | No                    | High             | 0                 |
| 410        | RED OAK AFTER SCHOOL PROGRAM                              | Child Care       | Moderate         | No                    | Low              | 0                 |
| 411        | SMALL WONDERS   | Child Care       | Low              | No                    | High             | 0                 |
| 412        | SPARKS CENTER   | Child Care       | Moderate         | No                    | Low              | 2                 |
| 413        | TINY TOTS   | Child Care       | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 2                 |
| 414        | CHILD FOCUS CENTER  | Child Care       | Moderate         | No                    | Low              | 0                 |
| 415        | UMASS/BOSTON EARLY LEARNING CE                            | Child Care       | Moderate         | No                    | Low              | 2                 |
| 416        | TARTT'S DAY CARE CENTER AND PR                            | Child Care       | Moderate         | No                    | Low              | 0                 |
| 417        | PAIGE ACADEMY AT RCC                                      | Child Care       | Moderate         | No                    | Low              | 0                 |
| 418        | Ethos   | Elderly Services | Moderate         | No                    | High             | 0                 |
| 419        | ABCD Mattapan Family Service Center                       | Elderly Services | Moderate         | No                    | High             | 0                 |
| 420        | ABCD North End/West End Neighborhood Service Center       | Elderly Services | Moderate         | No                    | Low              | 0                 |
| 421        | Boston Medical Center                                     | Elderly Services | Moderate         | No                    | Low              | 2                 |
| 422        | Caritas Good Samaritan Hospice                            | Elderly Services | Low              | No                    | Low              | 0                 |
| 423        | Greater Boston Chinese Golden Age Center                  | Elderly Services | Moderate         | No                    | Low              | 2                 |
| 424        | Developmental Evaluation and Adjustment Facilities (DEAF) | Elderly Services | Low              | No                    | Low              | 0                 |
| 425        | ESAC (Ecumenical Social Action Committee, Inc.)           | Elderly Services | Moderate         | No                    | High             | 0                 |

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| 426        | Ethos   | Elderly Services | Moderate         | No                | High             | 0                 |
| 427        | Fenway Community Development Corporation                        | Elderly Services | Moderate         | No                | Low              | 2                 |
| 428        | Fenway Community Development Corporation                        | Elderly Services | Moderate         | No                | Low              | 2                 |
| 429        | Greater Boston Legal Services                                   | Elderly Services | Moderate         | No                | Low              | 2                 |
| 430        | HEARTH, Inc.  | Elderly Services | Moderate         | No                | Low              | 2                 |
| 431        | Inquilinos Boricuas en Accion (IBA)                             | Elderly Services | Moderate         | No                | Low              | 2                 |
| 432        | John F. Kennedy Family Service Center, Inc.                     | Elderly Services | Moderate         | No                | Low              | 0                 |
| 433        | Kit Clark Senior Services Inc.                                  | Elderly Services | Moderate         | No                | High             | 0                 |
| 434        | La Alianza Hispana  | Elderly Services | Moderate         | No                | Low              | 0                 |
| 435        | MAB Community Services, Inc.                                    | Elderly Services | Moderate         | No                | Low              | 0                 |
| 436        | Massachusetts Association of Older Americans                    | Elderly Services | Moderate         | No                | Low              | 0                 |
| 437        | Friendship Works  | Elderly Services | Moderate         | No                | Low              | 0                 |
| 438        | Nuestra Comunidad Development Corporation                       | Elderly Services | Low              | No                | High             | 0                 |
| 439        | South Boston Neighborhood House                                 | Elderly Services | Moderate         | No                | Low              | 0                 |
| 440        | United South End Settlements                                    | Elderly Services | Moderate         | No                | Low              | 2                 |
| 441        | Upham's Corner Health Center                                    | Elderly Services | Moderate         | No                | Low              | 0                 |
| 442        | Ethos   | Elderly Services | Moderate         | No                | High             | 0                 |
| 443        | Greater Chinese Golden Age Center                               | Elderly Services | Moderate         | No                | Low              | 2                 |
| 444        | Kit Clark Senior Services                                       | Elderly Services | Moderate         | No                | High             | 0                 |
| 445        | Chinese Golden Age Center                                       | Elderly Services | Moderate         | No                | Low              | 2                 |
| 446        | Ethos   | Elderly Services | Moderate         | No                | High             | 0                 |
| 447        | Kit Clark Seniorá Services                                      | Elderly Services | Moderate         | No                | High             | 0                 |
| 448        | UphamÆs Corner Health Center                                    | Elderly Services | Moderate         | No                | Low              | 0                 |
| 449        | Boston Senior Home Care   | Elderly Services | Moderate         | No                | Low              | 2                 |
| 450        | Central Boston Elder Services                                   | Elderly Services | Moderate         | No                | Low              | 0                 |
| 451        | Ethos   | Elderly Services | Moderate         | No                | High             | 0                 |
| 452        | LGBT Aging Project  | Elderly Services | Moderate         | No                | High             | 0                 |
| 453        | Massachusetts Society for the Prevention of Cruelty to Children | Elderly Services | Moderate         | No                | Low              | 0                 |

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|------------|--------------|------------------|------------------|-------------------|------------------|-------------------|
| 454        | Amory Street | Elderly Services | Moderate         | No                | High             | 0                 |
| 455        | Annapolis    | Elderly Services | Low              | No                | High             | 0                 |
| 456        | Ashmont      | Elderly Services | Moderate         | No                | High             | 0                 |
| 457        | Ausonia      | Elderly Services | Moderate         | No                | Low              | 2                 |
| 458        | Bellflower   | Elderly Services | Moderate         | No                | Low              | 2                 |
| 459        | M.M. Collins | Elderly Services | Moderate         | No                | High             | 0                 |
| 460        | Davison      | Elderly Services | Moderate         | No                | High             | 0                 |
| 461        | Eva White    | Elderly Services | Moderate         | No                | Low              | 4                 |
| 462        | Foley Apartm | Elderly Services | Moderate         | No                | Low              | 0                 |
| 463        | Franklin Fie | Elderly Services | Moderate         | No                | High             | 0                 |
| 464        | Frederick Do | Elderly Services | Moderate         | No                | Low              | 2                 |
| 465        | General Warr | Elderly Services | Moderate         | No                | Low              | 0                 |
| 466        | Groveland Ap | Elderly Services | Moderate         | No                | High             | 0                 |
| 467        | Hampton Hous | Elderly Services | Moderate         | No                | Low              | 2                 |
| 468        | Hassan Apart | Elderly Services | Low              | No                | High             | 0                 |
| 469        | Heritage Apa | Elderly Services | Moderate         | No                | Low              | 2                 |
| 470        | Holgate Apar | Elderly Services | Moderate         | No                | High             | 0                 |
| 471        | J.J. Meade   | Elderly Services | Moderate         | No                | High             | 0                 |
| 472        | John J. Carr | Elderly Services | Low              | No                | High             | 0                 |
| 473        | Joseph C. Ma | Elderly Services | Low              | No                | High             | 0                 |
| 474        | Lower Mills  | Elderly Services | Moderate         | No                | High             | 0                 |
| 475        | M.L.K Jr. To | Elderly Services | Moderate         | No                | Low              | 0                 |
| 476        | Monsignor Po | Elderly Services | Moderate         | No                | Low              | 0                 |
| 477        | Pasciucco Ap | Elderly Services | Moderate         | No                | Low              | 0                 |
| 478        | Patricia Whi | Elderly Services | Low              | No                | High             | 0                 |
| 479        | Peabody/Engl | Elderly Services | Moderate         | No                | High             | 0                 |
| 480        | Rockland Tow | Elderly Services | Low              | No                | High             | 0                 |
| 481        | Roslyn Apart | Elderly Services | Low              | No                | High             | 0                 |
| 482        | Spring Stree | Elderly Services | Low              | No                | High             | 0                 |

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|------------|--|------------------|------------------|-------------------|------------------|-------------------|
| 483        | St. Botolph                              | Elderly Services | Moderate         | No                | Low              | 2                 |
| 484        | Torre Unidad                             | Elderly Services | Moderate         | No                | Low              | 2                 |
| 485        | Walnut Park                              | Elderly Services | Moderate         | No                | High             | 0                 |
| 486        | 91-95 Washin                             | Elderly Services | Low              | No                | Low              | 0                 |
| 487        | Washington M                             | Elderly Services | Moderate         | No                | Low              | 2                 |
| 488        | West Ninth S                             | Elderly Services | Moderate         | No                | Low              | 2                 |
| 489        | ABCD Mattapan Center                     | Elderly Services | Moderate         | No                | High             | 0                 |
| 490        | La Alianza Hispana                       | Elderly Services | Moderate         | No                | Low              | 0                 |
| 491        | Inquilinos Boricuas en Accion            | Elderly Services | Moderate         | No                | Low              | 2                 |
| 492        | South Boston Neighborhood House          | Elderly Services | Moderate         | No                | Low              | 0                 |
| 493        | United South End Settlements             | Elderly Services | Moderate         | No                | Low              | 2                 |
| 494        | Veronica B. Smith                        | Elderly Services | Low              | No                | High             | 0                 |
| 495        | Beacon House-KCSS                        | Elderly Services | Moderate         | No                | High             | 0                 |
| 496        | Arch-KCSS                                | Elderly Services | Moderate         | No                | Low              | 0                 |
| 497        | Morville-KCSS                            | Elderly Services | Moderate         | No                | Low              | 2                 |
| 498        | Emmanuel Church of Boston-Ethos          | Elderly Services | Moderate         | No                | Low              | 2                 |
| 499        | Main-KCSS                                | Elderly Services | Moderate         | No                | Low              | 2                 |
| 500        | Bellflower-KCSS                          | Elderly Services | Moderate         | No                | Low              | 2                 |
| 501        | Codman-KCSS                              | Elderly Services | Low              | No                | High             | 0                 |
| 502        | Kit Clark-KCSS                           | Elderly Services | Moderate         | No                | High             | 0                 |
| 503        | Lower Mills-KCSS                         | Elderly Services | Moderate         | No                | High             | 0                 |
| 504        | Haitian Multi-Service Yawkey Center-KCSS | Elderly Services | Moderate         | No                | High             | 0                 |
| 505        | Vietnamese Center-KCSS                   | Elderly Services | Low              | No                | High             | 0                 |
| 506        | Heritage-KCSS                            | Elderly Services | Moderate         | No                | Low              | 2                 |
| 507        | Christopher Columbus-KCSS                | Elderly Services | Moderate         | No                | Low              | 2                 |
| 508        | La Alianza Hispana-KCSS                  | Elderly Services | Moderate         | No                | Low              | 0                 |
| 509        | Ruggles-KCSS                             | Elderly Services | Moderate         | No                | Low              | 2                 |
| 510        | Walnut House-KCSS                        | Elderly Services | Moderate         | AE                | High             | 2                 |
| 511        | St. Patrick's-KCSS                       | Elderly Services | Moderate         | No                | Low              | 0                 |

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|------------|------------------------------------|------------------|------------------|-----------------------|------------------|-------------------|
| 512        | Amory-Ethos                        | Elderly Services | Moderate         | No                    | High             | 0                 |
| 513        | Church of the Holy Spirit-Ethos    | Elderly Services | Moderate         | No                    | High             | 0                 |
| 514        | Condon-KCSS                        | Elderly Services | Moderate         | No                    | Low              | 0                 |
| 515        | Curley-KCSS                        | Elderly Services | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 2                 |
| 516        | Cardinal Medeiros Center-KCSS      | Elderly Services | Moderate         | No                    | Low              | 2                 |
| 517        | People's Baptist-KCSS              | Elderly Services | Moderate         | No                    | Low              | 2                 |
| 518        | Anna Bissonnette House- KCSS       | Elderly Services | Moderate         | No                    | Low              | 2                 |
| 519        | Unity Towers-KCSS                  | Elderly Services | Moderate         | No                    | Low              | 2                 |
| 520        | Farnsworth-Ethos                   | Elderly Services | Moderate         | No                    | Low              | 2                 |
| 521        | Back of the Hill Apartments- Ethos | Elderly Services | Moderate         | No                    | Low              | 0                 |
| 522        | Nate Smith House-Ethos             | Elderly Services | Moderate         | No                    | High             | 0                 |
| 523        | Victorian House-CGAC               | Elderly Services | Low              | No                    | High             | 0                 |
| 524        | Joseph Malone-Ethos                | Elderly Services | Low              | No                    | High             | 0                 |
| 525        | Roslindale House-Ethos             | Elderly Services | Low              | No                    | High             | 0                 |
| 526        | Woodbourne Apartments- Ethos       | Elderly Services | Moderate         | No                    | High             | 0                 |
| 527        | Rockingham Glen-Ethos              | Elderly Services | Low              | No                    | High             | 0                 |
| 528        | Roche Center-Ethos                 | Elderly Services | Low              | No                    | High             | 0                 |
| 529        | Hong Lok House-CGAC                | Elderly Services | Moderate         | No                    | Low              | 0                 |
| 530        | Boston Rehabilitation Association  | Elderly Services | Low              | No                    | Low              | 0                 |
| 531        | McNamara House Apartments          | Elderly Services | Moderate         | No                    | Low              | 0                 |
| 532        | Brighton Garden Apartments         | Elderly Services | Moderate         | No                    | Low              | 2                 |
| 533        | Wallingford Housing Apartments     | Elderly Services | Low              | No                    | High             | 0                 |
| 534        | Convenant House Apartments         | Elderly Services | Moderate         | No                    | High             | 0                 |
| 535        | Patricia White Apartments          | Elderly Services | Low              | No                    | High             | 0                 |
| 536        | Reservoir Towers                   | Elderly Services | Low              | No                    | High             | 0                 |
| 537        | Beacon House                       | Elderly Services | Moderate         | No                    | High             | 0                 |
| 538        | Bowdoin School Apartments          | Elderly Services | Moderate         | No                    | Low              | 0                 |

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|------------|---|------------------|------------------|-------------------|------------------|-------------------|
| 539        | Anderson Apartments                                       | Elderly Services | Moderate         | No                | Low              | 0                 |
| 540        | Spencer House   | Elderly Services | Moderate         | No                | High             | 0                 |
| 541        | Constitution Co-Op Development                            | Elderly Services | Moderate         | No                | Low              | 4                 |
| 542        | Charles Newton Apartments                                 | Elderly Services | Moderate         | No                | Low              | 4                 |
| 543        | Building 104  | Elderly Services | Moderate         | No                | Low              | 2                 |
| 544        | Ferrin Street Apartments                                  | Elderly Services | Moderate         | No                | Low              | 0                 |
| 545        | Anchorage Apartments                                      | Elderly Services | Moderate         | No                | Low              | 2                 |
| 546        | Mary Colbert  | Elderly Services | Moderate         | No                | Low              | 0                 |
| 547        | Basilica  | Elderly Services | Moderate         | No                | Low              | 2                 |
| 548        | Hong Luck   | Elderly Services | Moderate         | No                | Low              | 0                 |
| 549        | Quincy Tower  | Elderly Services | Moderate         | No                | Low              | 0                 |
| 550        | South East  | Elderly Services | Moderate         | No                | Low              | 0                 |
| 551        | South Cove West   | Elderly Services | Moderate         | No                | Low              | 2                 |
| 552        | Savin Hill Apartments                                     | Elderly Services | Moderate         | No                | Low              | 4                 |
| 553        | Keystone Apartments                                       | Elderly Services | Moderate         | No                | High             | 0                 |
| 554        | Adams Templeton Apartments                                | Elderly Services | Moderate         | No                | High             | 0                 |
| 555        | Templeton Apartments                                      | Elderly Services | Moderate         | No                | High             | 0                 |
| 556        | Kelly House Apartments                                    | Elderly Services | Moderate         | No                | Low              | 0                 |
| 557        | Catherine Clark Apartments                                | Elderly Services | Moderate         | No                | Low              | 0                 |
| 558        | Cardinal Mederios Manor                                   | Elderly Services | Moderate         | No                | Low              | 0                 |
| 559        | Ameff Housing   | Elderly Services | Moderate         | No                | High             | 0                 |
| 560        | Garridon School   | Elderly Services | Moderate         | No                | High             | 0                 |
| 561        | Harbor Point- Housing-Harbour Point Dept of Public Safety | Elderly Services | Moderate         | No                | Low              | 2                 |
| 562        | Talbot and Bernard Apartments                             | Elderly Services | Moderate         | No                | High             | 0                 |
| 563        | Fieldstone Apartments                                     | Elderly Services | Moderate         | No                | High             | 0                 |
| 564        | Geneva Avenue   | Elderly Services | Moderate         | No                | High             | 0                 |
| 565        | Chauncy House   | Elderly Services | Moderate         | No                | Low              | 0                 |
| 566        | Mason Place   | Elderly Services | Low              | No                | High             | 0                 |
| 567        | Stearns   | Elderly Services | Moderate         | No                | Low              | 0                 |



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|------------|-----------------------------------|------------------|------------------|-----------------------|------------------|-------------------|
| 568        | Landfall Apartments               | Elderly Services | Moderate         | AE                    | Low              | 1                 |
| 569        | Landfall West Apartments          | Elderly Services | Moderate         | No                    | Low              | 0                 |
| 570        | Barnes School Apartments          | Elderly Services | Moderate         | No                    | Low              | 0                 |
| 571        | Victory Gardens Apartments        | Elderly Services | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 2                 |
| 572        | Chevrus Apartments                | Elderly Services | Moderate         | No                    | Low              | 0                 |
| 573        | Woodbury Cunard Apartments        | Elderly Services | Moderate         | No                    | Low              | 2                 |
| 574        | The Lyman School Apartments       | Elderly Services | Moderate         | No                    | Low              | 2                 |
| 575        | Kenmore Abbey Apartments          | Elderly Services | Moderate         | No                    | Low              | 2                 |
| 576        | St. Cecilia's House               | Elderly Services | Moderate         | No                    | Low              | 2                 |
| 577        | Morville House                    | Elderly Services | Moderate         | No                    | Low              | 2                 |
| 578        | Norway Housing Apartments         | Elderly Services | Moderate         | No                    | Low              | 2                 |
| 579        | Symphony Plaza East Apartments    | Elderly Services | Moderate         | No                    | Low              | 0                 |
| 580        | Symphony Plaza West Apartments    | Elderly Services | Moderate         | No                    | Low              | 2                 |
| 581        | Hemenway Apartments               | Elderly Services | Moderate         | No                    | Low              | 2                 |
| 582        | Wait Street Apartments            | Elderly Services | Moderate         | No                    | Low              | 0                 |
| 583        | Blake Estates Associates I & II   | Elderly Services | Low              | No                    | High             | 0                 |
| 584        | Georgetown Housing                | Elderly Services | Low              | No                    | High             | 0                 |
| 585        | Riley House                       | Elderly Services | Low              | No                    | High             | 0                 |
| 586        | Forbes Building                   | Elderly Services | Moderate         | No                    | High             | 0                 |
| 587        | Nate Smith                        | Elderly Services | Moderate         | No                    | High             | 0                 |
| 588        | Farnsworth House Apartments       | Elderly Services | Moderate         | No                    | Low              | 2                 |
| 589        | Woodbourne Housing                | Elderly Services | Moderate         | No                    | High             | 0                 |
| 590        | Jamaica Plain CO-OP Apartments    | Elderly Services | Moderate         | No                    | High             | 0                 |
| 591        | Angela Westover                   | Elderly Services | Moderate         | No                    | High             | 0                 |
| 592        | The Foley Apartments              | Elderly Services | Moderate         | No                    | High             | 0                 |
| 593        | Mattapan School House Association | Elderly Services | Low              | No                    | High             | 0                 |
| 594        | Mattapan Center for Life          | Elderly Services | Moderate         | No                    | High             | 0                 |

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|------------|---|-------------------|------------------|-------------------|------------------|-------------------|
| 595        | Flynn House   | Elderly Services  | Moderate         | No                | Low              | 0                 |
| 596        | Back of the Hill                                      | Elderly Services  | Moderate         | No                | Low              | 0                 |
| 597        | Casa Maria Apartments                                 | Elderly Services  | Moderate         | No                | Low              | 2                 |
| 598        | Villa Michelangelo Apartments                         | Elderly Services  | Moderate         | No                | Low              | 0                 |
| 599        | Conway Court  | Elderly Services  | Low              | No                | High             | 0                 |
| 600        | Longfellow House                                      | Elderly Services  | Low              | No                | High             | 0                 |
| 601        | Roslindale House                                      | Elderly Services  | Low              | No                | High             | 0                 |
| 602        | Council of Elders Towers                              | Elderly Services  | Moderate         | No                | Low              | 2                 |
| 603        | Smith House Apartments                                | Elderly Services  | Moderate         | No                | Low              | 0                 |
| 604        | Marcus Garvey Gardens Apartments                      | Elderly Services  | Moderate         | No                | Low              | 0                 |
| 605        | Robert L. Fortes Apartments                           | Elderly Services  | Moderate         | No                | Low              | 2                 |
| 606        | Restoration House Apartments                          | Elderly Services  | Moderate         | No                | Low              | 0                 |
| 607        | Baker Manor   | Elderly Services  | Moderate         | No                | Low              | 0                 |
| 608        | Walnut House  | Elderly Services  | Moderate         | No                | Low              | 0                 |
| 609        | Castle Cove Apartments                                | Elderly Services  | Moderate         | No                | Low              | 4                 |
| 610        | Flaherty Apartments                                   | Elderly Services  | Moderate         | No                | Low              | 0                 |
| 611        | John Boyle O'Reilly School                            | Elderly Services  | Moderate         | No                | Low              | 0                 |
| 612        | Ebenezer House Apartments                             | Elderly Services  | Moderate         | No                | Low              | 2                 |
| 613        | Franklin Square House                                 | Elderly Services  | Moderate         | No                | Low              | 2                 |
| 614        | Concord House Apartments                              | Elderly Services  | Moderate         | No                | Low              | 2                 |
| 615        | St. Botolph Terr. Apartments                          | Elderly Services  | Moderate         | No                | Low              | 0                 |
| 616        | St. Helena's House                                    | Elderly Services  | Moderate         | No                | Low              | 2                 |
| 617        | St. Cecilia's House                                   | Elderly Services  | Moderate         | No                | Low              | 2                 |
| 618        | Blackstone  | Elderly Services  | Moderate         | No                | Low              | 0                 |
| 619        | Anderson Park Apartments                              | Elderly Services  | Moderate         | No                | Low              | 0                 |
| 620        | Amy Lowell Apartments                                 | Elderly Services  | Moderate         | No                | Low              | 0                 |
| 621        | Rockingham Glen Apartments                            | Elderly Services  | Low              | No                | High             | 0                 |
| 622        | Cheriton Grove Apartments                             | Elderly Services  | Low              | No                | High             | 0                 |
| 623        | Boston Medical Center Elders Living at Home Prigram - | Homeless Shelters | Moderate         | No                | Low              | 2                 |

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|------------|--|-------------------|------------------|-----------------------|------------------|-------------------|
|            | Woods Mullen Shelter                         |                   |                  |                       |                  |                   |
| 624        | CRITTENTON HASTINGS HOUSE                    | Homeless Shelters | Low              | No                    | High             | 0                 |
| 625        | MASS. DEPT. OF TRANSITIONAL ASSISTANCE       | Homeless Shelters | Moderate         | No                    | Low              | 2                 |
| 626        | SANCTA MARIA HOME                            | Homeless Shelters | Moderate         | No                    | Low              | 2                 |
| 627        | CARDINAL MEDEIROS CENTER                     | Homeless Shelters | Moderate         | No                    | Low              | 2                 |
| 628        | LIFEHOUSE                                    | Homeless Shelters | Moderate         | No                    | Low              | 0                 |
| 629        | KIT CLARK SENIOR SERVICES                    | Homeless Shelters | Moderate         | No                    | High             | 0                 |
| 630        | New England Center for Homeless Veterans ááá | Homeless Shelters | Moderate         | No                    | Low              | 0                 |
| 631        | TRAVELERS AID SOCIETY                        | Homeless Shelters | Moderate         | No                    | Low              | 2                 |
| 632        | BROOKVIEW HOUSE TRANSITIONAL HSNG PRGM.      | Homeless Shelters | Moderate         | No                    | High             | 0                 |
| 633        | ROXBURY FAMILY SHELTER                       | Homeless Shelters | Moderate         | No                    | Low              | 0                 |
| 634        | 24 HOUR CHILD/AT RISK HOTLINE                | Homeless Shelters | Moderate         | No                    | Low              | 1                 |
| 635        | HOLY FAMILY                                  | Homeless Shelters | Moderate         | No                    | Low              | 0                 |
| 636        | CARDINAL MEDEIROS CENTER áááá                | Homeless Shelters | Moderate         | No                    | Low              | 2                 |
| 637        | CATHOLIC CHARITIES                           | Homeless Shelters | Moderate         | No                    | High             | 0                 |
| 638        | MASS BAY CHAPTER AMERICAN RED CROSS          | Homeless Shelters | Moderate         | No                    | Low              | 0                 |
| 639        | DONATION ASSISTANCE                          | Homeless Shelters | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 1                 |
| 640        | BOSTON NIGHT CENTER                          | Homeless Shelters | Moderate         | No                    | Low              | 0                 |
| 641        | BOSTON YMCA EMERGENCY ROOMS PROGRAM          | Homeless Shelters | Moderate         | No                    | Low              | 2                 |
| 642        | PROJECT PLACE PROGRAM FOR THE HOMELESS       | Homeless Shelters | Moderate         | No                    | Low              | 2                 |
| 643        | TRANSITION THRIFT STORE                      | Homeless Shelters | Moderate         | No                    | High             | 0                 |
| 644        | WOMEN UNIT SHELTER                           | Homeless Shelters | Moderate         | No                    | Low              | 2                 |
| 645        | REVISION HOUSE                               | Homeless Shelters | Moderate         | No                    | High             | 0                 |
| 646        | SAINT FRANCIS HOUSE DAY CENTER               | Homeless Shelters | Moderate         | No                    | Low              | 0                 |
| 647        | KINGSTON HOUSE                               | Homeless Shelters | Moderate         | No                    | Low              | 0                 |
| 648        | BOSTON YWCA BETTY'S PLACE                    | Homeless Shelters | Moderate         | No                    | Low              | 2                 |
| 649        | QUEEN OF PEACE                               | Homeless Shelters | Moderate         | No                    | Low              | 0                 |

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|------------|---|-------------------|------------------|-------------------|------------------|-------------------|
| 650        | HARBORLIGHT SALVATION ARMY SHELTER            | Homeless Shelters | Moderate         | No                | Low              | 2                 |
| 651        | CHARDON STREET SHELTER                        | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 652        | PINE STREET INN                               | Homeless Shelters | Moderate         | No                | Low              | 2                 |
| 653        | PROJECT HOPE SISTERS OF THE ASSUMPTION        | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 654        | CHILDREN'S SERVICES OF ROXBURY                | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 655        | CASA NUEVA VIDA                               | Homeless Shelters | Moderate         | No                | High             | 0                 |
| 656        | PILGRIM CHURCH SHELTER-CHILDREN'S SERVICES    | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 657        | CROSSROADS FAMILY SHELTER                     | Homeless Shelters | Moderate         | No                | Low              | 2                 |
| 658        | METROPOLITAN BOSTON HOUSING PARTNERSHIP, INC. | Homeless Shelters | Moderate         | No                | Low              | 2                 |
| 659        | LIFEHOUSE HOUSING SEARCH, INC.                | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 660        | BOSTON FAMILY SHELTER                         | Homeless Shelters | Moderate         | No                | Low              | 2                 |
| 661        | SOJOURNER HOUSE                               | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 662        | ROSIE'S PLACE                                 | Homeless Shelters | Moderate         | No                | Low              | 2                 |
| 663        | ST. MARY'S HOME                               | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 664        | NAZARETH HOUSE                                | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 665        | Emergency Shelter Commission                  | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 667        | HOLY FAMILY SHELTER                           | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 669        | FAMILY HOUSE SHELTER                          | Homeless Shelters | Moderate         | No                | High             | 0                 |
| 670        | ALPHONSUS HOUSE                               | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 671        | DIMMOCK UMMIS BOSTON CARES                    | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 672        | CASA ESPERANZA                                | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 673        | WOMENS LUNCH PLACE                            | Homeless Shelters | Moderate         | No                | Low              | 2                 |
| 674        | SOLOMAN CARTER FULLER HEALTH                  | Homeless Shelters | Moderate         | No                | Low              | 4                 |
| 675        | WOMENS HOPE (VICTORY PROG)                    | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 676        | TEEN LIVING AT INDEPENDENCE                   | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 677        | METRO BOSTON HOUSING PARTNERSHIP              | Homeless Shelters | Moderate         | No                | Low              | 2                 |
| 678        | FINEX   | Homeless Shelters | Moderate         | No                | High             | 0                 |
| 679        | CHARLESTOWN RECOVERY HOUSE                    | Homeless Shelters | Moderate         | No                | Low              | 2                 |
| 680        | DENNIS MCLAUGHLIN HOUSE                       | Homeless Shelters | Moderate         | No                | Low              | 2                 |

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|------------|---------------------------------------|-------------------|------------------|-------------------|------------------|-------------------|
| 681        | RENEWAL HOUSE                         | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 682        | HRDI FIRST ACADEMY                    | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 683        | MILLENIUUM HOUSE SECOND HOME          | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 684        | INTERIM HOUSE (JOHN FLOWERS RECOVERY) | Homeless Shelters | Moderate         | No                | High             | 0                 |
| 685        | ENTRE FAMILIA *REHAB                  | Homeless Shelters | Moderate         | No                | High             | 0                 |
| 686        | PORTIS FAMILY HOME                    | Homeless Shelters | Moderate         | No                | High             | 0                 |
| 687        | SHEPHARD HOUSE                        | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 688        | HAMILTON HOUSE                        | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 689        | WEST END HOUSE * Lindemann Hospital   | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 690        | MERIDIAN HOUSE                        | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 691        | BRIDGE OVER TROUBLED WATERS           | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 692        | MILLENIUUM HOUSE SECOND HOME DAY CARE | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 693        | ANSWER HOUSE                          | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 694        | SHILOH HOUSE                          | Homeless Shelters | Moderate         | No                | High             | 0                 |
| 695        | NEW HORIZON HOUSE                     | Homeless Shelters | Moderate         | No                | High             | 0                 |
| 696        | ALTERNATIVE (MONMOUTH SQR)            | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 697        | CHILDREN'S SERVICES                   | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 698        | CUSHING HOUSE                         | Homeless Shelters | Moderate         | No                | Low              | 2                 |
| 699        | DIMMOCK MARY ELIZA MAHONEY SHELTER    | Homeless Shelters | Moderate         | No                | High             | 0                 |
| 700        | PROJECT HOPE                          | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 701        | VICTROY HOUSE                         | Homeless Shelters | Moderate         | No                | High             | 0                 |
| 702        | SULLIVAN HOUSE                        | Homeless Shelters | Moderate         | No                | High             | 0                 |
| 703        | GAVIN HOUSE                           | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 704        | HELLO HOUSE- MEN                      | Homeless Shelters | Moderate         | No                | Low              | 2                 |
| 705        | GRANADA HOUSE                         | Homeless Shelters | Low              | No                | High             | 0                 |
| 706        | MASS MENTAL HEALTH CENTER Hospital    | Homeless Shelters | Moderate         | No                | Low              | 0                 |
| 707        | HOPE HOUSE                            | Homeless Shelters | Moderate         | No                | Low              | 2                 |
| 708        | ELIZABETH STONE HOUSE- FIRST ACADEMY  | Homeless Shelters | Moderate         | No                | High             | 0                 |
| 709        | UNITED HOMES SECOND HOMES             | Homeless Shelters | Moderate         | No                | Low              | 0                 |

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|------------|---|-------------------------------|------------------|-------------------|------------------|-------------------|
| 710        | NEW VICTORIES                                       | Homeless Shelters             | Moderate         | No                | Low              | 0                 |
| 711        | PARKWELL NURSING AND REHABILITATION CENTER          | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 712        | FAIRMOUNT REST HOME INCORPORATED                    | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 713        | PARK PLACE REHABILITATION AND SKILLED CARE CENTER   | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 714        | ROSCOMMON WEST ROXBURY EXTENDED CARE CENTER         | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 715        | ROSCOMMON EXTENDED CARE CENTER                      | Nursing Homes/Assisted Living | Moderate         | No                | High             | 0                 |
| 716        | STANDISH VILLAGE AT LOWER MILLS                     | Nursing Homes/Assisted Living | Moderate         | No                | High             | 0                 |
| 717        | THE FOLEY SENIOR RESIDENCES                         | Nursing Homes/Assisted Living | Moderate         | No                | High             | 0                 |
| 718        | EDELWEISS VILLAGE                                   | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 719        | DEUTSCHES ALTENHEIM GERMAN CENTRE FOR EXTENDED CARE | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 720        | THE BOSTON HOME                                     | Nursing Homes/Assisted Living | Moderate         | No                | High             | 0                 |
| 721        | ROSCOMMON ON THE PARKWAY EXTENDED CARE CENTER       | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 722        | BOSTONIAN NURSING CARE AND REHABILITATION CENTER    | Nursing Homes/Assisted Living | Moderate         | No                | High             | 4                 |
| 723        | STONEHEDGE REHABILITATION AND SKILLED CARE CENTER   | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 724        | MELVILLE REST HOME                                  | Nursing Homes/Assisted Living | Moderate         | No                | High             | 0                 |
| 725        | SAINT JOSEPH NURSING AND REHABILITATION CENTER      | Nursing Homes/Assisted Living | Moderate         | No                | High             | 0                 |
| 726        | HEBREW REHABILITATION CENTER                        | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 727        | SOPHIA SNOW HOUSE                                   | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 728        | SPRINGHOUSE   | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 729        | ANNS REST HOME                                      | Nursing Homes/Assisted Living | Moderate         | No                | High             | 0                 |
| 730        | LAUREL RIDGE REHABILITATION AND NURSING CENTER      | Nursing Homes/Assisted Living | Moderate         | No                | High             | 0                 |
| 731        | ARMENIAN NURSING AND REHABILITATION CENTER          | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 732        | BURGOYNE REST HOME                                  | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 733        | CUSHING MANOR COMMUNITY SUPPORT FACILITY            | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 734        | ROGERSON HOUSE                                      | Nursing Homes/Assisted Living | Moderate         | No                | High             | 0                 |
| 735        | MOUNT PLEASANT HOME                                 | Nursing Homes/Assisted Living | Moderate         | No                | High             | 0                 |
| 736        | GODDARD HOUSE SKILLED NURSING CENTER                | Nursing Homes/Assisted Living | Moderate         | No                | High             | 0                 |
| 737        | BENJAMIN HEALTHCARE CENTER                          | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |

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|------------|--|-------------------------------|------------------|-------------------|------------------|-------------------|
| 738        | SHERRILL HOUSE                                     | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 739        | LANDMARK AT LONGWOOD                               | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 740        | THE BAYVIEW  | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 741        | RUGGLES ASSISTED LIVING                            | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 2                 |
| 742        | HARBORLIGHTS REHABILITATION AND NURSING CENTER     | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 743        | MARIAN MANOR                                       | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 744        | CHESTNUT PARK AT CLEVELAND CIRCLE                  | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 745        | SUSAN BAILIS ASSISTED LIVING COMMUNITY             | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 746        | BRIGHTON HOUSE REHABILITATION AND NURSING CENTER   | Nursing Homes/Assisted Living | Low              | No                | Low              | 0                 |
| 747        | PROVIDENCE HOUSE AT COREY PARK                     | Nursing Homes/Assisted Living | Low              | No                | Low              | 0                 |
| 748        | COREY HILL NURSING HOME                            | Nursing Homes/Assisted Living | Low              | No                | Low              | 0                 |
| 749        | SOUTH COVE MANOR NURSING AND REHABILITATION CTR.   | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 4                 |
| 750        | HALE HOUSE   | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 2                 |
| 751        | WINGATE AT BRIGHTON                                | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 752        | PRESENTATION NURSING AND REHABILITATION CENTER     | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 753        | NORTH END REHABILITATION AND NURSING CENTER        | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 2                 |
| 754        | ZELMA LACEY HOUSE OF CHARLESTOWN                   | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 2                 |
| 755        | DON ORIONE HOME                                    | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 756        | HANCOCK SKILLED NURSING & REHAB CTR                | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 757        | JORDAN REHABILITATION & NURS CENTER                | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 758        | POND VIEW NURSING FACILITY                         | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 759        | RECUPERATIVE SERVICES UNIT                         | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 760        | Alumni Stadium-Conte Forum (Boston College Eagles) | Public Venues                 | Low              | No                | High             | 0                 |
| 761        | Fenway Park  | Public Venues                 | Moderate         | No                | Low              | 2                 |
| 762        | Mathews Arena (Northeastern Huskies)               | Public Venues                 | Moderate         | No                | Low              | 2                 |
| 763        | Case Athletic Gymnasium (The Roof)-Nickerson Field | Public Venues                 | Moderate         | No                | Low              | 0                 |
| 764        | Lavietes Pavilion (Harvard Crimson)                | Public Venues                 | Low              | No                | High             | 1                 |
| 765        | TD Garden Center                                   | Public Venues                 | Moderate         | No                | Low              | 1                 |
| 766        | Boston Convention & Exhibition Ctr                 | Public Venues                 | Moderate         | No                | Low              | 2                 |

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|------------|---|-----------------------|------------------|-------------------|------------------|-------------------|
| 767        | Hynes Veterans Mem'l Convention Ctr                     | Public Venues         | Moderate         | No                | Low              | 0                 |
| 768        | George R White Schoolboy Stadium                        | Public Venues         | Moderate         | No                | High             | 0                 |
| 769        | Reginald Lewis Athletic Center                          | Public Venues         | Moderate         | No                | Low              | 0                 |
| 770        | Matthews Arena  | Public Venues         | Moderate         | No                | Low              | 2                 |
| 771        | Harvard Stadium-Murr Center                             | Public Venues         | Low              | No                | High             | 2                 |
| 772        | Briggs Cage   | Public Venues         | Low              | No                | High             | 1                 |
| 773        | Blodgett Pool   | Public Venues         | Low              | No                | High             | 2                 |
| 774        | Gordon Indoor Track & Tennis                            | Public Venues         | Low              | No                | High             | 1                 |
| 775        | Dillon Field House                                      | Public Venues         | Low              | No                | High             | 1                 |
| 776        | Bright Hockey Center                                    | Public Venues         | Low              | No                | High             | 1                 |
| 777        | Palmer Dixon Courts                                     | Public Venues         | Low              | No                | High             | 1                 |
| 778        | Suffolk Downs   | Public Venues         | Moderate         | No                | Low              | 0                 |
| 779        | Adult Literacy Resource Center                          | Special-Institutional | Low              | No                | High             | 0                 |
| 780        | Ancient & Honorable Artillery                           | General Institution   | Moderate         | No                | Low              | 2                 |
| 781        | Angell Memorial Animal Hospital\MSPCA Library, Archives | Animal Hospital       | Moderate         | No                | High             | 0                 |
| 782        | Baruj Benacerraf Library                                | Special-Medical       | Moderate         | No                | Low              | 0                 |
| 783        | Boston, City Clerk                                      | Town Hall             | Moderate         | No                | Low              | 0                 |
| 784        | Boston Athenaeum  | Special               | Low              | No                | Low              | 0                 |
| 785        | Boston Museum   | Museum                | Moderate         | No                | Low              | 0                 |
| 786        | Boston Opera House                                      | Various               | Low              | No                | High             | 0                 |
| 787        | Boston Public Library                                   | Public Library        | Moderate         | No                | Low              | 2                 |
| 788        | Boston University Art Gallery                           | Gallery               | Moderate         | No                | Low              | 0                 |
| 789        | Bostonian Society                                       | General Institution   | Moderate         | No                | Low              | 0                 |
| 790        | Kessler Health Education Library                        | Special-Medical       | Moderate         | No                | Low              | 0                 |
| 791        | Bunker Hill Community College Art Gallery               | Gallery               | Moderate         | No                | Low              | 0                 |
| 792        | Central Libraryssachusetts Department of Public Health  | Special-Medical       | Moderate         | No                | Low              | 0                 |
| 793        | Chapter 91 Waterways Research Room                      | Various               | Moderate         | No                | Low              | 0                 |
| 794        | The Children's Hospital Boston Library                  | Special-Medical       | Moderate         | No                | Low              | 0                 |
| 795        | Children's Museum Resource Center                       | Museum                | Moderate         | No                | Low              | 1                 |



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|------------|--|-------------------------------|------------------|-------------------|------------------|-------------------|
| 796        | Christian Science Monitor Library                    | Special                       | Moderate         | No                | Low              | 2                 |
| 797        | Commonwealth Museum                                  | Museum                        | Moderate         | No                | Low              | 0                 |
| 798        | Congregational Library                               | Religious Institution/Archive | Low              | No                | High             | 0                 |
| 799        | Dr. Arnold L. Segel Library Center                   | Religious Institution/Archive | Moderate         | No                | Low              | 0                 |
| 800        | Ingersoll Bowditch Medical Library                   | Special-Medical               | Low              | No                | High             | 0                 |
| 801        | Federal Reserve Bank of Boston Research Library      | Special                       | Moderate         | No                | Low              | 2                 |
| 802        | Franklin Park Zoo Library                            | Special                       | Moderate         | No                | High             | 0                 |
| 803        | Frederick Ayer Mansion                               | Historic House/Site           | Moderate         | No                | Low              | 2                 |
| 804        | Gibson House Museum                                  | Historic House/Site           | Moderate         | No                | Low              | 2                 |
| 805        | Harvard Musical Association Library                  | Special                       | Moderate         | No                | Low              | 0                 |
| 806        | Isabella Stewart Gardner Museum                      | Museum                        | Moderate         | No                | Low              | 2                 |
| 807        | Jewish Community Relations Council of Greater Boston | Religious Institution/Archive | Moderate         | No                | Low              | 0                 |
| 808        | John F. Kennedy Presidential Library & Museum        | Museum                        | Moderate         | No                | Low              | 4                 |
| 809        | Main Gallery   | Gallery                       | Low              | No                | High             | 2                 |
| 810        | Mary Baker Eddy Library                              | Religious Institution/Archive | Moderate         | No                | Low              | 2                 |
| 811        | Mass. Cultural Council                               | General Institution           | Moderate         | No                | Low              | 2                 |
| 812        | Massachusetts Historical Society                     | Historical Society            | Moderate         | No                | Low              | 4                 |
| 813        | Massachusetts Water Resources Authority Library      | Special                       | Moderate         | No                | Low              | 2                 |
| 814        | Museum of Fine Arts, Boston                          | Museum                        | Moderate         | No                | Low              | 2                 |
| 815        | Museum of Science                                    | Museum                        | Moderate         | No                | Low              | 4                 |
| 816        | New England Aquarium Library                         | Special                       | Moderate         | AE                | Low              | 2                 |
| 817        | New England Historic Genealogical Society            | Historical Society            | Moderate         | No                | Low              | 2                 |
| 818        | Nichols House Museum                                 | Museum                        | Moderate         | No                | Low              | 0                 |
| 819        | Old South Meeting House                              | Historic House/Site           | Moderate         | No                | Low              | 0                 |
| 820        | Paul E. Woodard Health Sciences Library              | Special-Medical               | Moderate         | No                | Low              | 0                 |
| 821        | Paul Revere Memorial Association                     | General Institution           | Moderate         | No                | Low              | 0                 |
| 822        | Percy Howe Memorial Library                          | Special                       | Moderate         | No                | Low              | 2                 |
| 823        | South End Historical Society                         | Historical Society            | Moderate         | No                | Low              | 2                 |
| 824        | Spaulding Rehabilitation Hospital Medical Library    | Special-Medical               | Moderate         | No                | Low              | 2                 |

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|------------|---|-------------------------------|------------------|-------------------|------------------|-------------------|
| 825        | State Laboratory Institute Medical Center Library             | Special-Medical               | Moderate         | No                | High             | 0                 |
| 826        | State Library of Massachusetts                                | Special                       | Moderate         | No                | Low              | 0                 |
| 827        | State Transportation Library                                  | Special                       | Moderate         | No                | Low              | 2                 |
| 828        | Suffolk County House of Corrections Library                   | Special                       | Moderate         | No                | Low              | 2                 |
| 829        | The Boston Baha'i Community                                   | Religious Institution/Archive | Moderate         | No                | Low              | 2                 |
| 830        | The Cutler Majestic Theater at Emerson College                | Various                       | Moderate         | No                | Low              | 0                 |
| 831        | The Freedom Trail Foundation                                  | General Institution           | Moderate         | No                | Low              | 0                 |
| 832        | The French Library  | Special                       | Moderate         | No                | Low              | 2                 |
| 833        | Samuel Crocker Lawrence Library                               | Special                       | Moderate         | No                | Low              | 2                 |
| 834        | Trinity Church in the City of Boston                          | Religious Institution/Archive | Moderate         | No                | Low              | 2                 |
| 835        | USS Constitution Museum                                       | Museum                        | Moderate         | No                | Low              | 2                 |
| 836        | Vilna Shul, Boston's Center for Jewish Culture                | Religious Institution/Archive | Moderate         | No                | Low              | 0                 |
| 837        | World Education/SABES Resource Center                         | Special                       | Moderate         | No                | Low              | 1                 |
| 838        | The Forest Hills Educational Trust                            | Various                       | Moderate         | No                | High             | 0                 |
| 839        | Dohoney Libraries   | Various                       | Low              | No                | High             | 0                 |
| 840        | Stohlman Library  | Various                       | Low              | No                | High             | 0                 |
| 841        | Boston CSJ Archives   | Various                       | Low              | No                | High             | 0                 |
| 842        | Boston National Historic Park                                 | Historic House/Site           | Moderate         | AE                | Low              | 2                 |
| 843        | Colpoys Library   | Various                       | Moderate         | No                | High             | 0                 |
| 844        | Dorchester Historical Society                                 | Various                       | Moderate         | No                | Low              | 0                 |
| 845        | East Library  | Various                       | Low              | No                | High             | 0                 |
| 846        | Bettencourt Medical Library                                   | Various                       | Moderate         | No                | High             | 0                 |
| 847        | Wayne S. Wright Community Resource Center Lib                 | Various                       | Moderate         | No                | Low              | 0                 |
| 848        | Arnold Arboretum  | Various                       | Moderate         | No                | High             | 0                 |
| 849        | Loring-Greenough House  | Various                       | Low              | No                | High             | 0                 |
| 850        | Roslindale Historical Society                                 | Various                       | Low              | No                | High             | 0                 |
| 851        | City of Boston Archives-Mass. Professional Psychology Library | Various                       | Low              | No                | High             | 0                 |
| 852        | Religious institution   | Faith Based                   | Moderate         | No                | Low              | 0                 |

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|------------|-----------------------|-------------|------------------|-------------------|------------------|-------------------|
| 853        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 854        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 855        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 856        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 857        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 858        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 859        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 860        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 861        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 862        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 863        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 864        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 865        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 866        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 867        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 868        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 869        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 870        | Religious institution | Faith Based | Moderate         | No                | Low              | 2                 |
| 871        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 872        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 873        | Religious institution | Faith Based | Low              | No                | High             | 0                 |
| 874        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 875        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 876        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 877        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 878        | Religious institution | Faith Based | Low              | No                | High             | 0                 |
| 879        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 880        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 881        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |

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|------------|----------------------------|-------------|------------------|-------------------|------------------|-------------------|
| 882        | St Joseph & Lazarus Church | Faith Based | Moderate         | No                | Low              | 4                 |
| 883        | Religious institution      | Faith Based | Moderate         | No                | High             | 0                 |
| 884        | Religious institution      | Faith Based | Moderate         | No                | Low              | 0                 |
| 885        | Religious institution      | Faith Based | Moderate         | No                | Low              | 0                 |
| 886        | Religious institution      | Faith Based | Moderate         | No                | High             | 0                 |
| 887        | Religious institution      | Faith Based | Moderate         | No                | Low              | 0                 |
| 888        | Religious institution      | Faith Based | Moderate         | No                | High             | 0                 |
| 889        | Religious institution      | Faith Based | Moderate         | No                | High             | 0                 |
| 890        | Religious institution      | Faith Based | Low              | No                | High             | 0                 |
| 891        | Religious institution      | Faith Based | Moderate         | No                | Low              | 0                 |
| 892        | Religious institution      | Faith Based | Low              | No                | High             | 0                 |
| 893        | Religious institution      | Faith Based | Low              | No                | High             | 0                 |
| 894        | Religious institution      | Faith Based | Moderate         | No                | High             | 0                 |
| 895        | Religious institution      | Faith Based | Moderate         | No                | High             | 0                 |
| 896        | Religious institution      | Faith Based | Moderate         | No                | Low              | 0                 |
| 897        | Religious institution      | Faith Based | Moderate         | No                | Low              | 2                 |
| 898        | Religious institution      | Faith Based | Moderate         | No                | Low              | 0                 |
| 899        | Religious institution      | Faith Based | Moderate         | No                | Low              | 2                 |
| 900        | Religious institution      | Faith Based | Low              | No                | High             | 0                 |
| 901        | Religious institution      | Faith Based | Moderate         | No                | Low              | 0                 |
| 902        | Religious institution      | Faith Based | Moderate         | No                | Low              | 0                 |
| 903        | Religious institution      | Faith Based | Moderate         | No                | High             | 0                 |
| 904        | Religious institution      | Faith Based | Moderate         | No                | High             | 0                 |
| 905        | Religious institution      | Faith Based | Moderate         | No                | Low              | 0                 |
| 906        | mosque                     | Faith Based | Moderate         | No                | High             | 0                 |
| 907        | Religious institution      | Faith Based | Moderate         | No                | Low              | 4                 |
| 908        | Religious institution      | Faith Based | Moderate         | No                | Low              | 0                 |
| 909        | Religious institution      | Faith Based | Moderate         | No                | Low              | 2                 |
| 910        | Religious institution      | Faith Based | Moderate         | No                | High             | 0                 |

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|------------|-----------------------|-------------|------------------|-------------------|------------------|-------------------|
| 911        | Religious institution | Faith Based | Low              | No                | Low              | 0                 |
| 912        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 913        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 914        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 915        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 916        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 917        | Religious institution | Faith Based | Low              | No                | High             | 0                 |
| 918        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 919        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 920        | Religious institution | Faith Based | Moderate         | No                | Low              | 2                 |
| 921        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 922        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 923        | Religious institution | Faith Based | Moderate         | No                | Low              | 2                 |
| 924        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 925        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 926        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 927        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 928        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 929        | Religious institution | Faith Based | Moderate         | No                | Low              | 4                 |
| 930        | Religious institution | Faith Based | Low              | No                | Low              | 0                 |
| 931        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 932        | Religious institution | Faith Based | Moderate         | No                | Low              | 2                 |
| 933        | Religious institution | Faith Based | Moderate         | No                | Low              | 2                 |
| 934        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 935        | Religious institution | Faith Based | Low              | No                | High             | 0                 |
| 936        | Religious institution | Faith Based | Low              | No                | High             | 0                 |
| 937        | Religious institution | Faith Based | Low              | No                | High             | 0                 |
| 938        | Religious institution | Faith Based | Low              | No                | High             | 0                 |
| 939        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |

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|------------|-----------------------|-------------|------------------|-------------------|------------------|-------------------|
| 940        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 941        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 942        | Religious institution | Faith Based | Low              | No                | High             | 0                 |
| 943        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 944        | Religious institution | Faith Based | Low              | No                | High             | 0                 |
| 945        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 946        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 947        | Religious institution | Faith Based | Low              | No                | High             | 0                 |
| 948        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 949        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 950        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 951        | Religious institution | Faith Based | Moderate         | No                | Low              | 2                 |
| 952        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 953        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 954        | Religious institution | Faith Based | Moderate         | No                | Low              | 4                 |
| 955        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 956        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 957        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 958        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 959        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 960        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 961        | Religious institution | Faith Based | Moderate         | No                | Low              | 4                 |
| 962        | Religious institution | Faith Based | Moderate         | No                | Low              | 2                 |
| 963        | Religious institution | Faith Based | Moderate         | No                | Low              | 2                 |
| 964        | Religious institution | Faith Based | Moderate         | No                | Low              | 2                 |
| 965        | Religious institution | Faith Based | Moderate         | No                | Low              | 2                 |
| 966        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 967        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 968        | Religious institution | Faith Based | Low              | No                | High             | 0                 |

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|------------|-----------------------|-------------|------------------|-------------------|------------------|-------------------|
| 969        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 970        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 971        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 972        | Religious institution | Faith Based | Low              | No                | High             | 0                 |
| 973        | Religious institution | Faith Based | Low              | No                | Low              | 0                 |
| 974        | Religious institution | Faith Based | Moderate         | No                | Low              | 2                 |
| 975        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 976        | Religious institution | Faith Based | Moderate         | No                | Low              | 2                 |
| 977        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 978        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 979        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 980        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 981        | Religious institution | Faith Based | Low              | No                | High             | 0                 |
| 982        | Church                | Faith Based | Moderate         | No                | High             | 0                 |
| 983        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 984        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 985        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 986        | Religious institution | Faith Based | Moderate         | No                | Low              | 2                 |
| 987        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 988        | Religious institution | Faith Based | Moderate         | No                | Low              | 2                 |
| 989        | Religious institution | Faith Based | Moderate         | No                | Low              | 2                 |
| 990        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 991        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 992        | Religious institution | Faith Based | Low              | No                | High             | 0                 |
| 993        | Religious institution | Faith Based | Low              | No                | High             | 0                 |
| 994        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 995        | Religious institution | Faith Based | Moderate         | No                | High             | 0                 |
| 996        | Religious institution | Faith Based | Moderate         | No                | Low              | 0                 |
| 997        | Religious institution | Faith Based | Moderate         | No                | Low              | 2                 |

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|------------|----------------------------------|----------------|------------------|-------------------|------------------|-------------------|
| 998        | Religious institution            | Faith Based    | Moderate         | No                | High             | 0                 |
| 999        | Religious institution            | Faith Based    | Moderate         | No                | High             | 0                 |
| 1000       | West End Library                 | Public Library | Moderate         | No                | Low              | 0                 |
| 1001       | Codman Square Library            | Public Library | Moderate         | No                | High             | 0                 |
| 1002       | Hyde Park Library                | Public Library | Low              | No                | High             | 0                 |
| 1003       | Connolly Library                 | Public Library | Moderate         | No                | High             | 0                 |
| 1004       | Dudley Library                   | Public Library | Moderate         | No                | Low              | 0                 |
| 1005       | Kirstein Business Branch Library | Public Library | Moderate         | No                | Low              | 0                 |
| 1006       | North End Library                | Public Library | Moderate         | No                | Low              | 0                 |
| 1007       | South End Library                | Public Library | Moderate         | No                | Low              | 2                 |
| 1008       | Allston Library                  | Public Library | Low              | No                | Low              | 0                 |
| 1009       | Brighton Library                 | Public Library | Low              | No                | High             | 0                 |
| 1010       | Faneuil Library                  | Public Library | Low              | No                | High             | 0                 |
| 1011       | Charlestown Library              | Public Library | Moderate         | No                | Low              | 0                 |
| 1012       | Adams Street Library             | Public Library | Moderate         | No                | High             | 0                 |
| 1013       | Fields Corner Library            | Public Library | Moderate         | No                | High             | 0                 |
| 1014       | Lower Mills Library              | Public Library | Moderate         | No                | High             | 0                 |
| 1015       | Uphams Corner Library            | Public Library | Moderate         | No                | Low              | 0                 |
| 1016       | East Boston Library              | Public Library | Moderate         | No                | Low              | 0                 |
| 1017       | Orient Heights Library           | Public Library | Moderate         | No                | Low              | 0                 |
| 1018       | Jamaica Plain Library            | Public Library | Moderate         | No                | High             | 0                 |
| 1019       | Mattapan Library                 | Public Library | Moderate         | No                | High             | 0                 |
| 1020       | Roslindale Library               | Public Library | Low              | No                | High             | 0                 |
| 1021       | Egleston Square Library          | Public Library | Moderate         | No                | High             | 0                 |
| 1022       | Parker Hill Library              | Public Library | Moderate         | No                | Low              | 0                 |
| 1023       | West Roxbury Library             | Public Library | Low              | No                | High             | 0                 |
| 1024       | South Boston Library             | Public Library | Moderate         | No                | Low              | 0                 |
| 1025       | Washington Village Library       | Public Library | Moderate         | No                | Low              | 2                 |
| 1026       | All Saints' Episcopal Church     | Faith Based    | Moderate         | No                | High             | 0                 |



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|------------|---|-------------|------------------|-------------------|------------------|-------------------|
| 1027       | Annunciation Greek Orthodox Cathedral of New England  | Faith Based | Moderate         | No                | Low              | 2                 |
| 1028       | Azusa Christian Community Center                      | Faith Based | Moderate         | No                | High             | 0                 |
| 1029       | Bethel AME Church                                     | Faith Based | Moderate         | No                | High             | 0                 |
| 1030       | Bethel Pentecostal Haitian Church                     | Faith Based | Moderate         | No                | High             | 0                 |
| 1031       | Bethel Tabernacle Pentecostal Church                  | Faith Based | Moderate         | No                | High             | 0                 |
| 1032       | Bethlehem Apost. Faith Holiness Church of God         | Faith Based | Moderate         | No                | High             | 0                 |
| 1033       | Bible Baptist Church                                  | Faith Based | Moderate         | No                | Low              | 0                 |
| 1034       | Bible Way Christian Center                            | Faith Based | Moderate         | No                | Low              | 0                 |
| 1035       | Born Again House of Prayer Ministry, Inc.             | Faith Based | Moderate         | No                | High             | 0                 |
| 1036       | Boylston Congregational Church                        | Faith Based | Moderate         | No                | High             | 0                 |
| 1037       | Calvary Baptist Church                                | Faith Based | Moderate         | No                | High             | 0                 |
| 1038       | Calvary Church International                          | Faith Based | Moderate         | No                | Low              | 0                 |
| 1039       | Cathedral of the Holy Cross                           | Faith Based | Moderate         | No                | Low              | 2                 |
| 1040       | Central Congregational Church of J.P.                 | Faith Based | Moderate         | No                | High             | 0                 |
| 1041       | Chief Cornerstone Church of God Apostolic             | Faith Based | Moderate         | No                | High             | 0                 |
| 1042       | Chinese Christian Church of Praise & Worship          | Faith Based | Moderate         | No                | Low              | 2                 |
| 1043       | Christ the King Parish                                | Faith Based | Moderate         | No                | High             | 0                 |
| 1044       | Church of God Bethel of Boston                        | Faith Based | Moderate         | No                | High             | 0                 |
| 1045       | Church of God Valley of Blessing                      | Faith Based | Moderate         | No                | Low              | 4                 |
| 1046       | Church of the Nazarene Ebenezer                       | Faith Based | Moderate         | No                | High             | 0                 |
| 1047       | City of Praise Family Church                          | Faith Based | Moderate         | No                | High             | 0                 |
| 1048       | Columbus Avenue AME Zion Church                       | Faith Based | Moderate         | No                | Low              | 2                 |
| 1049       | Community Church of Neponset                          | Faith Based | Moderate         | No                | High             | 2                 |
| 1050       | Concord Baptist Church                                | Faith Based | Moderate         | No                | Low              | 2                 |
| 1051       | Congregaciōn Leñ de Judß                              | Faith Based | Moderate         | No                | Low              | 2                 |
| 1052       | Covenant Congregational Church                        | Faith Based | Moderate         | No                | High             | 0                 |
| 1053       | Cuarta Iglesia de Jesucristo El Buen Samaritano, Inc. | Faith Based | Moderate         | No                | High             | 0                 |
| 1054       | Day Spring Christian Church                           | Faith Based | Moderate         | No                | High             | 0                 |
| 1055       | Deeper Life Bible Church                              | Faith Based | Moderate         | No                | Low              | 0                 |

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|------------|---|-------------|------------------|-------------------|------------------|-------------------|
| 1056       | Deliverance Shiloh Apostolic Church, The          | Faith Based | Moderate         | No                | High             | 0                 |
| 1057       | Dorchester Cape Verdian SDA Church                | Faith Based | Moderate         | No                | High             | 0                 |
| 1058       | Ebenezer Baptist Church                           | Faith Based | Moderate         | No                | Low              | 2                 |
| 1059       | Ebenezer Haitian Church of the Nazarene           | Faith Based | Moderate         | No                | High             | 0                 |
| 1060       | Eglise Baptiste du Bon Berger                     | Faith Based | Moderate         | No                | High             | 0                 |
| 1061       | Eglise Baptiste Pierre Angulaire                  | Faith Based | Moderate         | No                | High             | 0                 |
| 1062       | Eglise Christ Vivant                              | Faith Based | Moderate         | No                | High             | 0                 |
| 1063       | Eglise de Dieu Haïtienne de Boston                | Faith Based | Moderate         | No                | High             | 0                 |
| 1064       | Eglise Haitienne du NazarØen - Amis de la Sagesse | Faith Based | Moderate         | No                | High             | 0                 |
| 1065       | En el Nombre de Jesus                             | Faith Based | Moderate         | No                | High             | 0                 |
| 1066       | Ephese Seventh Day Adventist Church               | Faith Based | Moderate         | No                | High             | 0                 |
| 1067       | Faith Urban Assembly                              | Faith Based | Moderate         | No                | High             | 0                 |
| 1068       | Fellowship Church of God                          | Faith Based | Moderate         | No                | High             | 0                 |
| 1069       | Final Thrust Church                               | Faith Based | Moderate         | No                | High             | 0                 |
| 1070       | First Baptist Church in Dorchester (The)          | Faith Based | Moderate         | No                | High             | 0                 |
| 1071       | First Baptist Church of Jamaica Plain             | Faith Based | Moderate         | No                | High             | 0                 |
| 1072       | First Church in Jamaica Plain                     | Faith Based | Moderate         | No                | High             | 0                 |
| 1073       | First Parish Church in Dorchester                 | Faith Based | Moderate         | No                | Low              | 0                 |
| 1074       | First Star Holiness Church, Inc.                  | Faith Based | Moderate         | No                | High             | 0                 |
| 1075       | Friendship Apostolic Church                       | Faith Based | Moderate         | No                | High             | 0                 |
| 1076       | Full Life Gospel Center                           | Faith Based | Moderate         | No                | High             | 0                 |
| 1077       | Global Ministries Christian Church                | Faith Based | Moderate         | No                | High             | 0                 |
| 1078       | Gospel Proclaiming Mission                        | Faith Based | Moderate         | No                | Low              | 0                 |
| 1079       | Grace and Hope Mission Inc                        | Faith Based | Moderate         | No                | High             | 0                 |
| 1080       | Grace Church of All Nations                       | Faith Based | Moderate         | No                | High             | 0                 |
| 1081       | Grant AME Church                                  | Faith Based | Moderate         | No                | Low              | 0                 |
| 1082       | Greater Friendship Missionary Baptist Church      | Faith Based | Moderate         | No                | High             | 0                 |
| 1083       | Greater Harvest Worship Center                    | Faith Based | Moderate         | No                | High             | 0                 |
| 1084       | Greater Life Baptist Church                       | Faith Based | Moderate         | No                | High             | 0                 |

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|------------|--|-------------|------------------|-------------------|------------------|-------------------|
| 1085       | Greenwood Memorial United Methodist Church             | Faith Based | Moderate         | No                | High             | 0                 |
| 1086       | Holy Sanctuary of Deliverance                          | Faith Based | Moderate         | No                | High             | 0                 |
| 1087       | Holy Trinity Catholic Church                           | Faith Based | Moderate         | No                | Low              | 2                 |
| 1088       | Iglesia Adventista del 7mo Dia de Betel                | Faith Based | Moderate         | No                | High             | 0                 |
| 1089       | Iglesia Canaan Defensores de la Fe, Jamaica Plain      | Faith Based | Moderate         | No                | High             | 0                 |
| 1090       | Iglesia de Cristo Miel Ministerios ELIM, Boston        | Faith Based | Moderate         | No                | Low              | 2                 |
| 1091       | Iglesia de Cristo Misionera, Inc.                      | Faith Based | Moderate         | No                | High             | 0                 |
| 1092       | Iglesia de Cristo Misionera, MI                        | Faith Based | Moderate         | No                | High             | 0                 |
| 1093       | Iglesia de Cristo Misionera, Mission Hill              | Faith Based | Moderate         | No                | Low              | 0                 |
| 1094       | Iglesia de Dios Pentecostal                            | Faith Based | Moderate         | No                | Low              | 2                 |
| 1095       | Iglesia de Dios Pentecostal "La Senda Antigua"         | Faith Based | Moderate         | No                | High             | 0                 |
| 1096       | Iglesia de Dios Pentecostal "Roca de Consolacion"      | Faith Based | Moderate         | No                | High             | 0                 |
| 1097       | Iglesia de Dios Pentecostal Arca de Refugio C.L.A.     | Faith Based | Moderate         | No                | High             | 0                 |
| 1098       | Iglesia de Dios Pentecostal Esmirna, M.I.              | Faith Based | Moderate         | No                | High             | 0                 |
| 1099       | Iglesia de Dios Pentecostal M.I. "Puerta de Salvacion" | Faith Based | Moderate         | No                | High             | 0                 |
| 1100       | Iglesia de Dios Pentecostal Monte de los Olivos AICU   | Faith Based | Moderate         | No                | High             | 0                 |
| 1101       | Iglesia de Dios Pentecostal, M.I., J.P.                | Faith Based | Moderate         | No                | High             | 0                 |
| 1102       | Iglesia de Dios, Inc., Jamaica Plain                   | Faith Based | Moderate         | No                | High             | 0                 |
| 1103       | Iglesia de Dios, M.B., Mission Hill                    | Faith Based | Moderate         | No                | Low              | 0                 |
| 1104       | Iglesia Monte de Santidad                              | Faith Based | Moderate         | No                | High             | 0                 |
| 1105       | Iglesia Oasis de Vida                                  | Faith Based | Moderate         | No                | High             | 2                 |
| 1106       | Iglesia Pentecostal Cristo El Rey                      | Faith Based | Moderate         | No                | High             | 0                 |
| 1107       | Iglesia Pentecostal Fuente de Vida                     | Faith Based | Moderate         | No                | Low              | 0                 |
| 1108       | Iglesia Reformada Emanuel                              | Faith Based | Moderate         | No                | High             | 0                 |
| 1109       | International Outreach Ministries                      | Faith Based | Moderate         | No                | High             | 0                 |
| 1110       | Jamaica Plain Spanish Seventh Day Adventist Church     | Faith Based | Moderate         | No                | High             | 0                 |
| 1111       | Jesu Cristo La Unica Esperanza                         | Faith Based | Moderate         | No                | High             | 0                 |
| 1112       | Joy and Gladness Pentecostal Church, Inc.              | Faith Based | Moderate         | No                | High             | 0                 |
| 1113       | Jubilee Christian Fellowship                           | Faith Based | Moderate         | No                | High             | 0                 |

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|------------|---|-------------|------------------|-------------------|------------------|-------------------|
| 1114       | Lord and Christ Fellowship                          | Faith Based | Moderate         | No                | High             | 0                 |
| 1115       | Lower Light Gospel Center                           | Faith Based | Moderate         | No                | High             | 0                 |
| 1116       | Macedonia Baptist Church                            | Faith Based | Moderate         | No                | High             | 0                 |
| 1117       | Men and Women of Crossroads Ministries              | Faith Based | Moderate         | No                | High             | 0                 |
| 1118       | Mercy and Grace Ministries                          | Faith Based | Moderate         | No                | High             | 0                 |
| 1119       | Mission Church                                      | Faith Based | Moderate         | No                | Low              | 0                 |
| 1120       | Mount Calvary Baptist Church (The)                  | Faith Based | Moderate         | No                | Low              | 2                 |
| 1121       | Mount Calvary Holy Assembly No. 1, Inc.             | Faith Based | Moderate         | No                | High             | 0                 |
| 1122       | New Bethel Apostolic Church of Jesus Christ         | Faith Based | Moderate         | No                | High             | 0                 |
| 1123       | New Hope Baptist Church                             | Faith Based | Moderate         | No                | Low              | 2                 |
| 1124       | New Life Restoration Temple                         | Faith Based | Moderate         | No                | High             | 0                 |
| 1125       | New Mount Calvary                                   | Faith Based | Moderate         | No                | High             | 0                 |
| 1126       | Octava Iglesia Jesucristo el Buen Samaritano        | Faith Based | Moderate         | No                | Low              | 2                 |
| 1127       | Our Lady of Lourdes Catholic Church                 | Faith Based | Moderate         | No                | High             | 0                 |
| 1128       | Our Lady of the Cedars of Lebanon Church            | Faith Based | Low              | No                | High             | 0                 |
| 1129       | Pentecostal House of Prayer for All People          | Faith Based | Moderate         | No                | High             | 0                 |
| 1130       | Peoples Baptist Church                              | Faith Based | Moderate         | No                | Low              | 2                 |
| 1131       | Power in the Word Chapel                            | Faith Based | Moderate         | No                | High             | 0                 |
| 1132       | Prayer Room Pentecostal Church of Faith             | Faith Based | Moderate         | No                | High             | 0                 |
| 1133       | Primera Iglesia Bautista Hispana, Jamaica Plain     | Faith Based | Moderate         | No                | High             | 0                 |
| 1134       | Primera Iglesia de Dios Pentecostal, M.I.           | Faith Based | Moderate         | No                | High             | 0                 |
| 1135       | Primera Iglesia de Dios, Inc.                       | Faith Based | Moderate         | No                | High             | 0                 |
| 1136       | Primera Iglesia Presbiteriana (E.U.A.)              | Faith Based | Moderate         | No                | High             | 0                 |
| 1137       | Quinta Iglesia /Jesu El Buen Samaritano             | Faith Based | Moderate         | No                | High             | 0                 |
| 1138       | Revival Deliverance Temple Church                   | Faith Based | Moderate         | No                | High             | 0                 |
| 1139       | River of Life Church                                | Faith Based | Moderate         | No                | High             | 0                 |
| 1140       | Salvation Army South End Community & Worship Center | Faith Based | Moderate         | No                | Low              | 2                 |
| 1141       | Second Church in Dorchester                         | Faith Based | Moderate         | No                | High             | 0                 |
| 1142       | Shawmut Community Church of God                     | Faith Based | Moderate         | No                | Low              | 0                 |

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|------------|---|-------------|------------------|-------------------|------------------|-------------------|
| 1143       | Shawmut Springs Church                                | Faith Based | Moderate         | No                | Low              | 0                 |
| 1144       | Solid Rock, The                                       | Faith Based | Moderate         | No                | High             | 0                 |
| 1145       | South End Neighborhood Church of Emmanuel             | Faith Based | Moderate         | No                | Low              | 2                 |
| 1146       | Spanish Church of God of Boston (The)                 | Faith Based | Moderate         | No                | Low              | 0                 |
| 1147       | St. Ambrose Catholic Church                           | Faith Based | Moderate         | No                | High             | 0                 |
| 1148       | St. Andrews United Methodist Church                   | Faith Based | Moderate         | No                | High             | 0                 |
| 1149       | St. Ann's Catholic Church, Dorchester                 | Faith Based | Moderate         | No                | High             | 0                 |
| 1150       | St. Augustine's and St. Martin's Episcopal Church     | Faith Based | Moderate         | No                | Low              | 0                 |
| 1151       | St. Brendan's Catholic Church                         | Faith Based | Moderate         | No                | High             | 0                 |
| 1152       | St. Cyprian's Episcopal Church                        | Faith Based | Moderate         | No                | Low              | 2                 |
| 1153       | St. Gregory's Catholic Church                         | Faith Based | Moderate         | No                | High             | 0                 |
| 1154       | St. John the Baptist Hellenic Orthodox Church         | Faith Based | Moderate         | No                | Low              | 2                 |
| 1155       | St. John's Episcopal Church, Jamaica Plain            | Faith Based | Moderate         | No                | High             | 0                 |
| 1156       | St. Mark's Catholic Church                            | Faith Based | Moderate         | No                | High             | 0                 |
| 1157       | St. Peter's Catholic Church, Dorchester               | Faith Based | Moderate         | No                | Low              | 0                 |
| 1158       | St. Stephen's Episcopal Church                        | Faith Based | Moderate         | No                | Low              | 2                 |
| 1159       | St. Thomas Aquinas Catholic Church                    | Faith Based | Moderate         | No                | High             | 0                 |
| 1160       | The Temple of Restoration Church                      | Faith Based | Moderate         | No                | High             | 0                 |
| 1161       | Trinity Latvian Evangelical Lutheran Church in Boston | Faith Based | Moderate         | No                | High             | 0                 |
| 1162       | Trinity Temple  | Faith Based | Moderate         | No                | Low              | 0                 |
| 1163       | Ukrainian Orthodox Church of St. Andrew               | Faith Based | Moderate         | No                | High             | 0                 |
| 1164       | Unidos En Cristo                                      | Faith Based | Moderate         | No                | High             | 0                 |
| 1165       | United Emmanuel Holiness Church, Inc.                 | Faith Based | Moderate         | No                | Low              | 2                 |
| 1166       | Universal Church of God in Christ Outreach Ministry   | Faith Based | Moderate         | No                | High             | 0                 |
| 1167       | Victory Christian Fellowship Ministries               | Faith Based | Moderate         | No                | High             | 0                 |
| 1168       | Vietnamese Alliance Church                            | Faith Based | Moderate         | No                | High             | 0                 |
| 1169       | Vietnamese Assemblies of God of Boston                | Faith Based | Moderate         | No                | Low              | 0                 |
| 1170       | Wesley United Methodist Church                        | Faith Based | Moderate         | No                | High             | 0                 |
| 1171       | Wesleyan Church of Dorchester                         | Faith Based | Moderate         | No                | High             | 0                 |

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|------------|--|-----------------------|------------------|-----------------------|------------------|-------------------|
| 1172       | Word of Life Tabernacle                    | Faith Based           | Moderate         | No                    | High             | 0                 |
| 1173       | Orient Heights Community Center            | Municipal Building    | Moderate         | No                    | Low              | 2                 |
| 1174       | Harborside Community Center - Umana Barnes | Community Center      | Moderate         | No                    | Low              | 2                 |
| 1175       | Paris Street Pool*                         | BCYF community center | Moderate         | No                    | Low              | 2                 |
| 1176       | Paris Street Community Center              | Community Center      | Moderate         | No                    | Low              | 1                 |
| 1177       | Golden Age Center                          | BCYF community center | Moderate         | No                    | Low              | 2                 |
| 1178       | Stillman Tennis Center                     | BCYF community center | Moderate         | No                    | Low              | 2                 |
| 1179       | Charlestown Community Center               | BCYF community center | Moderate         | No                    | Low              | 4                 |
| 1180       | Kent Center                                | Community center      | Moderate         | No                    | Low              | 0                 |
| 1181       | Nazarro Community Center                   | BCYF community center | Moderate         | No                    | Low              | 0                 |
| 1182       | BCNC/Quincy*                               | BCYF community center | Moderate         | No                    | Low              | 0                 |
| 1183       | Thomas Johnson Center                      | Community Center      | Moderate         | No                    | Low              | 0                 |
| 1184       | Condon Community Center                    | BCYF community center | Moderate         | No                    | Low              | 0                 |
| 1185       | Walsh Center                               | Community Center      | Moderate         | No                    | Low              | 0                 |
| 1186       | Tynan Community Center                     | Community Center      | Moderate         | No                    | Low              | 0                 |
| 1187       | Curley Center                              | BCYF community center | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 2                 |
| 1188       | Vine Street Community Center               | Community Center      | Moderate         | No                    | Low              | 0                 |
| 1189       | Blackstone Community Center                | BCYF community center | Moderate         | No                    | Low              | 2                 |
| 1190       | Tobin Community Center                     | Community Center      | Moderate         | No                    | Low              | 0                 |
| 1191       | Shelburne Center                           | Community Center      | Moderate         | No                    | Low              | 0                 |
| 1192       | Jamaica Plain Community Center             | Community Center      | Moderate         | No                    | High             | 0                 |
| 1193       | Agassiz - closed?                          | BCYF community center | Moderate         | No                    | High             | 0                 |
| 1194       | Holland Community Center                   | BCYF community center | Moderate         | No                    | High             | 0                 |
| 1195       | Perkins Community Center                   | Community Center      | Moderate         | No                    | High             | 0                 |
| 1196       | Cleveland Community Center                 | BCYF community center | Moderate         | No                    | High             | 0                 |
| 1197       | Murphy Community Center                    | Community Center      | Moderate         | No                    | High             | 2                 |
| 1198       | Gallivan Community Center                  | BCYF community center | Moderate         | No                    | High             | 0                 |

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|------------|---|-------------------------|------------------|-------------------|------------------|-------------------|
| 1199       | Hyde Park Community Center                                | BCYF community center   | Low              | No                | High             | 0                 |
| 1200       | Curtis Hall Community Center                              | BCYF community center   | Moderate         | No                | High             | 0                 |
| 1201       | Roslindale Community Center                               | BCYF community center   | Low              | No                | High             | 0                 |
| 1202       | Flaherty Pool*  | BCYF community center   | Low              | No                | High             | 0                 |
| 1203       | Archdale Community Center                                 | BCYF community center   | Moderate         | No                | High             | 0                 |
| 1204       | Roche Center  | Community Center        | Low              | No                | High             | 0                 |
| 1205       | West Roxbury*   | BCYF community center   | Low              | No                | High             | 0                 |
| 1206       | Draper Pool*  | BCYF community center   | Low              | No                | High             | 0                 |
| 1207       | Ohrenberger Community Center                              | BCYF community center   | Low              | No                | High             | 0                 |
| 1208       | Jackson-Mann Community Center                             | BCYF community center   | Low              | No                | Low              | 0                 |
| 1209       | Mirabella Pool*   | BCYF community center   | Moderate         | No                | Low              | 1                 |
| 1210       | Clougherty Pool*  | BCYF community center   | Moderate         | No                | Low              | 0                 |
| 1211       | Grove Hall Community Center                               | BCYF community center   | Moderate         | No                | High             | 0                 |
| 1212       | Mason Pool*   | BCYF community center   | Moderate         | No                | Low              | 2                 |
| 1213       | Orchard Gardens   | BCYF community center   | Moderate         | No                | Low              | 0                 |
| 1214       | BOSTON PRE-RELEASE CENTER                                 | Correctional Facilities | Moderate         | No                | High             | 0                 |
| 1215       | SPECTRUM GIRLS DETENTION CENTER                           | Correctional Facilities | Moderate         | No                | High             | 0                 |
| 1216       | Shattuck Hospital Correction Unit                         | Correctional Facilities | Moderate         | No                | High             | 0                 |
| 1217       | SUFFOLK COUNTY HOUSE OF CORRECTION                        | Correctional Facilities | Moderate         | No                | Low              | 2                 |
| 1218       | SUFFOLK COUNTY SUPERIOR COURT                             | Correctional Facilities | Moderate         | No                | Low              | 0                 |
| 1219       | Suffolk County Jail                                       | Correctional Facilities | Moderate         | No                | Low              | 2                 |
| 1220       | John Joseph Moakley United States Courthouse              | Court House             | Moderate         | No                | Low              | 1                 |
| 1221       | US Bankruptcy Court - John W. McCormack Court House       | Court House             | Moderate         | No                | Low              | 0                 |
| 1222       | US Bankruptcy Court Clerk                                 | Court House             | Moderate         | No                | Low              | 2                 |
| 1223       | Boston Housing Court - Edward W. Brooke Courthouse        | Court House             | Moderate         | No                | Low              | 2                 |
| 1224       | Boston Municipal Court Dept - Edward W. Brooke Courthouse | Court House             | Moderate         | No                | Low              | 2                 |
| 1225       | Charlestown Division, Boston Municipal Court Department   | Court House             | Moderate         | No                | Low              | 0                 |
| 1226       | Dorchester Division, Boston Municipal Court Department    | Court House             | Moderate         | No                | Low              | 0                 |

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|------------|--|--------------------------------------|------------------|-------------------|------------------|-------------------|
| 1227       | South Boston Division, Boston Municipal Court Department     | Court House                          | Moderate         | No                | Low              | 0                 |
| 1228       | Suffolk Juvenile Court - Edward W. Brooke Courthouse         | Court House                          | Moderate         | No                | Low              | 2                 |
| 1229       | Suffolk Probate & Family Court - Edward W. Brooke Courthouse | Court House                          | Moderate         | No                | Low              | 2                 |
| 1230       | West Roxbury Division, Boston Municipal Court Department     | Court House                          | Moderate         | No                | High             | 0                 |
| 1231       | Brighton Division, Boston Municipal Court Department         | Court House                          | Low              | No                | High             | 0                 |
| 1232       | Roxbury Division, Boston Municipal Court Department          | Court House                          | Moderate         | No                | Low              | 0                 |
| 1233       | BOSTON OPERATIONS CENTER BOSTON EDISON                       | Electric-Gas-Oil plants, substations | Moderate         | No                | Low              | 2                 |
| 1234       | TRIGEN BOSTON ENERGY   | Electric-Gas-Oil plants, substations | Moderate         | No                | Low              | 2                 |
| 1235       | TRIGEN BOSTON ENERGY CORP                                    | Electric-Gas-Oil plants, substations | Moderate         | No                | Low              | 0                 |
| 1236       | New Boston Generating Station L Street                       | Electric-Gas-Oil plants, substations | Moderate         | No                | Low              | 4                 |
| 1237       | New Boston Generating Station L Street                       | Electric-Gas-Oil plants, substations | Moderate         | No                | Low              | 4                 |
| 1238       | SITHE NEW BOSTON STATION LLC M Street Jet                    | Electric-Gas-Oil plants, substations | Moderate         | No                | Low              | 0                 |
| 1239       | Gillette Co  | Electric-Gas-Oil plants, substations | Moderate         | No                | Low              | 4                 |
| 1240       | Dewar Street 483   | Electric-Gas-Oil plants, substations | Moderate         | No                | Low              | 4                 |
| 1241       | MBTA No 106  | Electric-Gas-Oil plants, substations | Moderate         | No                | Low              | 4                 |
| 1242       | K Street No 1  | Electric-Gas-Oil plants, substations | Moderate         | No                | Low              | 0                 |
| 1243       | New Boston Generating Station L Street                       | Electric-Gas-Oil plants, substations | Moderate         | No                | Low              | 4                 |
| 1244       | K Street No 2 No 385   | Electric-Gas-Oil plants,             | Moderate         | No                | Low              | 4                 |



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|------------|---|--------------------------------------|------------------|-------------------|------------------|-------------------|
|            |   | substations                          |                  |                   |                  |                   |
| 1245       | Gillette Co                               | Electric-Gas-Oil plants, substations | Moderate         | No                | Low              | 4                 |
| 1246       | Scotia No 71                              | Electric-Gas-Oil plants, substations | Moderate         | No                | Low              | 0                 |
| 1247       | Carver No 514N                            | Electric-Gas-Oil plants, substations | Moderate         | No                | Low              | 0                 |
| 1248       | Kingston St                               | Electric-Gas-Oil plants, substations | Moderate         | No                | Low              | 2                 |
| 1249       | High Street 53                            | Electric-Gas-Oil plants, substations | Moderate         | No                | Low              | 0                 |
| 1250       | Chatham Street 12                         | Electric-Gas-Oil plants, substations | Moderate         | No                | Low              | 2                 |
| 1251       | Roslindale Post Office                    | Post Office                          | Low              | No                | High             | 0                 |
| 1252       | Suffolk University                        | Colleges                             | Moderate         | No                | Low              | 0                 |
| 1253       | Benjamin Franklin Institute of Technology | Colleges                             | Moderate         | No                | Low              | 2                 |
| 1254       | Bunker Hill Community College             | Colleges                             | Moderate         | No                | Low              | 0                 |
| 1255       | MGH Institute of Health Professions       | Colleges                             | Moderate         | No                | Low              | 2                 |
| 1256       | Emmanuel College                          | Colleges                             | Moderate         | No                | Low              | 2                 |
| 1257       | School of the Museum of Fine Arts-Boston  | Colleges                             | Moderate         | No                | Low              | 2                 |
| 1258       | Simmons College                           | Colleges                             | Moderate         | No                | Low              | 2                 |
| 1259       | Boston University                         | Colleges                             | Moderate         | No                | Low              | 2                 |
| 1260       | The Boston Conservatory                   | Colleges                             | Moderate         | No                | Low              | 2                 |
| 1261       | Wheelock College                          | Colleges                             | Moderate         | No                | Low              | 0                 |
| 1262       | Roxbury Community College                 | Colleges                             | Moderate         | No                | Low              | 0                 |
| 1263       | University of Massachusetts-Boston        | Colleges                             | Moderate         | No                | Low              | 0                 |
| 1264       | Boston University Research                | Colleges                             | Moderate         | No                | Low              | 4                 |
| 1265       | Boston University School of Law           | Colleges                             | Moderate         | No                | Low              | 0                 |
| 1266       | Boston University Sargent College         | Colleges                             | Moderate         | No                | Low              | 2                 |

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|------------|---|-------------|------------------|-------------------|------------------|-------------------|
| 1267       | Boston University School of Management                | Colleges    | Moderate         | No                | Low              | 2                 |
| 1268       | Boston University Admissions                          | Colleges    | Moderate         | No                | Low              | 2                 |
| 1269       | Boston University Rental Office                       | Colleges    | Moderate         | No                | Low              | 2                 |
| 1270       | Boston University Trustees                            | Colleges    | Moderate         | No                | Low              | 0                 |
| 1271       | Boston University                                     | Colleges    | Moderate         | No                | Low              | 0                 |
| 1272       | Boston University School of Medicine                  | Colleges    | Moderate         | No                | Low              | 4                 |
| 1273       | Boston University Public Health                       | Colleges    | Moderate         | No                | Low              | 2                 |
| 1274       | Simmons College                                       | Colleges    | Moderate         | No                | Low              | 0                 |
| 1275       | Harvard University                                    | Colleges    | Moderate         | No                | Low              | 0                 |
| 1276       | Tufts University                                      | Colleges    | Moderate         | No                | Low              | 2                 |
| 1277       | MASCO Colleges of the Fenway                          | Colleges    | Moderate         | No                | Low              | 0                 |
| 1278       | Harvard Business School                               | Colleges    | Low              | No                | Low              | 4                 |
| 1279       | New England College of Business and Finance           | Colleges    | Moderate         | No                | Low              | 0                 |
| 1280       | North Bennet Street School                            | Colleges    | Moderate         | No                | Low              | 0                 |
| 1281       | Empire Beauty School-Boston                           | Colleges    | Moderate         | No                | Low              | 0                 |
| 1282       | Urban College of Boston                               | Colleges    | Moderate         | No                | Low              | 0                 |
| 1283       | Bay State College                                     | Colleges    | Moderate         | No                | Low              | 2                 |
| 1284       | Butera School of Art                                  | Colleges    | Moderate         | No                | Low              | 2                 |
| 1285       | Emerson College                                       | Colleges    | Moderate         | No                | Low              | 0                 |
| 1286       | Fisher College  | Colleges    | Moderate         | No                | Low              | 2                 |
| 1287       | Gibbs College-Boston                                  | Colleges    | Moderate         | No                | Low              | 2                 |
| 1288       | New England Law-Boston                                | Colleges    | Moderate         | No                | Low              | 0                 |
| 1289       | Kaplan Career Institute                               | Colleges    | Moderate         | No                | Low              | 2                 |
| 1290       | Boston Architectural College                          | Colleges    | Moderate         | No                | Low              | 0                 |
| 1291       | Massachusetts College of Art and Design               | Colleges    | Moderate         | No                | Low              | 0                 |
| 1292       | Massachusetts College of Pharmacy and Health Sciences | Colleges    | Moderate         | No                | Low              | 0                 |
| 1293       | New England College of Optometry                      | Colleges    | Moderate         | No                | Low              | 2                 |
| 1294       | Northeastern University                               | Colleges    | Moderate         | No                | Low              | 2                 |
| 1295       | The New England Conservatory of Music                 | Colleges    | Moderate         | No                | Low              | 2                 |

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|------------|--|-------------|------------------|-------------------|------------------|-------------------|
| 1296       | Wentworth Institute of Technology                | Colleges    | Moderate         | No                | Low              | 4                 |
| 1297       | Berklee College of Music                         | Colleges    | Moderate         | No                | Low              | 0                 |
| 1298       | Kaplan Career Institute                          | Colleges    | Moderate         | No                | Low              | 2                 |
| 1299       | New England School of Photography                | Colleges    | Moderate         | No                | Low              | 2                 |
| 1300       | The Art Institute of Boston at Lesley University | Colleges    | Moderate         | No                | Low              | 0                 |
| 1301       | Laboure College                                  | Colleges    | Moderate         | No                | High             | 0                 |
| 1302       | Everest Institute-Brighton                       | Colleges    | Low              | No                | Low              | 0                 |
| 1303       | Saint John's Seminary                            | Colleges    | Low              | No                | High             | 0                 |
| 1304       | Boston College                                   | Colleges    | Moderate         | No                | Low              | 2                 |
| 1305       | Pine Manor College                               | Colleges    | Moderate         | No                | Low              | 0                 |
| 1306       | Massachusetts School of Professional Psychology  | Colleges    | Low              | No                | High             | 0                 |
| 1307       | Boston Baptist College                           | Colleges    | Low              | No                | High             | 0                 |
| 1308       | Guild Elementary                                 | Schools     | Moderate         | No                | Low              | 0                 |
| 1309       | Kennedy Patrick Elem                             | Schools     | Moderate         | No                | Low              | 0                 |
| 1310       | Otis Elementary                                  | Schools     | Moderate         | No                | Low              | 4                 |
| 1311       | O'Donnell Elementary                             | Schools     | Moderate         | No                | Low              | 0                 |
| 1312       | East Boston High                                 | Schools     | Moderate         | No                | Low              | 0                 |
| 1313       | Umana Middle School Academy                      | Schools     | Moderate         | No                | Low              | 2                 |
| 1314       | Alighieri Elementary                             | Schools     | Moderate         | No                | Low              | 2                 |
| 1315       | East Boston EEC                                  | Schools     | Moderate         | No                | Low              | 2                 |
| 1316       | McKay K-8  | Schools     | Moderate         | No                | Low              | 2                 |
| 1317       | Adams Elementary                                 | Schools     | Moderate         | No                | Low              | 0                 |
| 1318       | Harvard/Kent Elem                                | Schools     | Moderate         | No                | Low              | 4                 |
| 1319       | Charlestown High                                 | Schools     | Moderate         | No                | Low              | 0                 |
| 1320       | Edwards Middle                                   | Schools     | Moderate         | No                | Low              | 0                 |
| 1321       | Warren/Prescott                                  | Schools     | Moderate         | No                | Low              | 0                 |
| 1322       | Eliot K-8  | Schools     | Moderate         | No                | Low              | 0                 |
| 1323       | Quincy Upper School                              | Schools     | Moderate         | No                | Low              | 4                 |
| 1324       | Joshua Quincy School (K-5)                       | Schools     | Moderate         | No                | Low              | 0                 |

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|------------|---|-------------|------------------|-------------------|------------------|-------------------|
| 1325       | Snowden International                     | Schools     | Moderate         | No                | Low              | 2                 |
| 1326       | McKinley Elementary and South End Academy | Schools     | Moderate         | No                | Low              | 2                 |
| 1327       | Joseph J Hurley Elementary                | Schools     | Moderate         | No                | Low              | 4                 |
| 1328       | Blackstone Elementary                     | Schools     | Moderate         | No                | Low              | 2                 |
| 1329       | Emerson Elementary - Closed               | Schools     | Moderate         | No                | Low              | 0                 |
| 1330       | Mason Elementary                          | Schools     | Moderate         | No                | Low              | 4                 |
| 1331       | Clap Elementary                           | Schools     | Moderate         | No                | Low              | 0                 |
| 1332       | Gavin Middle -closed                      | Schools     | Moderate         | No                | Low              | 0                 |
| 1333       | Perkins Elementary                        | Schools     | Moderate         | No                | Low              | 2                 |
| 1334       | Excel High School                         | Schools     | Moderate         | No                | Low              | 0                 |
| 1335       | Tynan Elementary                          | Schools     | Moderate         | No                | Low              | 0                 |
| 1336       | Oliver Hazard Perry Elementary School     | Schools     | Moderate         | No                | Low              | 4                 |
| 1337       | Russell Elementary                        | Schools     | Moderate         | No                | Low              | 0                 |
| 1338       | Orchard Gardens K-8                       | Schools     | Moderate         | No                | Low              | 0                 |
| 1339       | Dearborn Middle                           | Schools     | Moderate         | No                | Low              | 0                 |
| 1340       | Boston Day & Evening Academies            | Schools     | Moderate         | No                | Low              | 0                 |
| 1341       | Carter Developmental Center               | Schools     | Moderate         | No                | Low              | 2                 |
| 1342       | Madison Park High School                  | Schools     | Moderate         | No                | Low              | 0                 |
| 1343       | O'Bryant Math & Sci.                      | Schools     | Moderate         | No                | Low              | 0                 |
| 1344       | James P Timilty Middle                    | Schools     | Moderate         | No                | Low              | 0                 |
| 1345       | Hale Elementary                           | Schools     | Moderate         | No                | Low              | 0                 |
| 1346       | Higginson/Lewis K-8                       | Schools     | Moderate         | No                | Low              | 0                 |
| 1347       | Haynes Early Education Center             | Schools     | Moderate         | No                | Low              | 0                 |
| 1348       | Trotter Elementary                        | Schools     | Moderate         | No                | High             | 0                 |
| 1349       | Boston Latin Academy                      | Schools     | Moderate         | No                | Low              | 0                 |
| 1350       | Ellis Elementary                          | Schools     | Moderate         | No                | High             | 0                 |
| 1351       | Winthrop Elementary                       | Schools     | Moderate         | No                | Low              | 0                 |
| 1352       | King K-8                                  | Schools     | Moderate         | No                | Low              | 0                 |
| 1353       | Lilla G. Frederick Middle School          | Schools     | Moderate         | No                | High             | 0                 |

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|------------|---|-------------|------------------|-------------------|------------------|-------------------|
| 1354       | East Zone ELC   | Schools     | Moderate         | No                | Low              | 0                 |
| 1355       | Holland Elementary  | Schools     | Moderate         | No                | High             | 0                 |
| 1356       | Mather Elementary   | Schools     | Moderate         | No                | Low              | 0                 |
| 1357       | Harbor School   | Schools     | Moderate         | No                | High             | 0                 |
| 1358       | Marshall Elementary   | Schools     | Moderate         | No                | High             | 0                 |
| 1359       | Henderson Elementary  | Schools     | Moderate         | No                | High             | 0                 |
| 1360       | Murphy School K-8   | Schools     | Moderate         | No                | High             | 2                 |
| 1361       | Kenny Elementary  | Schools     | Moderate         | No                | High             | 0                 |
| 1362       | Dorchester Academy  | Schools     | Moderate         | No                | High             | 0                 |
| 1363       | Taylor Elementary   | Schools     | Moderate         | No                | High             | 0                 |
| 1364       | Boston International HS, Newcomers Academy  | Schools     | Moderate         | No                | High             | 0                 |
| 1365       | Dr. Catherine Ellison-Rosa Parks Early Ed School                                  | Schools     | Moderate         | No                | High             | 0                 |
| 1366       | Mildred Avenue K-8  | Schools     | Moderate         | No                | High             | 0                 |
| 1367       | Tech Boston Academy (9-12)  | Schools     | Moderate         | No                | High             | 0                 |
| 1368       | Fifield Elementary  | Schools     | Moderate         | No                | High             | 0                 |
| 1369       | Lee Elementary & Lee Academy  | Schools     | Moderate         | No                | High             | 0                 |
| 1370       | Holmes Elementary   | Schools     | Moderate         | No                | High             | 0                 |
| 1371       | Middle School Academy   | Schools     | Moderate         | No                | High             | 0                 |
| 1372       | Young Achievers K-8   | Schools     | Moderate         | No                | High             | 0                 |
| 1373       | Mattahunt Elementary School   | Schools     | Moderate         | No                | High             | 0                 |
| 1374       | Chittick Elementary   | Schools     | Low              | No                | High             | 0                 |
| 1375       | Greenwood Elihu Elem  | Schools     | Low              | No                | High             | 0                 |
| 1376       | Social Justice Academy, Engineering School, Community Academy of Science & Health | Schools     | Low              | No                | High             | 0                 |
| 1377       | Philbrick Elementary  | Schools     | Low              | No                | High             | 0                 |
| 1378       | Haley Elementary  | Schools     | Moderate         | No                | High             | 0                 |
| 1379       | Boston Teachers Union School  | Schools     | Moderate         | No                | High             | 0                 |
| 1380       | Rogers Middle   | Schools     | Low              | No                | High             | 0                 |
| 1381       | Roosevelt Upper (2-7)   | Schools     | Low              | No                | High             | 0                 |

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|------------|-------------------------------------|-------------|------------------|-------------------|------------------|-------------------|
| 1382       | Channing Elementary                 | Schools     | Low              | No                | High             | 0                 |
| 1383       | Grew Elementary                     | Schools     | Low              | No                | High             | 0                 |
| 1384       | Conley Elementary                   | Schools     | Low              | No                | High             | 0                 |
| 1385       | Washington Irving Middle            | Schools     | Low              | No                | High             | 0                 |
| 1386       | Sumner Elementary                   | Schools     | Low              | No                | High             | 0                 |
| 1387       | Boston International High School    | Schools     | Moderate         | No                | High             | 0                 |
| 1388       | Hernandez Elementary School         | Schools     | Moderate         | No                | High             | 0                 |
| 1389       | English High                        | Schools     | Moderate         | No                | High             | 0                 |
| 1390       | Mendell Elementary                  | Schools     | Moderate         | No                | High             | 0                 |
| 1391       | JFK Elementary School               | Schools     | Moderate         | No                | High             | 0                 |
| 1392       | Hennigan Elementary                 | Schools     | Moderate         | No                | Low              | 0                 |
| 1393       | West Zone ELC                       | Schools     | Moderate         | No                | Low              | 0                 |
| 1394       | New Mission High & Mission Hill K-8 | Schools     | Moderate         | No                | Low              | 0                 |
| 1395       | Tobin K-8                           | Schools     | Moderate         | No                | Low              | 0                 |
| 1396       | Farragut Elementary                 | Schools     | Moderate         | No                | Low              | 0                 |
| 1397       | Boston Latin School                 | Schools     | Moderate         | No                | Low              | 0                 |
| 1398       | Kennedy Health Careers Acad         | Schools     | Moderate         | No                | Low              | 2                 |
| 1399       | Fenway High, Boston Arts Academy    | Schools     | Moderate         | No                | Low              | 2                 |
| 1400       | McKinley Prep High Sch              | Schools     | Moderate         | No                | Low              | 2                 |
| 1401       | McKinley Middle                     | Schools     | Moderate         | No                | Low              | 2                 |
| 1402       | Curley Lower (K1-5)                 | Schools     | Moderate         | No                | High             | 0                 |
| 1403       | Curley Upper (6-8)                  | Schools     | Moderate         | No                | High             | 0                 |
| 1404       | Agassiz Elementary -Closed          | Schools     | Moderate         | No                | High             | 0                 |
| 1405       | Manning Elementary                  | Schools     | Low              | No                | High             | 0                 |
| 1406       | Bates Elementary                    | Schools     | Low              | No                | High             | 0                 |
| 1407       | Mozart Elementary                   | Schools     | Low              | No                | High             | 0                 |
| 1408       | Kilmer Upper (4-8)                  | Schools     | Low              | No                | High             | 0                 |
| 1409       | Beethoven Elementary                | Schools     | Low              | No                | High             | 0                 |
| 1410       | Joyce Kilmer                        | Schools     | Low              | No                | High             | 0                 |

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|------------|--|-------------|------------------|-------------------|------------------|-------------------|
| 1411       | Urban Science Academy; Brook Farm/Media High                 | Schools     | Low              | No                | High             | 0                 |
| 1412       | Lyndon K-8   | Schools     | Low              | No                | High             | 0                 |
| 1413       | Edison K-8   | Schools     | Low              | No                | High             | 0                 |
| 1414       | Lyon K-8   | Schools     | Low              | No                | High             | 0                 |
| 1415       | Lyonry 9-12  | Schools     | Low              | No                | High             | 0                 |
| 1416       | Winship Elementary   | Schools     | Low              | No                | High             | 0                 |
| 1417       | Boston Community Leaders Academy & Another Course to College | Schools     | Low              | No                | High             | 0                 |
| 1418       | Brighton High  | Schools     | Low              | No                | High             | 0                 |
| 1419       | Baldwin ELC  | Schools     | Low              | No                | Low              | 0                 |
| 1420       | Horace Mann & Jackson/Mann K-8                               | Schools     | Low              | No                | Low              | 0                 |
| 1421       | Gardner Elementary School                                    | Schools     | Low              | No                | High             | 0                 |
| 1422       | Ohrenberger Elementary                                       | Schools     | Low              | No                | High             | 0                 |
| 1423       | Everett Elementary   | Schools     | Moderate         | No                | Low              | 0                 |
| 1424       | Boston Adult Tech Acad                                       | Schools     | Moderate         | No                | High             | 0                 |
| 1425       | Greenwood Sarah K-8  | Schools     | Moderate         | No                | High             | 0                 |
| 1426       | Burke High   | Schools     | Moderate         | No                | High             | 0                 |
| 1427       | Dever Elementary   | Schools     | Moderate         | No                | Low              | 4                 |
| 1428       | McCormack Middle   | Schools     | Moderate         | No                | Low              | 2                 |
| 1429       | Condon Elementary  | Schools     | Moderate         | No                | Low              | 0                 |
| 1430       | Franklin D. Roosevelt School/Hemenway Building               | Schools     | Low              | No                | High             | 0                 |
| 1431       | Bradley Elementary   | Schools     | Moderate         | No                | Low              | 0                 |
| 1432       | Not in Use   | Schools     | Moderate         | No                | High             | 0                 |
| 1433       | Not in Use   | Schools     | Moderate         | No                | Low              | 0                 |
| 1434       | Not in Use   | Schools     | Moderate         | No                | High             | 0                 |
| 1435       | Roxbury Preparatory Charter School                           | Schools     | Moderate         | No                | Low              | 0                 |
| 1436       | Smith Leadership Academy Charter Public School               | Schools     | Moderate         | No                | High             | 0                 |
| 1437       | Uphams Corner Charter School                                 | Schools     | Moderate         | No                | Low              | 2                 |
| 1438       | British School of Boston                                     | Schools     | Low              | No                | High             | 0                 |

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|------------|---|-------------|------------------|-------------------|------------------|-------------------|
| 1439       | EDCO Collaborative - EDCO YOUTH ALT                       | Schools     | Moderate         | No                | Low              | 2                 |
| 1440       | Academy Of the Pacific Rim Charter Public School          | Schools     | Low              | No                | High             | 0                 |
| 1441       | Boston Collegiate Charter School (Middle and High School) | Schools     | Moderate         | No                | Low              | 0                 |
| 1442       | Boston Day and Evening Academy Charter School             | Schools     | Moderate         | No                | Low              | 0                 |
| 1443       | Boston Preparatory Charter Public School                  | Schools     | Low              | No                | High             | 0                 |
| 1444       | Boston Renaissance Charter Public School                  | Schools     | Low              | No                | High             | 0                 |
| 1445       | Codman Academy Charter Public School                      | Schools     | Moderate         | No                | High             | 0                 |
| 1446       | Conservatory Lab Charter School                           | Schools     | Low              | No                | High             | 0                 |
| 1447       | Edward Brooke Charter School                              | Schools     | Low              | No                | High             | 0                 |
| 1448       | Excel Academy Charter School                              | Schools     | Moderate         | No                | Low              | 0                 |
| 1449       | Health Careers Academy Charter School                     | Schools     | Moderate         | No                | Low              | 2                 |
| 1450       | MATCH Charter Public High School                          | Schools     | Moderate         | No                | Low              | 0                 |
| 1451       | Neighborhood House Charter School                         | Schools     | Moderate         | No                | High             | 0                 |
| 1452       | Cathedral High  | Schools     | Moderate         | No                | Low              | 2                 |
| 1453       | Advent  | Schools     | Moderate         | No                | Low              | 2                 |
| 1454       | St John Elementary  | Schools     | Moderate         | No                | Low              | 0                 |
| 1455       | Berea SDA Acad  | Schools     | Moderate         | No                | High             | 0                 |
| 1456       | Pope John Paul II Academy (Lower Mills)                   | Schools     | Moderate         | No                | High             | 0                 |
| 1457       | Pope John Paul II Academy (Mattapan)                      | Schools     | Moderate         | No                | High             | 0                 |
| 1458       | Pope John Paul II Academy (Neponset)                      | Schools     | Moderate         | No                | High             | 0                 |
| 1459       | Mt St Joseph Academy                                      | Schools     | Low              | No                | High             | 0                 |
| 1460       | St Brigid Elementary                                      | Schools     | Moderate         | No                | Low              | 0                 |
| 1461       | St Kevin Elementary                                       | Schools     | Moderate         | No                | Low              | 0                 |
| 1462       | St Peter Elementary                                       | Schools     | Moderate         | No                | Low              | 0                 |
| 1463       | Commonwealth  | Schools     | Moderate         | No                | Low              | 2                 |
| 1464       | The Learning Project                                      | Schools     | Moderate         | No                | Low              | 2                 |
| 1465       | Newman School   | Schools     | Moderate         | No                | Low              | 2                 |
| 1466       | E Boston Central Catholic                                 | Schools     | Moderate         | No                | Low              | 2                 |
| 1467       | Neighborhood School                                       | Schools     | Moderate         | No                | High             | 0                 |



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|------------|--|-------------|------------------|-------------------|------------------|-------------------|
| 1468       | Our Lady Of Lourdes                            | Schools     | Moderate         | No                | High             | 0                 |
| 1469       | St Mary Of Czestochowa                         | Schools     | Moderate         | No                | Low              | 4                 |
| 1470       | Paige Academy                                  | Schools     | Moderate         | No                | Low              | 0                 |
| 1471       | Nativity Prep School                           | Schools     | Moderate         | No                | High             | 0                 |
| 1472       | O L Perpetual Help Elem                        | Schools     | Moderate         | No                | Low              | 0                 |
| 1473       | Sacred Heart Elementary                        | Schools     | Low              | No                | High             | 0                 |
| 1474       | Gate Of Heaven Elementary                      | Schools     | Moderate         | No                | Low              | 0                 |
| 1475       | St Columbkille Elem                            | Schools     | Low              | No                | High             | 0                 |
| 1476       | Catholic Memorial                              | Schools     | Low              | No                | High             | 0                 |
| 1477       | Roxbury Latin                                  | Schools     | Low              | No                | High             | 0                 |
| 1478       | Mother Caroline Academy                        | Schools     | Moderate         | No                | High             | 0                 |
| 1479       | Hollow Reed School                             | Schools     | Moderate         | No                | High             | 0                 |
| 1480       | Italian Home For Children                      | Schools     | Low              | No                | High             | 0                 |
| 1481       | Parkside Christian                             | Schools     | Moderate         | No                | High             | 0                 |
| 1482       | New Beginnings Academy                         | Schools     | Low              | No                | High             | 0                 |
| 1483       | Dr. Solomon Carter Fuller                      | Schools     | Moderate         | No                | Low              | 4                 |
| 1484       | Kennedy Hope Academy                           | Schools     | Low              | No                | Low              | 0                 |
| 1485       | Park Street School                             | Schools     | Moderate         | No                | Low              | 2                 |
| 1486       | Manville School                                | Schools     | Moderate         | No                | Low              | 0                 |
| 1487       | Blessed Mother Teresa School                   | Schools     | Moderate         | No                | Low              | 0                 |
| 1488       | Shaloh House Day                               | Schools     | Low              | No                | High             | 0                 |
| 1489       | Holy Name Elementary                           | Schools     | Low              | No                | High             | 0                 |
| 1490       | St Anne Elementary                             | Schools     | Low              | No                | High             | 0                 |
| 1491       | St Theresa Elementary                          | Schools     | Low              | No                | High             | 0                 |
| 1492       | Pope John Paul II Academy (Dorchester Central) | Schools     | Moderate         | No                | High             | 0                 |
| 1493       | St Brendan Elementary                          | Schools     | Moderate         | No                | High             | 0                 |
| 1494       | Cathedral Elementary                           | Schools     | Moderate         | No                | Low              | 2                 |
| 1495       | St Peter Academy                               | Schools     | Moderate         | No                | Low              | 0                 |
| 1496       | Seaport Campus School                          | Schools     | Moderate         | No                | Low              | 2                 |

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|------------|---|-------------|------------------|-----------------------|------------------|-------------------|
| 1497       | Epiphany School                                 | Schools     | Moderate         | No                    | High             | 0                 |
| 1498       | The Kingsley                                    | Schools     | Moderate         | No                    | Low              | 2                 |
| 1499       | The Winsor                                      | Schools     | Moderate         | No                    | Low              | 0                 |
| 1500       | Boston University Academy                       | Schools     | Moderate         | No                    | Low              | 0                 |
| 1501       | Kennedy Day School                              | Schools     | Low              | No                    | Low              | 0                 |
| 1502       | Boston College High                             | Schools     | Moderate         | No                    | Low              | 0                 |
| 1503       | Boston Trinity Academy                          | Schools     | Low              | No                    | High             | 0                 |
| 1504       | German International School Boston              | Schools     | Low              | No                    | High             | 0                 |
| 1505       | Pope John Paul II Academy (Columbia Road)       | Schools     | Moderate         | No                    | Low              | 0                 |
| 1506       | St Matthew Elementary                           | Schools     | Moderate         | No                    | High             | 0                 |
| 1507       | The Knight Children's Center                    | Schools     | Moderate         | No                    | High             | 0                 |
| 1508       | Children's Learning Ctr                         | Schools     | Low              | No                    | High             | 0                 |
| 1509       | Boston Collegiate Charter School (Lower School) | Schools     | Moderate         | No                    | Low              | 2                 |
| 1510       | MATCH Charter Public Middle School              | Schools     | Moderate         | No                    | High             | 0                 |
| 1511       | BOSTON RENAISSANCE CHARTER SCHOOL               | Schools     | Low              | 0.2 PCT ANNUAL CHANCE | High             | 0                 |
| 1512       | ROXBURY CHARTER HIGH PUBLIC SCHOOL              | Schools     | Moderate         | No                    | Low              | 0                 |
| 1513       | EGLESTON COMM HIGH SCHOOL                       | Schools     | Moderate         | No                    | High             | 0                 |
| 1514       | UPHAMS CORNER CHARTER SCHOOL                    | Schools     | Moderate         | No                    | Low              | 4                 |
| 1515       | COMMUNITY ACADEMY                               | Schools     | Moderate         | No                    | Low              | 2                 |
| 1516       | SAVIO PREPARATORY HIGH SCHOOL                   | Schools     | Moderate         | No                    | Low              | 0                 |
| 1517       | OUR LADY OF THE PRESENTATION                    | Schools     | Low              | No                    | High             | 0                 |
| 1518       | ST MARY STAR-SEA ELEM SCHOOL                    | Schools     | Moderate         | No                    | Low              | 0                 |
| 1519       | ST PATRICK SCHOOL                               | Schools     | Moderate         | No                    | Low              | 0                 |
| 1520       | HOLDEN SCHOOL, INC                              | Schools     | Moderate         | No                    | Low              | 0                 |
| 1521       | MESIVTA HIGH SCHOOL OF GREATER                  | Schools     | Low              | No                    | High             | 0                 |
| 1522       | COPPER BEECH MONTESSORI SCHOOL                  | Schools     | Moderate         | No                    | High             | 0                 |
| 1523       | COMPASS INC                                     | Schools     | Moderate         | No                    | High             | 0                 |

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| 1524       | JOHN WINTHROP SCHOOL                 | Schools               | Moderate         | No                    | Low              | 2                 |
| 1525       | City On A Hill Charter Public School | Schools               | Moderate         | No                    | Low              | 0                 |
| 1526       | COUNSELING AND INTERVENTION CENTER   | Emergency Site        | Low              | No                    | High             | 0                 |
| 1527       | West Street Substation               | Power Substation      | Moderate         | No                    | Low              | 0                 |
| 1528       | Alford Street Substation             | Power Substation      | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 4                 |
| 1529       | Sullivan Square Pump Station         | Water Pumping Station | Moderate         | No                    | Low              | 2                 |
| 1530       | Sullivan Square Pump Station         | Water Pumping Station | Moderate         | No                    | Low              | 2                 |
| 1531       | Unknown                              | Sewer Pumping Station | Moderate         | No                    | Low              | 3                 |
| 1532       | Austin Street Pumping Station        | Water Pumping Station | Moderate         | No                    | Low              | 0                 |
| 1533       | Storrow Drive Pumping Station        | Water Pumping Station | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 1                 |
| 1534       | Storrow Drive Pumping Station        | Water Pumping Station | Moderate         | No                    | Low              | 1                 |
| 1535       | Congress Street Pumping Station      | Water Pumping Station | Moderate         | No                    | Low              | 2                 |
| 1536       | Kneeland Street Pumping Station      | Water Pumping Station | Moderate         | No                    | Low              | 2                 |
| 1537       | Northern Pumping Station             | Sewer Pumping Station | Moderate         | No                    | Low              | 2                 |
| 1538       | Private Pumping Station              | Sewer Pumping Station | Moderate         | AE                    | Low              | 1                 |
| 1539       | Commonwealth Avenue Pumping Station  | Water Pumping Station | Moderate         | No                    | Low              | 2                 |
| 1540       | MBTA Pumping Station                 | Water Pumping Station | Moderate         | No                    | Low              | 2                 |
| 1541       | Pump Station #7                      | Water Pumping Station | Moderate         | No                    | Low              | 2                 |
| 1542       | Trilling Pumping Station             | Sewer Pumping Station | Moderate         | No                    | Low              | 1                 |
| 1543       | Northern Pumping Station             | Water Pumping Station | Moderate         | No                    | Low              | 1                 |
| 1544       | Summer Street Pumping Station        | Sewer Pumping Station | Moderate         | No                    | Low              | 2                 |
| 1545       | Park Drive Pumping Station           | Water Pumping Station | Moderate         | AE                    | Low              | 2                 |
| 1546       | Symphony Hall Pumping Station        | Water Pumping Station | Moderate         | No                    | Low              | 4                 |
| 1547       | Public Alley 710 Pumping Station     | Sewer Pumping Station | Moderate         | No                    | Low              | 2                 |
| 1548       | Union Park Pumping Station           | Sewer Pumping Station | Moderate         | No                    | Low              | 2                 |

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|------------|-------------------------------------|--------------------------|------------------|-------------------|------------------|-------------------|
| 1549       | Union Park Pumping Station          | Water Pumping Station    | Moderate         | No                | Low              | 1                 |
| 1550       | Ward Street Pumping Station         | Sewer Pumping Station    | Moderate         | No                | Low              | 0                 |
| 1551       | MBTA Pumping Station                | Water Pumping Station    | Moderate         | No                | Low              | 0                 |
| 1552       | Columbus Park Pumping Station       | Sewer Pumping Station    | Moderate         | No                | Low              | 4                 |
| 1553       | Knotting Hill Pumping Station Water | Sewer Pumping Station    | Low              | No                | High             | 0                 |
| 1554       | Port Norfolk Pumping Station        | Sewer Pumping Station    | Moderate         | No                | High             | 0                 |
| 1555       | Unknown                             | Sewer Pumping Station    | Low              | No                | High             | 0                 |
| 1556       | Deer Island Treatment Plant         | Water Treatment Facility | Moderate         | No                | Low              | 0                 |
| 1557       | Constitution Beach CSO              | Sewer Pumping Station    | Moderate         | No                | Low              | 2                 |
| 1558       | Fox Point CSO Facility              | Sewer Pumping Station    | Moderate         | No                | Low              | 4                 |
| 1559       | Commercial Point CSO Facility       | Sewer Pumping Station    | Moderate         | No                | High             | 4                 |
| 1560       | Fox Point CSO Facility              | Sewer Pumping Station    | Moderate         | No                | High             | 2                 |
| 1561       | Caruso Pumping Station              | Sewer Pumping Station    | Moderate         | No                | Low              | 4                 |
| 1562       | MWRA Water Meter #81                | Water Meter              | Low              | No                | High             | 2                 |
| 1563       | MWRA Water Meter #81                | Water Meter              | Low              | No                | High             | 2                 |
| 1564       | Prescott Street Substation          | Power Substation         | Moderate         | No                | Low              | 1                 |
| 1565       | Salem Street Substation             | Power Substation         | Moderate         | No                | Low              | 0                 |
| 1566       | William C. Kelly Square Substation  | Power Substation         | Moderate         | No                | Low              | 1                 |
| 1567       | Salem Street Substation             | Power Substation         | Moderate         | No                | Low              | 0                 |
| 1568       | Hawkins Street Substation           | Power Substation         | Moderate         | No                | Low              | 0                 |
| 1569       | Chatham Street Substation           | Power Substation         | Moderate         | No                | Low              | 2                 |
| 1570       | High Street Substation              | Power Substation         | Moderate         | No                | Low              | 0                 |
| 1571       | High Street Substation              | Power Substation         | Moderate         | No                | Low              | 0                 |
| 1572       | Congress Street Substation          | Power Substation         | Moderate         | No                | Low              | 1                 |
| 1573       | Warrenton Street Substation         | Power Substation         | Moderate         | No                | Low              | 0                 |
| 1574       | Lincoln Street Substation           | Power Substation         | Low              | No                | Low              | 0                 |
| 1575       | Lincoln Street Substation           | Power Substation         | Low              | No                | Low              | 0                 |
| 1576       | Commonwealth Avenue Substation      | Power Substation         | Low              | No                | Low              | 0                 |
| 1577       | Linden Street Substation            | Power Substation         | Low              | No                | Low              | 0                 |

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| 1578       | Chestnut Hill Avenue Substation    | Power Substation | Low              | No                | High             | 0                 |
| 1579       | Unknown                            | Power Substation | Moderate         | No                | Low              | 2                 |
| 1583       | Scotia Street Substation           | Power Substation | Moderate         | No                | Low              | 0                 |
| 1584       | Saint Juan Street Substation       | Power Substation | Moderate         | No                | Low              | 2                 |
| 1585       | Dorchester Avenue Substation       | Power Substation | Moderate         | No                | Low              | 2                 |
| 1586       | Southampton Street Substation      | Power Substation | Moderate         | No                | Low              | 2                 |
| 1587       | Cottrell Street Substation         | Power Substation | Moderate         | No                | Low              | 2                 |
| 1588       | Tremont Street Substation          | Power Substation | Moderate         | No                | Low              | 0                 |
| 1589       | Amory Street Substation            | Power Substation | Moderate         | No                | Low              | 0                 |
| 1590       | Hoyt Street Substation             | Power Substation | Moderate         | No                | Low              | 4                 |
| 1591       | Dewar Street Substation            | Power Substation | Moderate         | No                | Low              | 4                 |
| 1592       | Humbolt Street Substation          | Power Substation | Moderate         | No                | High             | 0                 |
| 1593       | Washington Street Substation       | Power Substation | Moderate         | No                | High             | 0                 |
| 1594       | Charles River Dam New              | Dam              | No               | AE                | High             | 0                 |
| 1595       | Charles River Dam Old              | Dam              | No               | AE                | High             | 0                 |
| 1596       | Chestnut Hill Reservoir Dam        | Dam              | Low              | No                | High             | 0                 |
| 1597       | Westinghouse Dam                   | Dam              | No               | AE                | High             | 0                 |
| 1598       | Southwest Campus Dam               | Dam              | No               | AE                | High             | 0                 |
| 1599       | Tileston & Hollingsworth Dam       | Dam              | Low              | AE                | High             | 0                 |
| 1600       | Neponset River Baker Chocolate Dam | Dam              | No               | AE                | High             | 0                 |
| 1601       | Bridge - MERIDIAN ST               | Bridge           | Moderate         | AE                | Low              | 0                 |
| 1602       | FiberTower Network Services Corp.  | Microwave Towers | Low              | No                | High             | 0                 |
| 1603       | FiberTower Network Services Corp.  | Microwave Towers | Low              | No                | High             | 0                 |
| 1604       | FiberTower Network Services Corp.  | Microwave Towers | Low              | No                | High             | 0                 |
| 1605       | FiberTower Network Services Corp.  | Microwave Towers | Low              | No                | High             | 0                 |
| 1606       | FiberTower Network Services Corp.  | Microwave Towers | Low              | No                | High             | 0                 |
| 1607       | FiberTower Network Services Corp.  | Microwave Towers | Low              | No                | High             | 0                 |
| 1608       | New Cingular Wireless PCS, LLC     | Microwave Towers | Moderate         | No                | High             | 0                 |
| 1609       | New Cingular Wireless PCS, LLC     | Microwave Towers | Moderate         | No                | High             | 0                 |

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|------------|---|------------------|------------------|-------------------|------------------|-------------------|
| 1610       | CELLCO PARTNERSHIP                      | Microwave Towers | Low              | No                | High             | 0                 |
| 1611       | Cellco Partnership                      | Microwave Towers | Low              | No                | High             | 0                 |
| 1612       | CELLCO PARTNERSHIP                      | Microwave Towers | Low              | No                | High             | 0                 |
| 1613       | Cellco Partnership                      | Microwave Towers | Low              | No                | High             | 0                 |
| 1614       | Cellco Partnership                      | Microwave Towers | Low              | No                | High             | 0                 |
| 1615       | Cellco Partnership                      | Microwave Towers | Low              | No                | High             | 0                 |
| 1616       | Cellco Partnership                      | Microwave Towers | Low              | No                | High             | 0                 |
| 1617       | CELLCO PARTNERSHIP                      | Microwave Towers | Low              | No                | High             | 0                 |
| 1618       | CELLCO PARTNERSHIP                      | Microwave Towers | Low              | No                | High             | 0                 |
| 1619       | CELLCO PARTNERSHIP                      | Microwave Towers | Low              | No                | High             | 0                 |
| 1620       | Cellco Partnership                      | Microwave Towers | Low              | No                | High             | 0                 |
| 1621       | Cellco Partnership                      | Microwave Towers | Low              | No                | High             | 0                 |
| 1622       | CELLCO PARTNERSHIP                      | Microwave Towers | Low              | No                | High             | 0                 |
| 1623       | Cellco Partnership                      | Microwave Towers | Low              | No                | High             | 0                 |
| 1624       | CELLCO PARTNERSHIP                      | Microwave Towers | Low              | No                | High             | 0                 |
| 1625       | Cellco Partnership                      | Microwave Towers | Low              | No                | High             | 0                 |
| 1626       | New Cingular Wireless PCS, LLC          | Microwave Towers | Low              | No                | High             | 0                 |
| 1627       | New Cingular Wireless PCS, LLC          | Microwave Towers | Low              | No                | High             | 0                 |
| 1628       | MASSACHUSETTS WATER RESOURCES AUTHORITY | Microwave Towers | Low              | No                | High             | 0                 |
| 1629       | MASSACHUSETTS WATER RESOURCES AUTHORITY | Microwave Towers | Low              | No                | High             | 0                 |
| 1630       | MASSACHUSETTS WATER RESOURCES AUTHORITY | Microwave Towers | Low              | No                | High             | 0                 |
| 1631       | Massachusetts Water Resources Authority | Microwave Towers | Low              | No                | High             | 0                 |
| 1632       | Massachusetts Water Resources Authority | Microwave Towers | Low              | No                | High             | 0                 |
| 1633       | Massachusetts Water Resources Authority | Microwave Towers | Low              | No                | High             | 0                 |
| 1634       | Massachusetts Water Resources Authority | Microwave Towers | Low              | No                | High             | 0                 |
| 1635       | MASSACHUSETTS WATER RESOURCES AUTHORITY | Microwave Towers | Low              | No                | High             | 0                 |
| 1636       | MASSACHUSETTS WATER RESOURCES AUTHORITY | Microwave Towers | Low              | No                | High             | 0                 |
| 1637       | New Cingular Wireless PCS, LLC          | Microwave Towers | Moderate         | No                | High             | 0                 |
| 1638       | New Cingular Wireless PCS, LLC          | Microwave Towers | Moderate         | No                | High             | 0                 |

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| <b>ID#</b> | <b>NAME</b>                       | <b>TYPE</b>      | <b>LANDSLIDE</b> | <b>FLOOD ZONE</b> | <b>SNOW FALL</b> | <b>HURR SURGE</b> |
|------------|-----------------------------------|------------------|------------------|-------------------|------------------|-------------------|
| 1639       | New Cingular Wireless PCS, LLC    | Microwave Towers | Low              | No                | High             | 0                 |
| 1640       | New Cingular Wireless PCS, LLC    | Microwave Towers | Low              | No                | High             | 0                 |
| 1641       | METROPOLITAN AREA NETWORKS, INC   | Microwave Towers | Low              | No                | High             | 0                 |
| 1642       | METROPOLITAN AREA NETWORKS, INC   | Microwave Towers | Low              | No                | High             | 0                 |
| 1643       | NSTAR Electric Company            | Microwave Towers | Low              | No                | High             | 0                 |
| 1644       | NSTAR Electric Company            | Microwave Towers | Low              | No                | High             | 0                 |
| 1645       | Boston, City of                   | Microwave Towers | Moderate         | No                | High             | 0                 |
| 1646       | Boston, City of                   | Microwave Towers | Moderate         | No                | High             | 0                 |
| 1647       | FiberTower Network Services Corp. | Microwave Towers | Moderate         | No                | High             | 0                 |
| 1648       | FiberTower Network Services Corp. | Microwave Towers | Moderate         | No                | High             | 0                 |
| 1649       | FiberTower Network Services Corp. | Microwave Towers | Moderate         | No                | High             | 2                 |
| 1650       | FiberTower Network Services Corp. | Microwave Towers | Moderate         | No                | High             | 2                 |
| 1651       | New Cingular Wireless PCS, LLC    | Microwave Towers | Moderate         | AE                | High             | 2                 |
| 1652       | New Cingular Wireless PCS, LLC    | Microwave Towers | Moderate         | AE                | High             | 2                 |
| 1653       | Partners HealthCare               | Microwave Towers | Low              | No                | High             | 0                 |
| 1654       | Partners HealthCare               | Microwave Towers | Low              | No                | High             | 0                 |
| 1655       | New Cingular Wireless PCS, LLC    | Microwave Towers | Low              | No                | High             | 0                 |
| 1656       | New Cingular Wireless PCS, LLC    | Microwave Towers | Low              | No                | High             | 0                 |
| 1657       | NEXTLINK WIRELESS INC.            | Microwave Towers | Moderate         | No                | High             | 0                 |
| 1658       | NEXTLINK WIRELESS INC.            | Microwave Towers | Moderate         | No                | High             | 0                 |
| 1659       | FiberTower Network Services Corp. | Microwave Towers | Moderate         | No                | High             | 0                 |
| 1660       | FiberTower Network Services Corp. | Microwave Towers | Moderate         | No                | High             | 0                 |
| 1661       | New Cingular Wireless PCS, LLC    | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1662       | New Cingular Wireless PCS, LLC    | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1663       | New Cingular Wireless PCS, LLC    | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1664       | New Cingular Wireless PCS, LLC    | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1665       | FiberTower Network Services Corp. | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1666       | FiberTower Network Services Corp. | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1667       | FiberTower Network Services Corp. | Microwave Towers | Moderate         | No                | Low              | 4                 |

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|------------|---|------------------|------------------|-------------------|------------------|-------------------|
| 1668       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1669       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1670       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1671       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1672       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1673       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1674       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1675       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1676       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1677       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1678       | Cellco Partnership                            | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1679       | CELLCO PARTNERSHIP                            | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1680       | CELLCO PARTNERSHIP                            | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1681       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1682       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1683       | Cellco Partnership                            | Microwave Towers | Moderate         | No                | High             | 0                 |
| 1684       | Cellco Partnership                            | Microwave Towers | Moderate         | No                | High             | 0                 |
| 1685       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | High             | 0                 |
| 1686       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | High             | 0                 |
| 1687       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | High             | 0                 |
| 1688       | Boston, City of                               | Microwave Towers | Moderate         | No                | High             | 0                 |
| 1689       | Boston, City of                               | Microwave Towers | Moderate         | No                | High             | 0                 |
| 1690       | Boston, City of                               | Microwave Towers | Moderate         | No                | High             | 0                 |
| 1691       | Boston, City of                               | Microwave Towers | Moderate         | No                | High             | 0                 |
| 1692       | UNIVERSITY OF MASSACHUSETTS                   | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1693       | UNIVERSITY OF MASSACHUSETTS                   | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1694       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1695       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1696       | WHDH-TV                                       | Microwave Towers | Moderate         | No                | Low              | 2                 |



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|------------|---|------------------|------------------|-------------------|------------------|-------------------|
| 1697       | GREATER BOSTON RADIO INC                      | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1698       | NASSAU BROADCASTING II, L.L.C.                | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1699       | Greater Boston Radio, Inc.                    | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1700       | GREATER BOSTON RADIO, INC.                    | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1701       | GREATER BOSTON RADIO, INC.                    | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1702       | GREATER BOSTON RADIO, INC.                    | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1703       | GREATER BOSTON RADIO, INC.                    | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1704       | GREATER BOSTON RADIO, INC.                    | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1705       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1706       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1707       | Bank of America N.A.                          | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1708       | Bank of America N.A.                          | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1709       | ART Licensing Corp.                           | Microwave Towers | Moderate         | No                | High             | 0                 |
| 1710       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | High             | 0                 |
| 1711       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | High             | 0                 |
| 1712       | NSTAR Electric Company                        | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1713       | NSTAR Electric Company                        | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1714       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1715       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1716       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1717       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1718       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1719       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1720       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1721       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1722       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1723       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1724       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1725       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 0                 |

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| <b>ID#</b> | <b>NAME</b>                                   | <b>TYPE</b>      | <b>LANDSLIDE</b> | <b>FLOOD ZONE</b> | <b>SNOW FALL</b> | <b>HURR SURGE</b> |
|------------|---|------------------|------------------|-------------------|------------------|-------------------|
| 1726       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1727       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1728       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1729       | New England Baptist Hspital                   | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1730       | New England Baptist Hospital                  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1731       | MASSACHUSETTS WATER RESOURCES AUTHORITY       | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1732       | MASSACHUSETTS WATER RESOURCES AUTHORITY       | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1733       | MASSACHUSETTS WATER RESOURCES AUTHORITY       | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1734       | Massachusetts Water Resources Authority       | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1735       | CUENCA, PETER N                               | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1736       | MASSACHUSETTS WATER RESOURCES AUTHORITY       | Microwave Towers | Low              | No                | High             | 0                 |
| 1737       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1738       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1739       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1740       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1741       | FIBERTOWER NETWORK SERVICES CORP.             | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1742       | Harvard University                            | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1743       | Harvard University                            | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1744       | Broadband 2 Wireless                          | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1745       | MVA.NET LTD                                   | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1746       | MVA.NET LTD                                   | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1747       | Partners Healthcare                           | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1748       | Partners Healthcare                           | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1749       | Boston, City of                               | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1750       | Boston, City of                               | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1751       | Boston, City of                               | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1752       | Boston, City of                               | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1753       | Boston, City of                               | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1754       | Boston, City of                               | Microwave Towers | Moderate         | No                | Low              | 2                 |

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|------------|---|------------------|------------------|-------------------|------------------|-------------------|
| 1755       | NSTAR Electric Company                        | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1756       | NSTAR Electric Company                        | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1757       | Boston, City of                               | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1758       | Boston, City of                               | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1759       | PRESIDENT AND FELLOWS OF HARVARD COLLEGE      | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1760       | PRESIDENT AND FELLOWS OF HARVARD COLLEGE      | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1761       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1762       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1763       | New England Baptist Hspital                   | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1764       | New England Baptist Hospital                  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1765       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1766       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1767       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1768       | Partners Healthcare                           | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1769       | Partners Healthcare                           | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1770       | Partners HealthCare                           | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1771       | Partners HealthCare Systems, Inc.             | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1772       | Partners HealthCare Systems, Inc.             | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1773       | Partners HealthCare Systems, Inc.             | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1774       | Partners HealthCare Systems, Inc.             | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1775       | Partners HealthCare                           | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1776       | Partners HealthCare                           | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1777       | Partners Healthcare                           | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1778       | Partners Healthcare                           | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1779       | Harvard University                            | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1780       | Harvard University                            | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1781       | MASSACHUSETTS WATER RESOURCES AUTHORITY       | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1782       | MASSACHUSETTS WATER RESOURCES AUTHORITY       | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1783       | Partners HealthCare                           | Microwave Towers | Moderate         | No                | Low              | 0                 |

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|------------|--------------------------------|------------------|------------------|-----------------------|------------------|-------------------|
| 1784       | Partners HealthCare            | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 1785       | Partners Healthcare            | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 1786       | Partners Healthcare            | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 1787       | Partners Healthcare            | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 1788       | Partners HealthCare            | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 1789       | Partners Healthcare            | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 1790       | Partners Heathcare             | Microwave Towers | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 0                 |
| 1791       | Partners Healthcare            | Microwave Towers | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 0                 |
| 1792       | Partners HealthCare            | Microwave Towers | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 0                 |
| 1793       | Partners HealthCare            | Microwave Towers | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 0                 |
| 1794       | Partners Healthcare            | Microwave Towers | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 0                 |
| 1795       | DANA FARBER CANCER INSTITUTE   | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 1796       | DANA FARBER CANCER INSTITUTE   | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 1797       | BOSTON UNIVERSITY              | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 1798       | BOSTON UNIVERSITY              | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 1799       | New Cingular Wireless PCS, LLC | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 1800       | New Cingular Wireless PCS, LLC | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 1801       | New Cingular Wireless PCS, LLC | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 1802       | Boston, City of                | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 1803       | Boston, City of                | Microwave Towers | Moderate         | No                    | Low              | 2                 |

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|------------|---|------------------|------------------|-----------------------|------------------|-------------------|
| 1804       | Harvard Medical School                        | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 1805       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 1806       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 1807       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 1808       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 1809       | FiberTower Network Services Corp.             | Microwave Towers | Low              | No                    | High             | 0                 |
| 1810       | FiberTower Network Services Corp.             | Microwave Towers | Low              | No                    | High             | 0                 |
| 1811       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 1812       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 1813       | MASSACHUSETTS PORT AUTHORITY                  | Microwave Towers | Moderate         | AE                    | Low              | 2                 |
| 1814       | MASSACHUSETTS PORT AUTHORITY                  | Microwave Towers | Moderate         | AE                    | Low              | 2                 |
| 1815       | NSTAR Electric Company                        | Microwave Towers | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 4                 |
| 1816       | NSTAR Electric Company                        | Microwave Towers | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 4                 |
| 1817       | NSTAR Electric Company                        | Microwave Towers | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 4                 |
| 1818       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 1819       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 1820       | MASSACHUSETTS PORT AUTHORITY                  | Microwave Towers | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 2                 |
| 1821       | MASSACHUSETTS PORT AUTHORITY                  | Microwave Towers | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 2                 |
| 1822       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                    | Low              | 2                 |

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|------------|---------------------------------------|------------------|------------------|-------------------|------------------|-------------------|
| 1823       | FiberTower Network Services Corp.     | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1824       | FiberTower Network Services Corp.     | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1825       | FiberTower Network Services Corp.     | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1826       | BOSTON CATHOLIC TELEVISION CENTER INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1827       | BOSTON CATHOLIC TELEVISION CENTER INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1828       | MASSACHUSETTS PORT AUTHORITY          | Microwave Towers | Moderate         | AE                | Low              | 2                 |
| 1829       | MASSACHUSETTS PORT AUTHORITY          | Microwave Towers | Moderate         | AE                | Low              | 2                 |
| 1830       | MASSACHUSETTS PORT AUTHORITY          | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1831       | MASSACHUSETTS PORT AUTHORITY          | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1832       | FiberTower Network Services Corp.     | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1833       | FiberTower Network Services Corp.     | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1834       | FIBERTOWER NETWORK SERVICES CORP.     | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1835       | Cellco Partnership                    | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1836       | CELLCO PARTNERSHIP                    | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1837       | MASSACHUSETTS PORT AUTHORITY          | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1838       | MASSACHUSETTS PORT AUTHORITY          | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1839       | MASSACHUSETTS PORT AUTHORITY          | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1840       | MASSACHUSETTS PORT AUTHORITY          | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1841       | MASSACHUSETTS PORT AUTHORITY          | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1842       | MASSACHUSETTS PORT AUTHORITY          | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1843       | MASSACHUSETTS PORT AUTHORITY          | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1844       | MASSACHUSETTS PORT AUTHORITY          | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1845       | MASSACHUSETTS PORT AUTHORITY          | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1846       | MASSACHUSETTS PORT AUTHORITY          | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1847       | Broadband 2 Wireless                  | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1848       | Broadband 2 Wireless                  | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1849       | Partners Healthcare                   | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1850       | Partners HealthCare                   | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1851       | Partners Healthcare                   | Microwave Towers | Moderate         | No                | Low              | 2                 |

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| <b>ID#</b> | <b>NAME</b>                                   | <b>TYPE</b>      | <b>LANDSLIDE</b> | <b>FLOOD ZONE</b> | <b>SNOW FALL</b> | <b>HURR SURGE</b> |
|------------|---|------------------|------------------|-------------------|------------------|-------------------|
| 1852       | Partners Healthcare                           | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1853       | Harvard Medical School                        | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1854       | TowerStream Corp                              | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1855       | Towerstream Corp                              | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1856       | MUZAK LLC                                     | Microwave Towers | Low              | A                 | High             | 0                 |
| 1857       | Partners Healthcare Systems, Inc.             | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1858       | Partners Healthcare Systems, Inc.             | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1859       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1860       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1861       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1862       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1863       | Cellco Partnership                            | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1864       | Cellco Partnership                            | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1865       | Partners Heathcare                            | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1866       | Partners Healthcare                           | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1867       | Partners Healthcare Systems, Inc.             | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1868       | Partners Healthcare Systems, Inc.             | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1869       | Partners Healthcare                           | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1870       | Partners Healthcare                           | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1871       | Partners HealthCare Systems, Inc.             | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1872       | Partners HealthCare Systems, Inc.             | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1873       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1874       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1875       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1876       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1877       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1878       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1879       | Broadband 2 Wireless                          | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1880       | Industrial Tower and Wireless, LLC.           | Microwave Towers | Moderate         | No                | Low              | 2                 |

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|------------|---|------------------|------------------|-------------------|------------------|-------------------|
| 1881       | Industrial Tower and Wireless, LLC.           | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1882       | Industrial Tower and Wireless, LLC.           | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1883       | Industrial Tower and Wireless, LLC.           | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1884       | ZGS BOSTON, INC.                              | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 1885       | Partners HealthCare                           | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1886       | Partners HealthCare                           | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1887       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1888       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1889       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1890       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1891       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1892       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1893       | Cellco Partnership                            | Microwave Towers | Low              | No                | Low              | 0                 |
| 1894       | CELLCO PARTNERSHIP                            | Microwave Towers | Low              | No                | Low              | 0                 |
| 1895       | Cello Partnership                             | Microwave Towers | Low              | No                | Low              | 0                 |
| 1896       | WGBH EDUCATIONAL FOUNDATION                   | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1897       | WGBH EDUCATIONAL FOUNDATION                   | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1898       | NSTAR Electric Company                        | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1899       | NSTAR Electric Company                        | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1900       | NSTAR Electric Company                        | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1901       | NSTAR Electric Company                        | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1902       | NSTAR Electric Company                        | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1903       | NSTAR Electric Company                        | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1904       | NSTAR Electric Company                        | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1905       | JCE LICENSES, L.L.C.                          | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1906       | BringCom Incorporated                         | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1907       | BringCom Incorporated                         | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1908       | BOSTON CATHOLIC TELEVISION CENTER INC         | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1909       | BOSTON CATHOLIC TELEVISION CENTER INC         | Microwave Towers | Moderate         | No                | Low              | 0                 |



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|------------|---|------------------|------------------|-------------------|------------------|-------------------|
| 1910       | BOSTON CATHOLIC TELEVISION CENTER INC                     | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1911       | BOSTON CATHOLIC TELEVISION CENTER, INC.                   | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1912       | BOSTON CATHOLIC TELEVISION CENTER, INC.                   | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1913       | BOSTON CATHOLIC TELEVISION CENTER, INC.                   | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1914       | GREATER BOSTON RADIO INC                                  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1915       | AMFM RADIO LICENSES, L.L.C.                               | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1916       | TowerStream Corp  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1917       | TowerStream Corp  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1918       | TowerStream Corp  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1919       | Towerstream Corp  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1920       | Commonwealth of Massachusetts, Department of State Police | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1921       | Commonwealth of Massachusetts, Department of State Police | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1922       | Boston, City of   | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1923       | Community WISP, Inc.                                      | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1924       | Community WISP, Inc.                                      | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1925       | NSTAR Electric Company                                    | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1926       | Towerstream Corp  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1927       | Towerstream Corp  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1928       | Towerstream Corp  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1929       | Greater Boston Radio, Inc.                                | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1930       | GREATER BOSTON RADIO, INC.                                | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1931       | Towerstream Corp  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1932       | Community WISP Inc  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1933       | Boston Properties Limited Partnership                     | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1934       | Boston Properties Limited Partnership                     | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1935       | Towerstream Corp  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1936       | Omega Communications Corporation                          | Microwave Towers | Moderate         | No                | Low              | 0                 |

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|------------|--|------------------|------------------|-------------------|------------------|-------------------|
| 1937       | Towerstream Corp                                     | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1938       | Towerstream Corp                                     | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1939       | GREATER BOSTON RADIO INC                             | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1940       | Towerstream Corp                                     | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1941       | BRICKYARD VFX, L.L.C.                                | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1942       | BRICKYARD VFX, L.L.C.                                | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1943       | GREATER BOSTON RADIO INC                             | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1944       | Towerstream Corp                                     | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1945       | Towerstream Corp                                     | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1946       | GREATER BOSTON RADIO, INC.                           | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1947       | GREATER BOSTON RADIO, INC.                           | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1948       | FiberTower Network Services Corp.                    | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1949       | FiberTower Network Services Corp.                    | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1950       | FiberTower Network Services Corp.                    | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1951       | Cellco Partnership                                   | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1952       | Cellco Partnership                                   | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1953       | CUENCA, PETER N                                      | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1954       | HEMISPHERE BROADCASTING CORPORATION                  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1955       | ENTRAVISION HOLDINGS, LLC                            | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1956       | WCVB HEARST-ARGYLE TV, INC.                          | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1957       | WCVB HEARST-ARGYLE TV, INC.                          | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1958       | ION MEDIA BOSTON LICENSE, INC., DEBTOR-IN-POSSESSION | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1959       | MUZAK LLC  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1960       | WHDH-TV  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1961       | WHDH-TV  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1962       | WCVB HEARST-ARGYLE TV, INC.                          | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1963       | WHDH-TV  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1964       | PRESIDENT AND FELLOWS OF HARVARD COLLEGE             | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1965       | WCVB HEARST-ARGYLE TV, INC.                          | Microwave Towers | Moderate         | No                | Low              | 0                 |

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|------------|--|------------------|------------------|-------------------|------------------|-------------------|
| 1966       | PRESIDENT AND FELLOWS OF HARVARD COLLEGE | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1967       | Cellco Partnership                       | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1968       | Cellco Partnership                       | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1969       | CELLCO PARTNERSHIP                       | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1970       | FiberTower Network Services Corp.        | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1971       | FiberTower Network Services Corp.        | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1972       | New Cingular Wireless PCS, LLC           | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1973       | New Cingular Wireless PCS, LLC           | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1974       | BRICKYARD VFX, L.L.C.                    | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1975       | BRICKYARD VFX, L.L.C.                    | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 1976       | AMFM RADIO LICENSES, L.L.C.              | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1977       | SPECIAL AGENT SYSTEMS, INC.              | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1978       | AlarmNet, Inc.                           | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1979       | Pipeline Wireless, LLC                   | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1980       | Pipeline Wireless, LLC                   | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1981       | Pipeline Wireless, LLC                   | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1982       | CBS CORPORATON                           | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1983       | CBS CORPORATON                           | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1984       | FiberTower Network Services Corp.        | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1985       | FiberTower Network Services Corp.        | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1986       | FiberTower Network Services Corp.        | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1987       | FiberTower Network Services Corp.        | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1988       | FiberTower Network Services Corp.        | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1989       | FiberTower Network Services Corp.        | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1990       | PIPELINE WIRELESS, LLC                   | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1991       | Pipeline Wireless, LLC                   | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1992       | FiberTower Network Services Corp.        | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1993       | FiberTower Network Services Corp.        | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1994       | FiberTower Network Services Corp.        | Microwave Towers | Moderate         | No                | Low              | 2                 |

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|------------|---|------------------|------------------|-------------------|------------------|-------------------|
| 1995       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1996       | PIPELINE WIRELESS, LLC                        | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1997       | Pipeline Wireless, LLC                        | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1998       | PIPELINE WIRELESS, LLC                        | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 1999       | Pipeline Wireless, LLC                        | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2000       | Pipeline Wireless, LLC                        | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2001       | FIBERTOWER NETWORK SERVICES CORP              | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2002       | Pipeline Wireless, LLC                        | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2003       | PIPELINE WIRELESS, LLC                        | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2004       | Pipeline Wireless, LLC                        | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2005       | PIPELINE WIRELESS, LLC                        | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2006       | SmartRoute Systems, Inc.                      | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2007       | BOSTON UNIVERSITY                             | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2008       | MVA.NET LTD                                   | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2009       | MVA.NET LTD                                   | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2010       | SmartRoute Systems, Inc.                      | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2011       | MASSACHUSETTS INSTITUTE OF TECHNOLOGY         | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2012       | MASSACHUSETTS INSTITUTE OF TECHNOLOGY         | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2013       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2014       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2015       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2016       | Emerson College                               | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2017       | Emerson College                               | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2018       | MASSACHUSETTS PORT AUTHORITY                  | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2019       | MASSACHUSETTS PORT AUTHORITY                  | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2020       | MASSACHUSETTS PORT AUTHORITY                  | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2021       | MASSACHUSETTS PORT AUTHORITY                  | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2022       | MASSACHUSETTS PORT AUTHORITY                  | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2023       | Boston Gas                                    | Microwave Towers | Moderate         | No                | Low              | 2                 |

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|------------|---|------------------|------------------|-------------------|------------------|-------------------|
| 2024       | Community WISP, Inc.                          | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2025       | Community WISP Inc                            | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2026       | MPX INC                                       | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 2027       | MPX INC                                       | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 2028       | BOSTON UNIVERSITY                             | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2029       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2030       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2031       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2032       | Tufts University                              | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2033       | Tufts University                              | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2034       | Grand Circle LLC                              | Microwave Towers | Moderate         | No                | Low              | 1                 |
| 2035       | Grand Circle LLC                              | Microwave Towers | Moderate         | No                | Low              | 1                 |
| 2036       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 1                 |
| 2037       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 1                 |
| 2038       | TRUSTEES OF BOSTON UNIVERSITY                 | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2039       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2040       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2041       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2042       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2043       | AT&T CORP.                                    | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2044       | AT&T CORP.                                    | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2045       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2046       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2047       | BOSTON UNIVERSITY                             | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2048       | BOSTON UNIVERSITY                             | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2049       | BOSTON UNIVERSITY                             | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2050       | BOSTON UNIVERSITY                             | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2051       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2052       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | Low              | 0                 |

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| <b>ID#</b> | <b>NAME</b>                                   | <b>TYPE</b>      | <b>LANDSLIDE</b> | <b>FLOOD ZONE</b> | <b>SNOW FALL</b> | <b>HURR SURGE</b> |
|------------|---|------------------|------------------|-------------------|------------------|-------------------|
| 2053       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2054       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2055       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2056       | BOSTON UNIVERSITY                             | Microwave Towers | No               | AE                | High             | 0                 |
| 2057       | MASSACHUSETTS, COMMONWEALTH OF                | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2058       | MASSACHUSETTS BAY TRANSPORTATION AUTHORITY    | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2059       | MASSACHUSETTS BAY TRANSPORTATION AUTHORITY    | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2060       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2061       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2062       | MASSACHUSETTS, COMMONWEALTH OF                | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2063       | MASSACHUSETTS, COMMONWEALTH OF                | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2064       | CELLCO PARTNERSHIP                            | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2065       | CELLCO PARTNERSHIP                            | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2066       | WATERTOWN, TOWN OF                            | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2067       | CELLCO PARTNERSHIP                            | Microwave Towers | Low              | No                | Low              | 0                 |
| 2068       | Cello Partnership                             | Microwave Towers | Low              | No                | Low              | 0                 |
| 2069       | BOSTON CATHOLIC TELEVISION CENTER INC         | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 2070       | NEXTLINK WIRELESS INC.                        | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2071       | NEXTLINK WIRELESS INC.                        | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2072       | MASSACHUSETTS WATER RESOURCES AUTHORITY       | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2073       | MASSACHUSETTS WATER RESOURCES AUTHORITY       | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2074       | MASSACHUSETTS WATER RESOURCES AUTHORITY       | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2075       | MASSACHUSETTS WATER RESOURCES AUTHORITY       | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2076       | Verizon New England, Inc.                     | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2077       | EMERSON COLLEGE                               | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2078       | EMERSON COLLEGE                               | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2079       | HARVARD RADIO BROADCASTING CO., INC.          | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2080       | HARVARD RADIO BROADCASTING CO., INC.          | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2081       | MCC BROADCASTING COMPANY, INC.                | Microwave Towers | Moderate         | No                | Low              | 0                 |

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|------------|-----------------------------------|------------------|------------------|-------------------|------------------|-------------------|
| 2082       | EMERSON COLLEGE                   | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2083       | EMERSON COLLEGE                   | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2084       | FiberTower Network Services Corp. | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2085       | FiberTower Network Services Corp. | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2086       | FiberTower Network Services Corp. | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2087       | FiberTower Network Services Corp. | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2088       | FiberTower Network Services Corp. | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2089       | FiberTower Network Services Corp. | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2090       | FiberTower Network Services Corp. | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2091       | FiberTower Network Services Corp. | Microwave Towers | Low              | No                | Low              | 0                 |
| 2092       | FiberTower Network Services Corp. | Microwave Towers | Low              | No                | Low              | 0                 |
| 2093       | Emerson College                   | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2094       | Emerson College                   | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2095       | NSTAR Electric Company            | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2096       | NSTAR Electric Company            | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2097       | New Cingular Wireless PCS, LLC    | Microwave Towers | Low              | No                | Low              | 0                 |
| 2098       | New Cingular Wireless PCS, LLC    | Microwave Towers | Low              | No                | Low              | 0                 |
| 2099       | New Cingular Wireless PCS, LLC    | Microwave Towers | Low              | No                | Low              | 0                 |
| 2100       | New Cingular Wireless PCS, LLC    | Microwave Towers | Low              | No                | Low              | 0                 |
| 2101       | New Cingular Wireless PCS, LLC    | Microwave Towers | Low              | No                | Low              | 0                 |
| 2102       | New Cingular Wireless PCS, LLC    | Microwave Towers | Low              | No                | Low              | 0                 |
| 2103       | BOSTON UNIVERSITY                 | Microwave Towers | Low              | No                | Low              | 0                 |
| 2104       | BOSTON UNIVERSITY                 | Microwave Towers | Low              | No                | Low              | 0                 |
| 2105       | MPX INC                           | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2106       | MPX INC                           | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2107       | ADT SECURITY SERVICES INC         | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2108       | Bank of America N.A.              | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2109       | Bank of America N.A.              | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2110       | Bank of America N.A.              | Microwave Towers | Moderate         | No                | Low              | 0                 |

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|------------|---|------------------|------------------|-----------------------|------------------|-------------------|
| 2111       | Massachusetts Water Resources Authority       | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 2112       | Massachusetts Water Resources Authority       | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 2113       | Massachusetts Water Resources Authority       | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 2114       | MASSACHUSETTS WATER RESOURCES AUTHORITY       | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 2115       | MASSPORT AUTHORITY                            | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 2116       | MASSPORT AUTHORITY                            | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 2117       | IDT Spectrum, LLC                             | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 2118       | IDT Spectrum, LLC                             | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 2119       | AlarmNet, Inc.                                | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 2120       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 2121       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 2122       | WCVB HEARST-ARGYLE TV, INC.                   | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 2123       | WCVB HEARST-ARGYLE TV, INC.                   | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 2124       | WCVB HEARST-ARGYLE TV, INC.                   | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 2125       | BOSTON, CITY OF                               | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 2126       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 2127       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 2128       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 2129       | WGBH EDUCATIONAL FOUNDATION                   | Microwave Towers | Low              | No                    | High             | 0                 |
| 2130       | WGBH EDUCATIONAL FOUNDATION                   | Microwave Towers | Low              | No                    | High             | 0                 |
| 2131       | WGBH EDUCATIONAL FOUNDATION                   | Microwave Towers | Low              | No                    | High             | 0                 |
| 2132       | WGBH EDUCATIONAL FOUNDATION                   | Microwave Towers | Low              | No                    | High             | 0                 |
| 2133       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 2134       | MASSPORT AUTHORITY                            | Microwave Towers | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 2                 |
| 2135       | MASSPORT AUTHORITY                            | Microwave Towers | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 2                 |



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|------------|-----------------------------|------------------|------------------|-------------------|------------------|-------------------|
| 2136       | AT&T CORP.                  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2137       | AT&T CORP.                  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2138       | Mount Auburn Hospital       | Microwave Towers | Low              | No                | High             | 0                 |
| 2139       | Mount Auburn Hospital       | Microwave Towers | Low              | No                | High             | 0                 |
| 2140       | Mount Auburn Hospital       | Microwave Towers | Low              | No                | High             | 0                 |
| 2141       | WGBH EDUCATIONAL FOUNDATION | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2142       | Broadband 2 Wireless        | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2143       | Broadband 2 Wireless        | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2144       | IDT Spectrum, LLC           | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2145       | IDT Spectrum, LLC           | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2146       | TowerStream Corp            | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2147       | Towerstream Corp            | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2148       | Towerstream Corp            | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2149       | Towerstream Corp            | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2150       | Pipeline Wireless, LLC      | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2151       | Pipeline Wireless, LLC      | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2152       | PIPELINE WIRELESS, LLC      | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2153       | AT&T CORP.                  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2154       | AT&T CORP.                  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2155       | AT&T CORP.                  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2156       | IDT Spectrum, LLC           | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 2157       | IDT Spectrum, LLC           | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 2158       | MVA.NET LTD                 | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2159       | MVA.NET LTD.                | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2160       | MVA.NET LTD                 | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2161       | MVA.NET LTD                 | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2162       | MVA.NET LTD                 | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2163       | AT&T CORP.                  | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 2164       | AT&T CORP.                  | Microwave Towers | Moderate         | No                | Low              | 4                 |

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|------------|--|------------------|------------------|-------------------|------------------|-------------------|
| 2165       | Omega Communications Corporation                     | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2166       | AT&T CORP.   | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2167       | AT&T CORP.   | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2168       | CBS CORPORATON                                       | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2169       | WCVB HEARST-ARGYLE TV, INC.                          | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2170       | WCVB HEARST-ARGYLE TV, INC.                          | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2171       | CBS CORPORATON                                       | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2172       | CBS CORPORATON                                       | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2173       |  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2174       | NEXTLINK WIRELESS INC.                               | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2175       | NEXTLINK WIRELESS INC.                               | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2176       | NEXTLINK WIRELESS INC.                               | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2177       | NEXTLINK WIRELESS INC.                               | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2178       | WHDH-TV  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2179       | WHDH-TV  | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2180       | ION MEDIA BOSTON LICENSE, INC., DEBTOR-IN-POSSESSION | Microwave Towers | Low              | No                | High             | 0                 |
| 2181       | CBS RADIO EAST INC.                                  | Microwave Towers | Low              | No                | High             | 0                 |
| 2182       | HEMISPHERE BROADCASTING CORPORATION                  | Microwave Towers | Low              | No                | High             | 0                 |
| 2183       | NSTAR Electric Company                               | Microwave Towers | Low              | No                | Low              | 0                 |
| 2184       | NSTAR Electric Company                               | Microwave Towers | Low              | No                | Low              | 0                 |
| 2185       | NSTAR Electric Company                               | Microwave Towers | Low              | No                | Low              | 0                 |
| 2186       | New Cingular Wireless PCS, LLC                       | Microwave Towers | Low              | No                | Low              | 0                 |
| 2187       | New Cingular Wireless PCS, LLC                       | Microwave Towers | Low              | No                | Low              | 0                 |
| 2188       | MASSACHUSETTS, COMMONWEALTH OF                       | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2189       | MASSACHUSETTS, COMMONWEALTH OF                       | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2190       | MASSACHUSETTS, COMMONWEALTH OF                       | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2191       | MASSACHUSETTS, COMMONWEALTH OF                       | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2192       | MASSACHUSETTS, COMMONWEALTH OF                       | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2193       | MASSACHUSETTS, COMMONWEALTH OF                       | Microwave Towers | Moderate         | No                | Low              | 0                 |

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|------------|---|------------------|------------------|-------------------|------------------|-------------------|
| 2194       | MASSACHUSETTS, COMMONWEALTH OF          | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2195       | MASSACHUSETTS, COMMONWEALTH OF          | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2196       | MASSACHUSETTS WATER RESOURCES AUTHORITY | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2197       | MASSACHUSETTS WATER RESOURCES AUTHORITY | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2198       | SmartRoute Systems, Inc.                | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2199       | WHDH-TV                                 | Microwave Towers | Moderate         | AE                | Low              | 2                 |
| 2200       | Boston, City of                         | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2201       | Boston, City of                         | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2202       | Boston, City of                         | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2203       | Boston, City of                         | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2204       | Boston, City of                         | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2205       | Boston, City of                         | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2206       | WHDH-TV                                 | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2207       | Cellco Partnership                      | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2208       | CELLCO PARTNERSHIP                      | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2209       | WHDH-TV                                 | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2210       | WHDH-TV                                 | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2211       | WHDH-TV                                 | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2212       | WHDH-TV                                 | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2213       | WHDH-TV                                 | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2214       | WHDH-TV                                 | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2215       | WHDH-TV                                 | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2216       | WHDH-TV                                 | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2217       | WHDH-TV                                 | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2218       | WHDH-TV                                 | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2219       | WHDH-TV                                 | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2220       | WHDH-TV                                 | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2221       | WHDH-TV                                 | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2222       | WHDH-TV                                 | Microwave Towers | Moderate         | No                | Low              | 0                 |

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|------------|---|------------------|------------------|-------------------|------------------|-------------------|
| 2223       | WHDH-TV                                       | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2224       | WHDH-TV                                       | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2225       | WHDH-TV                                       | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2226       | MASSACHUSETTS GENERAL HOSPITAL                | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2227       | MASSACHUSETTS GENERAL HOSPITAL                | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2228       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 2229       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 2230       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 2231       | Partners HealthCare                           | Microwave Towers | Moderate         | AE                | Low              | 2                 |
| 2232       | Partners HealthCare                           | Microwave Towers | Moderate         | AE                | Low              | 2                 |
| 2233       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2234       | WGBH EDUCATIONAL FOUNDATION                   | Microwave Towers | Low              | No                | Low              | 0                 |
| 2235       | WGBH EDUCATIONAL FOUNDATION                   | Microwave Towers | Low              | No                | Low              | 0                 |
| 2236       | RHODE ISLAND PUBLIC TELECOM. AUTHORITY        | Microwave Towers | Low              | No                | Low              | 0                 |
| 2237       | WGBH EDUCATIONAL FOUNDATION                   | Microwave Towers | Low              | No                | Low              | 0                 |
| 2238       | RHODE ISLAND PUBLIC TELECOM. AUTHORITY        | Microwave Towers | Low              | No                | Low              | 0                 |
| 2239       | WGBH EDUCATIONAL FOUNDATION                   | Microwave Towers | Low              | No                | Low              | 0                 |
| 2240       | WGBH EDUCATIONAL FOUNDATION                   | Microwave Towers | Low              | No                | Low              | 0                 |
| 2241       | WGBH EDUCATIONAL FOUNDATION                   | Microwave Towers | Low              | No                | Low              | 0                 |
| 2242       | WGBH EDUCATIONAL FOUNDATION                   | Microwave Towers | Low              | No                | Low              | 0                 |
| 2243       | WGBH EDUCATIONAL FOUNDATION                   | Microwave Towers | Low              | No                | Low              | 0                 |
| 2244       | WGBH EDUCATIONAL FOUNDATION                   | Microwave Towers | Low              | No                | Low              | 0                 |
| 2245       | WGBH EDUCATIONAL FOUNDATION                   | Microwave Towers | Low              | No                | Low              | 0                 |
| 2246       | WGBH EDUCATIONAL FOUNDATION                   | Microwave Towers | Low              | No                | Low              | 0                 |
| 2247       | NSTAR Electric Company                        | Microwave Towers | Low              | No                | Low              | 0                 |
| 2248       | NSTAR Electric Company                        | Microwave Towers | Low              | No                | Low              | 0                 |
| 2249       | SmartRoute Systems, Inc.                      | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2250       | FiberTower Network Services Corp.             | Microwave Towers | Low              | No                | High             | 0                 |
| 2251       | FiberTower Network Services Corp.             | Microwave Towers | Low              | No                | High             | 0                 |

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|------------|-----------------------------------|------------------|------------------|-------------------|------------------|-------------------|
| 2252       | CBS RADIO EAST INC.               | Microwave Towers | Low              | No                | High             | 4                 |
| 2253       | CBS RADIO STATIONS INC.           | Microwave Towers | Low              | No                | High             | 2                 |
| 2254       | NBC TELEMUNDO LICENSE CO.         | Microwave Towers | Low              | No                | High             | 2                 |
| 2255       | CBS CORPORATON                    | Microwave Towers | Low              | No                | High             | 0                 |
| 2256       | CBS CORPORATON                    | Microwave Towers | Low              | No                | High             | 0                 |
| 2257       | CBS CORPORATON                    | Microwave Towers | Low              | No                | High             | 0                 |
| 2258       | CBS CORPORATON                    | Microwave Towers | Low              | No                | High             | 0                 |
| 2259       | CBS CORPORATON                    | Microwave Towers | Low              | No                | High             | 0                 |
| 2260       | CBS CORPORATON                    | Microwave Towers | Low              | No                | High             | 0                 |
| 2261       | CBS CORPORATON                    | Microwave Towers | Low              | No                | High             | 0                 |
| 2262       | CBS CORPORATON                    | Microwave Towers | Low              | No                | High             | 0                 |
| 2263       | CBS CORPORATON                    | Microwave Towers | Low              | No                | High             | 0                 |
| 2264       | CBS CORPORATIOIN                  | Microwave Towers | Low              | No                | High             | 0                 |
| 2265       | PROVIDENCE TV LICENSEE CORP.      | Microwave Towers | Low              | No                | High             | 0                 |
| 2266       | CBS CORPORATON                    | Microwave Towers | Low              | No                | High             | 0                 |
| 2267       | MASSACHUSETTS GENERAL HOSPITAL    | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2268       | MASSACHUSETTS GENERAL HOSPITAL    | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2269       | FiberTower Network Services Corp. | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2270       | FiberTower Network Services Corp. | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2271       | FiberTower Network Services Corp. | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2272       | MASSACHUSETTS PORT AUTHORITY      | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 2273       | MASSACHUSETTS PORT AUTHORITY      | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 2274       | MASSACHUSETTS PORT AUTHORITY      | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 2275       | MASSACHUSETTS PORT AUTHORITY      | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 2276       | MASSACHUSETTS PORT AUTHORITY      | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 2277       | Partners Healthcare               | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2278       | Partners Healthcare               | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2279       | Partners HealthCare Systems, Inc. | Microwave Towers | Moderate         | No                | Low              | 0                 |
| 2280       | Partners HealthCare Systems, Inc. | Microwave Towers | Moderate         | No                | Low              | 0                 |

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|------------|---|------------------|------------------|-------------------|------------------|-------------------|
| 2281       | MASSPORT AUTHORITY                            | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2282       | MASSPORT AUTHORITY                            | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2283       | MASSPORT AUTHORITY                            | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2284       | MASSPORT AUTHORITY                            | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2285       | MASSPORT AUTHORITY                            | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2286       | MASSPORT AUTHORITY                            | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2287       | MASSPORT AUTHORITY                            | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2288       | MASSPORT AUTHORITY                            | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2289       | SmartRoute Systems, Inc.                      | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2290       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2291       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2292       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2293       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2294       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2295       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2296       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 2297       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 2298       | Cellco Partnership                            | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2299       | Cellco Partnership                            | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2300       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2301       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2302       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2303       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 1                 |
| 2304       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                | Low              | 1                 |
| 2305       | Towerstream Corp                              | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2306       | Towerstream Corp                              | Microwave Towers | Moderate         | No                | Low              | 2                 |
| 2307       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 2308       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                | Low              | 4                 |
| 2309       | Museum of Science                             | Microwave Towers | Moderate         | 0.2 PCT           | Low              | 1                 |

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|------------|---|------------------|------------------|-----------------------|------------------|-------------------|
|            |   |                  |                  | ANNUAL CHANCE         |                  |                   |
| 2310       | Museum of Science                             | Microwave Towers | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 1                 |
| 2311       | Keane Corporation                             | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 2312       | Keane Corporation                             | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 2313       | MASSPORT AUTHORITY                            | Microwave Towers | Moderate         | No                    | Low              | 4                 |
| 2314       | MASSPORT AUTHORITY                            | Microwave Towers | Moderate         | No                    | Low              | 4                 |
| 2315       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                    | Low              | 4                 |
| 2316       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                    | Low              | 4                 |
| 2317       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 2318       | NEXTEL COMMUNICATIONS OF THE MID ATLANTIC INC | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 2319       | MASSPORT AUTHORITY                            | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 2320       | MASSPORT AUTHORITY                            | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 2321       | MASSPORT AUTHORITY                            | Microwave Towers | Moderate         | No                    | Low              | 1                 |
| 2322       | MASSPORT AUTHORITY                            | Microwave Towers | Moderate         | No                    | Low              | 1                 |
| 2323       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 2324       | New Cingular Wireless PCS, LLC                | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 2325       | MASSACHUSETTS GENERAL HOSPITAL                | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 2326       | Cellco Partnership                            | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 2327       | Cellco Partnership                            | Microwave Towers | Moderate         | No                    | Low              | 2                 |
| 2328       | MASSACHUSETTS PORT AUTHORITY                  | Microwave Towers | Moderate         | No                    | Low              | 1                 |
| 2329       | MASSACHUSETTS PORT AUTHORITY                  | Microwave Towers | Moderate         | No                    | Low              | 1                 |
| 2330       | MASSPORT AUTHORITY                            | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 2331       | MASSPORT AUTHORITY                            | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 2332       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 2333       | FiberTower Network Services Corp.             | Microwave Towers | Moderate         | No                    | Low              | 0                 |
| 2334       | FIBERTOWER NETWORK SERVICES CORP              | Microwave Towers | Moderate         | No                    | Low              | 0                 |

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|------------|---|--------------------|------------------|-----------------------|------------------|-------------------|
| 2335       | FiberTower Network Services Corp.                       | Microwave Towers   | Moderate         | No                    | Low              | 0                 |
| 2336       | New Cingular Wireless PCS, LLC                          | Microwave Towers   | Moderate         | No                    | Low              | 0                 |
| 2337       | New Cingular Wireless PCS, LLC                          | Microwave Towers   | Moderate         | No                    | Low              | 0                 |
| 2338       | New Cingular Wireless PCS, LLC                          | Microwave Towers   | Moderate         | No                    | Low              | 0                 |
| 2339       | New Cingular Wireless PCS, LLC                          | Microwave Towers   | Moderate         | No                    | Low              | 0                 |
| 2340       | MASSACHUSETTS GENERAL HOSPITAL                          | Microwave Towers   | Moderate         | No                    | Low              | 0                 |
| 2341       | NSAC, LLC   | BRS_EBS_TRANS      | Moderate         | No                    | Low              | 2                 |
| 2342       | THE PRESIDENT & FELLOWS of HARVARD COLLEGE              | BRS_EBS_TRANS      | Moderate         | No                    | Low              | 0                 |
| 2343       | EMERSON COLLEGE   | BRS_EBS_TRANS      | Moderate         | No                    | Low              | 0                 |
| 2344       | Spectrasite Communications, Inc. through American Tower | Antenna_Registrate | Moderate         | No                    | High             | 0                 |
| 2345       | BOSTON FIRE DEPARTMENT                                  | Antenna_Registrate | Moderate         | No                    | High             | 0                 |
| 2346       | Massachusetts Bay Transportation Authority              | Antenna_Registrate | Moderate         | No                    | High             | 0                 |
| 2347       | BOSTON FIRE DEPARTMENT                                  | Antenna_Registrate | Moderate         | No                    | High             | 0                 |
| 2348       | Massachusetts Bay Transportation Authority              | Antenna_Registrate | Moderate         | No                    | Low              | 0                 |
| 2349       | BOSTON FIRE DEPARTMENT                                  | Antenna_Registrate | Moderate         | No                    | High             | 0                 |
| 2350       | Massachusetts Bay Transportation Authority              | Antenna_Registrate | Moderate         | No                    | Low              | 0                 |
| 2351       | Massachusetts Water Resources Authority                 | Antenna_Registrate | Moderate         | No                    | Low              | 4                 |
| 2352       | Massachusetts Bay Transportation Authority              | Antenna_Registrate | Moderate         | No                    | Low              | 2                 |
| 2353       | Massachusetts Bay Transportation Authority              | Antenna_Registrate | Low              | No                    | High             | 0                 |
| 2354       | Spectrasite Communications, Inc. through American Tower | Antenna_Registrate | Moderate         | No                    | Low              | 2                 |
| 2355       | Massachusetts Port Authority                            | Antenna_Registrate | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 2                 |
| 2356       | Massachusetts Port Authority                            | Antenna_Registrate | Moderate         | AE                    | Low              | 2                 |
| 2357       | Tower Point Holdings, LLC                               | Antenna_Registrate | Moderate         | No                    | Low              | 2                 |
| 2358       | BOSTON UNIVERSITY COMMUNICATIONS INC                    | Antenna_Registrate | Moderate         | No                    | Low              | 0                 |
| 2359       | BOSTON FIRE DEPARTMENT                                  | Antenna_Registrate | Moderate         | No                    | Low              | 0                 |
| 2360       | Beacon Capital Parners                                  | Antenna_Registrate | Moderate         | No                    | Low              | 2                 |
| 2361       | JOHN HANCOCK MUTUAL LIFE INSURANCE COMPANY              | Antenna_Registrate | Moderate         | No                    | Low              | 2                 |



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|------------|--|--------------------|------------------|-------------------|------------------|-------------------|
| 2362       | JOHN HANCOCK MUTUAL LIFE INSURANCE COMPANY | Antenna_Registrate | Moderate         | No                | Low              | 2                 |
| 2363       | JOHN HANCOCK MUTUAL LIFE INSURANCE COMPANY | Antenna_Registrate | Moderate         | No                | Low              | 2                 |
| 2364       | TRUSTEES OF BOSTON UNIVERSITY              | Antenna_Registrate | Moderate         | No                | Low              | 2                 |
| 2365       | Massachusetts Bay Transportation Authority | Antenna_Registrate | Moderate         | No                | Low              | 0                 |
| 2366       | Dewey Square Tower Associates              | Antenna_Registrate | Moderate         | No                | Low              | 0                 |
| 2367       | Dewey Square Tower Associates              | Antenna_Registrate | Moderate         | No                | Low              | 0                 |
| 2368       | Massachusetts Bay Transportation Authority | Antenna_Registrate | Moderate         | No                | Low              | 2                 |
| 2369       | Massachusetts Turnpike Authority           | Antenna_Registrate | Low              | No                | Low              | 0                 |
| 2370       | WinStar Wireless Fiber Corp.               | Antenna_Registrate | Moderate         | No                | Low              | 0                 |
| 2371       | BROOKFIELD FINANCIAL PROPERTIES            | Antenna_Registrate | Moderate         | No                | Low              | 4                 |
| 2372       | One Beacon Street Limited Partnership      | Antenna_Registrate | Moderate         | No                | Low              | 0                 |
| 2373       | CBS Communications Services Inc.           | Antenna_Registrate | Low              | No                | High             | 4                 |
| 2374       | NEW BOSTON GARDEN CORP                     | Antenna_Registrate | Moderate         | No                | Low              | 2                 |
| 2375       | BOSTON FIRE DEPARTMENT                     | Antenna_Registrate | Moderate         | AE                | Low              | 2                 |
| 2376       | J & F REALTY TRUST                         | Antenna_Registrate | Moderate         | No                | Low              | 2                 |
| 2377       | T-Mobile Northeast LLC                     | Antenna_Registrate | Moderate         | No                | Low              | 0                 |
| 2378       | Massachusetts Bay Transportation Authority | Antenna_Registrate | Moderate         | No                | Low              | 4                 |
| 2379       | Massachusetts Bay Transportation Authority | Antenna_Registrate | Moderate         | No                | Low              | 2                 |
| 2380       | SBC TOWER HOLDINGS LLC                     | Antenna_Registrate | Moderate         | No                | Low              | 0                 |
| 2383       | NORTHEASTERN UNIVERSITY                    | FM Antenna         | Moderate         | No                | Low              | 2                 |
| 2384       | HEMISPHERE BROADCASTING CORPORATION        | FM Antenna         | Moderate         | No                | Low              | 0                 |
| 2385       | HEMISPHERE BROADCASTING CORPORATION        | FS Antenna         | Moderate         | No                | Low              | 0                 |
| 2386       | GREATER BOSTON RADIO, INC.                 | FM Antenna         | Moderate         | No                | Low              | 0                 |
| 2387       | GREATER BOSTON RADIO, INC.                 | FS Antenna         | Moderate         | No                | Low              | 0                 |
| 2388       | GREATER BOSTON RADIO, INC.                 | FM Antenna         | Moderate         | No                | Low              | 0                 |
| 2389       | CBS RADIO INC. OF BOSTON                   | FM Antenna         | Moderate         | No                | Low              | 0                 |
| 2390       | CBS RADIO INC. OF BOSTON                   | FS Antenna         | Moderate         | No                | Low              | 0                 |
| 2391       | TRUSTEES OF BOSTON UNIVERSITY              | FS Antenna         | Moderate         | No                | Low              | 2                 |
| 2392       | EMERSON COLLEGE                            | FM Antenna         | Moderate         | No                | Low              | 4                 |

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|------------|---|-------------------------------------|------------------|-------------------|------------------|-------------------|
| 2393       | WGBH EDUCATIONAL FOUNDATION                   | FX Antenna                          | Moderate         | No                | Low              | 2                 |
| 2395       | BOSTON OPERATIONS CENTER BOSTON EDISON        | Tier 2 Sites 2010-Trigen            | Moderate         | No                | Low              | 2                 |
| 2396       | TRIGEN BOSTON ENERGY                          | Tier 2 Sites 2010-Trigen            | Moderate         | No                | Low              | 2                 |
| 2397       | TRIGEN BOSTON ENERGY CORP                     | Trigen                              | Moderate         | No                | Low              | 0                 |
| 2398       | TRIGEN-BOSTON ENERGY CORP                     | Tier 2 Sites 2010-Trigen_ASG        | Moderate         | No                | Low              | 0                 |
| 2399       | New Boston Generating Station L Street        | Generating Plants                   | Moderate         | No                | Low              | 4                 |
| 2400       | New Boston Generating Station L Street        | Generating Plants                   | Moderate         | No                | Low              | 4                 |
| 2401       | SITHE NEW BOSTON STATION LLC M Street Jet     | Tier 2 Sites 2010-Generating Plants | Moderate         | No                | Low              | 0                 |
| 2402       | Gillette Co                                   | Tier 2 Sites 2010-Generating Plants | Moderate         | No                | Low              | 4                 |
| 2403       | Dewar Street 483                              | Tier 2 Sites 2010-Substations_ASG   | Moderate         | No                | Low              | 4                 |
| 2404       | MBTA No 106                                   | Tier 2 Sites 2010-Substations_ASG   | Moderate         | No                | Low              | 4                 |
| 2405       | K Street No 1                                 | Tier 2 Sites 2010-Substations_ASG   | Moderate         | No                | Low              | 0                 |
| 2406       | New Boston Generating Station L Street        | Substations                         | Moderate         | No                | Low              | 4                 |
| 2407       | K Street No 2 No 385                          | Tier 2 Sites 2010-Substations       | Moderate         | No                | Low              | 4                 |
| 2408       | Gillette Co                                   | Tier 2 Sites 2010-Substations       | Moderate         | No                | Low              | 4                 |
| 2409       | Scotia No 71                                  | Tier 2 Sites 2010-Substations       | Moderate         | No                | Low              | 0                 |
| 2410       | Carver No 514N                                | Substations                         | Moderate         | No                | Low              | 0                 |
| 2411       | Kingston St                                   | Substations                         | Moderate         | No                | Low              | 2                 |
| 2412       | High Street 53                                | Substations                         | Moderate         | No                | Low              | 0                 |
| 2413       | Chatham Street 12                             | Substations                         | Moderate         | No                | Low              | 2                 |
| 2414       | Hawkins Street 2                              | Substations                         | Moderate         | No                | Low              | 2                 |
| 2415       | Arbour Hospital                               | Primary                             | Moderate         | No                | High             | 0                 |
| 2416       | Franciscan Children's Hospital & Rehab Center | Primary                             | Moderate         | No                | Low              | 0                 |
| 2417       | Hebrew Rehabilitation Center                  | Primary                             | Low              | No                | High             | 0                 |

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| 2418       | Jewish Memorial Hospital & Radius Hospital         | Primary                       | Moderate         | No                | Low              | 0                 |
| 2419       | Kindred Hospital                                   | Primary                       | Low              | No                | Low              | 0                 |
| 2420       | Lemuel Shattuck Hospital                           | Primary                       | Moderate         | No                | High             | 0                 |
| 2421       | ShrinerÆs Burn Instituteá                          | Primary                       | Moderate         | No                | Low              | 0                 |
| 2422       | Spaulding Rehabilitation Hospital                  | Primary                       | Moderate         | No                | Low              | 2                 |
| 2423       | Beth Isreal Deaconess medical Center - East Campus | Primary                       | Moderate         | No                | Low              | 0                 |
| 2424       | Boston Medical Center - Menino Campus              | Primary                       | Moderate         | No                | Low              | 2                 |
| 2425       | Brigham and Women's Hospital                       | Primary                       | Moderate         | No                | Low              | 0                 |
| 2426       | Carney Hospital                                    | Primary                       | Moderate         | No                | High             | 0                 |
| 2427       | Children's Hospital Boston                         | Primary                       | Moderate         | No                | Low              | 0                 |
| 2428       | Dana-Farber Cancer Institute                       | Primary                       | Moderate         | No                | Low              | 0                 |
| 2429       | Faulkner Hospital                                  | Primary                       | Low              | No                | High             | 0                 |
| 2430       | Massachusetts Eye and Ear Infirmary                | Primary                       | Moderate         | No                | Low              | 2                 |
| 2431       | St. Elizabeth's Hospital                           | Primary                       | Low              | No                | High             | 0                 |
| 2432       | Tufts Medical Center                               | Primary                       | Moderate         | No                | Low              | 2                 |
| 2433       | VA Bos. Healthcare System - Jamaica Plain          | Primary                       | Moderate         | No                | Low              | 0                 |
| 2434       | VA Bos. Healthcare System - W. Roxbury             | Primary                       | Low              | No                | High             | 0                 |
| 2435       | Beth Israel Deaconess Medical Center - West Campus | Primary                       | Moderate         | No                | Low              | 0                 |
| 2436       | Boston Medical Center - East Newton Campus         | Primary                       | Moderate         | No                | Low              | 2                 |
| 2437       | New England Baptist Hospital                       | Primary                       | Moderate         | No                | Low              | 0                 |
| 2438       | BOSTON VETERAN CENTER                              | Primary                       | Moderate         | No                | Low              | 2                 |
| 2439       | Veterans Affairs Boston Health Care System         | Primary                       | Moderate         | No                | Low              | 2                 |
| 2440       | Erich Lindemann Mental Health Center               | Primary                       | Moderate         | No                | Low              | 0                 |
| 2441       | Urgent Care Medical Unit                           | Primary                       | Moderate         | No                | Low              | 2                 |
| 2442       | Boston Public Health Commission Medical Facilities | Primary                       | Moderate         | No                | Low              | 4                 |
| 2443       | MGH at the Navy Yard                               | Primary                       | Moderate         | No                | Low              | 2                 |
| 2444       | Mass General Hospital                              | Primary                       | Moderate         | No                | Low              | 2                 |
| 2445       | PARKWELL NURSING AND REHABILITATION CENTER         | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 2446       | FAIRMOUNT REST HOME INCORPORATED                   | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |

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| 2447       | PARK PLACE REHABILITATION AND SKILLED CARE CENTER   | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 2448       | ROSCOMMON WEST ROXBURY EXTENDED CARE CENTER         | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 2449       | ROSCOMMON EXTENDED CARE CENTER                      | Nursing Homes/Assisted Living | Moderate         | No                | High             | 0                 |
| 2450       | STANDISH VILLAGE AT LOWER MILLS                     | Nursing Homes/Assisted Living | Moderate         | No                | High             | 0                 |
| 2451       | THE FOLEY SENIOR RESIDENCES                         | Nursing Homes/Assisted Living | Moderate         | No                | High             | 0                 |
| 2452       | EDELWEISS VILLAGE                                   | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 2453       | DEUTSCHES ALTENHEIM GERMAN CENTRE FOR EXTENDED CARE | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 2454       | THE BOSTON HOME                                     | Nursing Homes/Assisted Living | Moderate         | No                | High             | 0                 |
| 2455       | ROSCOMMON ON THE PARKWAY EXTENDED CARE CENTER       | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 2456       | BOSTONIAN NURSING CARE AND REHABILITATION CENTER    | Nursing Homes/Assisted Living | Moderate         | No                | High             | 4                 |
| 2457       | STONEHEDGE REHABILITATION AND SKILLED CARE CENTER   | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 2458       | MELVILLE REST HOME                                  | Nursing Homes/Assisted Living | Moderate         | No                | High             | 0                 |
| 2459       | SAINT JOSEPH NURSING AND REHABILITATION CENTER      | Nursing Homes/Assisted Living | Moderate         | No                | High             | 0                 |
| 2460       | HEBREW REHABILITATION CENTER                        | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 2461       | SOPHIA SNOW HOUSE                                   | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 2462       | SPRINGHOUSE   | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 2463       | ANNS REST HOME                                      | Nursing Homes/Assisted Living | Moderate         | No                | High             | 0                 |
| 2464       | LAUREL RIDGE REHABILITATION AND NURSING CENTER      | Nursing Homes/Assisted Living | Moderate         | No                | High             | 0                 |
| 2465       | ARMENIAN NURSING AND REHABILITATION CENTER          | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 2466       | BURGOYNE REST HOME                                  | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 2467       | CUSHING MANOR COMMUNITY SUPPORT FACILITY            | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 2468       | ROGERSON HOUSE                                      | Nursing Homes/Assisted Living | Moderate         | No                | High             | 0                 |
| 2469       | MOUNT PLEASANT HOME                                 | Nursing Homes/Assisted Living | Moderate         | No                | High             | 0                 |
| 2470       | GODDARD HOUSE SKILLED NURSING CENTER                | Nursing Homes/Assisted Living | Moderate         | No                | High             | 0                 |
| 2471       | BENJAMIN HEALTHCARE CENTER                          | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 2472       | SHERRILL HOUSE                                      | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 2473       | LANDMARK AT LONGWOOD                                | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 2474       | THE BAYVIEW   | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |

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|------------|--|-------------------------------|------------------|-------------------|------------------|-------------------|
| 2475       | RUGGLES ASSISTED LIVING                            | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 2                 |
| 2476       | HARBORLIGHTS REHABILITATION AND NURSING CENTER     | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 2477       | MARIAN MANOR                                       | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 2478       | CHESTNUT PARK AT CLEVELAND CIRCLE                  | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 2479       | SUSAN BAILIS ASSISTED LIVING COMMUNITY             | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 2480       | BRIGHTON HOUSE REHABILITATION AND NURSING CENTER   | Nursing Homes/Assisted Living | Low              | No                | Low              | 0                 |
| 2481       | PROVIDENCE HOUSE AT COREY PARK                     | Nursing Homes/Assisted Living | Low              | No                | Low              | 0                 |
| 2482       | COREY HILL NURSING HOME                            | Nursing Homes/Assisted Living | Low              | No                | Low              | 0                 |
| 2483       | SOUTH COVE MANOR NURSING AND REHABILITATION CENTER | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 4                 |
| 2484       | HALE HOUSE   | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 2                 |
| 2485       | WINGATE AT BRIGHTON                                | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 2486       | PRESENTATION NURSING AND REHABILITATION CENTER     | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 2487       | NORTH END REHABILITATION AND NURSING CENTER        | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 2                 |
| 2488       | ZELMA LACEY HOUSE OF CHARLESTOWN                   | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 2                 |
| 2489       | DON ORIONE HOME                                    | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 2490       | HANCOCK SKILLED NURSING & REHAB CTR                | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 2491       | JORDAN REHABILITATION & NURS CENTER                | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 2492       | POND VIEW NURSING FACILITY                         | Nursing Homes/Assisted Living | Moderate         | No                | Low              | 0                 |
| 2493       | RECUPERATIVE SERVICES UNIT                         | Nursing Homes/Assisted Living | Low              | No                | High             | 0                 |
| 2494       | APAC Child And Family Service Ctr Child Care       | Child Care                    | Low              | No                | Low              | 0                 |
| 2495       | Bright Horizon's Children's Center-Allston         | Child Care                    | Low              | No                | Low              | 0                 |
| 2496       | Brighton/Allston Afterschool Enrichment Prog.      | Child Care                    | Low              | No                | Low              | 0                 |
| 2497       | Fairy Tale Children's Center Inc.                  | Child Care                    | Moderate         | No                | Low              | 0                 |
| 2498       | HUNTINGTON AVE YMCA @ GARDNER PILOT ACADEMY        | Child Care                    | Low              | No                | High             | 0                 |
| 2499       | Jackson-Mann Community Center School-Afterschool   | Child Care                    | Low              | No                | Low              | 0                 |
| 2500       | Pine Village Preschool                             | Child Care                    | Low              | No                | High             | 0                 |
| 2501       | Rivendell Child Care Center                        | Child Care                    | Low              | No                | Low              | 0                 |
| 2502       | Wonder Years, Inc.                                 | Child Care                    | Low              | No                | Low              | 0                 |

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|------------|--|-------------|------------------|-------------------|------------------|-------------------|
| 2503       | Allson Brighton St. Gabriel's Head Start                   | Child Care  | Low              | No                | Low              | 0                 |
| 2504       | Edison After School Program                                | Child Care  | Low              | No                | High             | 0                 |
| 2505       | Allston/Brighton APAC, Inc.                                | Child Care  | Low              | No                | Low              | 0                 |
| 2506       | Leventhal-Sidman JCC/Brookline Preschool                   | Child Care  | Low              | No                | High             | 0                 |
| 2507       | Oak Square YMCA @ Winship                                  | Child Care  | Low              | No                | High             | 0                 |
| 2508       | Camp Connolly  | Child Care  | Low              | No                | High             | 0                 |
| 2509       | Franciscan Family Child Care Center                        | Child Care  | Low              | No                | High             | 0                 |
| 2510       | St. E's Children's Center                                  | Child Care  | Low              | No                | High             | 0                 |
| 2511       | Yal-Day-New Day Care Center                                | Child Care  | Low              | No                | High             | 0                 |
| 2512       | Acorn Center for Early Education/Care                      | Child Care  | Moderate         | No                | Low              | 2                 |
| 2513       | ARC-EN-CIEL Day Care and Montessori School                 | Child Care  | Low              | No                | High             | 0                 |
| 2514       | Blackstone's New Adventure                                 | Child Care  | Moderate         | No                | Low              | 2                 |
| 2515       | Associated Early Care Education Inc. - Castle Square       | Child Care  | Moderate         | No                | Low              | 2                 |
| 2516       | Boston University Children's Center                        | Child Care  | Moderate         | No                | Low              | 0                 |
| 2517       | Bright Horizons @ Seaport                                  | Child Care  | Moderate         | No                | Low              | 2                 |
| 2518       | Bright Horizons @ Seaport SACC Backup                      | Child Care  | Moderate         | No                | Low              | 2                 |
| 2519       | Bright Horizons @125 Summer Street                         | Child Care  | Moderate         | No                | Low              | 0                 |
| 2520       | Bright Horizons at One Financial Center                    | Child Care  | Moderate         | No                | Low              | 0                 |
| 2521       | Bright Horizons Children's Center                          | Child Care  | Moderate         | No                | Low              | 2                 |
| 2522       | Bright Horizons Children's Center at the Prudential Center | Child Care  | Moderate         | No                | Low              | 0                 |
| 2523       | Bright Horizons Family Center at Landmark                  | Child Care  | Moderate         | AE                | Low              | 2                 |
| 2524       | Bright Horizons Family Solution @ Beacon Hill              | Child Care  | Moderate         | No                | Low              | 0                 |
| 2525       | Buds and Blossoms Early Education and Care Center          | Child Care  | Moderate         | No                | Low              | 2                 |
| 2526       | Children's Hospital Child Care Center                      | Child Care  | Moderate         | No                | Low              | 0                 |
| 2527       | Children's Place at Goodwin Procter                        | Child Care  | Moderate         | No                | Low              | 2                 |
| 2528       | Children's Quarters Charlestown Navy Yard                  | Child Care  | Moderate         | No                | Low              | 2                 |
| 2529       | Commonwealth Children's Center - RM 105A                   | Child Care  | Moderate         | No                | Low              | 0                 |
| 2530       | Eagle's Nest Learning Center                               | Child Care  | Moderate         | No                | Low              | 2                 |
| 2531       | Early Childhood Learning Lab                               | Child Care  | Moderate         | No                | Low              | 2                 |

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| 2532       | Ellis Memorial Early Education and Care Program-STE 101 | Child Care  | Moderate         | No                | Low              | 2                 |
| 2533       | Ellis Memorial Children's Center                        | Child Care  | Moderate         | No                | Low              | 2                 |
| 2534       | Ellis Memorial SAP at Madison Park Village              | Child Care  | Moderate         | No                | Low              | 2                 |
| 2535       | Families First Day Care                                 | Child Care  | Moderate         | No                | Low              | 2                 |
| 2536       | Government Center Child Care                            | Child Care  | Moderate         | No                | Low              | 0                 |
| 2537       | Government Center Child Care Corp - O'Neil Federal Bldg | Child Care  | Moderate         | No                | Low              | 2                 |
| 2538       | Harborview Children's Center                            | Child Care  | Moderate         | No                | Low              | 1                 |
| 2539       | Huntington Ave YMCA @ Hurley School                     | Child Care  | Moderate         | No                | Low              | 0                 |
| 2540       | Huntington Ave Day Camp                                 | Child Care  | Moderate         | No                | Low              | 2                 |
| 2541       | Infants and Other People                                | Child Care  | Moderate         | No                | Low              | 2                 |
| 2542       | Kids Palace Learning Center, LLC.                       | Child Care  | Moderate         | No                | Low              | 2                 |
| 2543       | Kinder Care Learning Center                             | Child Care  | Moderate         | No                | Low              | 2                 |
| 2544       | Little Wonders Child Care Center                        | Child Care  | Moderate         | No                | High             | 0                 |
| 2545       | MGH Back Up Children's Center - WARREN LOBBY SUITE 130  | Child Care  | Moderate         | No                | Low              | 2                 |
| 2546       | Millenium Day Care II                                   | Child Care  | Moderate         | No                | Low              | 0                 |
| 2547       | Millennium Day Care                                     | Child Care  | Moderate         | No                | Low              | 4                 |
| 2548       | North End Children's Center @ North End Health Center   | Child Care  | Moderate         | No                | Low              | 0                 |
| 2549       | North End Head Start                                    | Child Care  | Moderate         | No                | Low              | 0                 |
| 2550       | Old South Preschool                                     | Child Care  | Moderate         | No                | Low              | 2                 |
| 2551       | Park Street Kids, Inc.                                  | Child Care  | Moderate         | No                | Low              | 0                 |
| 2552       | Pine Village Preschool                                  | Child Care  | Moderate         | No                | Low              | 2                 |
| 2553       | Roxbury YMCA @ Blackstone School                        | Child Care  | Moderate         | No                | Low              | 2                 |
| 2554       | RTH Children's Center                                   | Child Care  | Moderate         | No                | Low              | 0                 |
| 2555       | Russell J. Call Children's Center                       | Child Care  | Moderate         | No                | Low              | 2                 |
| 2556       | Salvation Army After School Program                     | Child Care  | Moderate         | No                | Low              | 2                 |
| 2557       | Soldiers Field Park Children's Center                   | Child Care  | Moderate         | No                | Low              | 2                 |
| 2558       | South End Head Start                                    | Child Care  | Moderate         | No                | Low              | 0                 |
| 2559       | Spruce Street Nursery School                            | Child Care  | Moderate         | No                | Low              | 0                 |
| 2560       | Sunrise Learning Academy LLC                            | Child Care  | Moderate         | No                | Low              | 0                 |

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| 2561       | Sunshine Childcare  | Child Care  | Moderate         | No                | Low              | 2                 |
| 2562       | Tartt's Day Care Center II                                      | Child Care  | Moderate         | No                | Low              | 2                 |
| 2563       | The Children's Center at Ropes & Gray                           | Child Care  | Moderate         | No                | Low              | 0                 |
| 2564       | The Children's Place At   | Child Care  | Moderate         | No                | Low              | 2                 |
| 2565       | The Frances Jacobson Early Childhood Center                     | Child Care  | Moderate         | No                | Low              | 0                 |
| 2566       | Torit Language Center Montessori                                | Child Care  | Moderate         | No                | Low              | 0                 |
| 2567       | Transportation Children's Center - RM 3330                      | Child Care  | Moderate         | No                | Low              | 2                 |
| 2568       | United South End Settlements Child Development Program          | Child Care  | Moderate         | No                | Low              | 2                 |
| 2569       | Wang YMCA of Chinatown - SACC                                   | Child Care  | Moderate         | No                | Low              | 0                 |
| 2570       | Youth Education Program (YEP)                                   | Child Care  | Moderate         | No                | Low              | 2                 |
| 2571       | Anchor After School Program NAVY YARD                           | Child Care  | Moderate         | No                | Low              | 2                 |
| 2572       | Boys & Girls Club of Boston @ Charlestown Club                  | Child Care  | Moderate         | No                | Low              | 0                 |
| 2573       | Bright Horizons Childrens Center at the Schraffts               | Child Care  | Moderate         | AE                | Low              | 1                 |
| 2574       | Charlestown Cooperative Nursery School                          | Child Care  | Moderate         | No                | Low              | 0                 |
| 2575       | Good Shepherd Preschool   | Child Care  | Moderate         | No                | Low              | 0                 |
| 2576       | J.F.K. Head Start and Day Care Program                          | Child Care  | Moderate         | No                | Low              | 2                 |
| 2577       | Kent After School Program                                       | Child Care  | Moderate         | No                | Low              | 4                 |
| 2578       | MGH Children's Center - CAPTAINS QUARTERS                       | Child Care  | Moderate         | No                | Low              | 2                 |
| 2579       | A Child's View  | Child Care  | Moderate         | No                | Low              | 0                 |
| 2580       | ABCD Walnut Grove Head Start                                    | Child Care  | Moderate         | No                | High             | 0                 |
| 2581       | ASPIRE After School Program/Alliance for inclusion & Prevention | Child Care  | Moderate         | No                | High             | 0                 |
| 2582       | Au Co Preschool / Viet Aid After School Programs                | Child Care  | Low              | No                | High             | 0                 |
| 2583       | Basics Tutorial - Mather School                                 | Child Care  | Moderate         | No                | Low              | 0                 |
| 2584       | Basics Tutorial - Thomas Kenny School                           | Child Care  | Moderate         | No                | High             | 0                 |
| 2585       | Basics Tutorial - William Monroe Trotter Sch.                   | Child Care  | Moderate         | No                | High             | 0                 |
| 2586       | Bird St. After School Program @ Russell Elementary School       | Child Care  | Moderate         | No                | Low              | 0                 |
| 2587       | Boys and Girls Clubs Of Dorchester                              | Child Care  | Moderate         | No                | Low              | 0                 |
| 2588       | Bradshaw Children's Learning Program                            | Child Care  | Moderate         | No                | High             | 0                 |



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| 2589       | Citizen Schools, Inc; (McCormack)                        | Child Care            | Moderate         | No                    | Low              | 2                 |
| 2590       | College Bound Dorchester Early Education at Little House | Child Care            | Moderate         | No                    | Low              | 0                 |
| 2591       | College Bound Dorchester Early Education at Log School   | Child Care            | Moderate         | No                    | High             | 0                 |
| 2592       | College Bound Dorchester/Ruth Darling Child Cape Center  | Child Care            | Moderate         | No                    | Low              | 0                 |
| 2593       | Columbia Point Infant Toddler Day Care                   | Child Care            | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 2                 |
| 2594       | Crispus Attucks Children's Center                        | Child Care            | Moderate         | No                    | High             | 0                 |
| 2595       | Dimock Headstart   | Child Care            | Moderate         | No                    | Low              | 0                 |
| 2596       | Eagle's Nest @ Boston College High School                | Child Care            | Moderate         | No                    | Low              | 4                 |
| 2597       | ABCD EARLY HEADSTART                                     | Child Care            | Moderate         | No                    | High             | 0                 |
| 2598       | Basics Tutorial - John Holland School                    | Child Care            | Moderate         | No                    | High             | 0                 |
| 2599       | Huntington Avenue YMCA @ Everett School                  | Child Care            | Moderate         | No                    | Low              | 0                 |
| 2600       | Huntington Avenue YMCA @ King K-8 School                 | Child Care            | Moderate         | No                    | Low              | 0                 |
| 2601       | Huntington AvenueYMCA @Winthrop                          | Child Care            | Moderate         | No                    | Low              | 0                 |
| 2602       | Murphy Community Center                                  | Community Center      | Moderate         | No                    | High             | 2                 |
| 2603       | Neponset Child Care                                      | Child Care            | Moderate         | No                    | High             | 0                 |
| 2604       | Project Hope Children's Center                           | Child Care            | Moderate         | No                    | Low              | 0                 |
| 2605       | Small Wonders Nursery School                             | Child Care            | Moderate         | No                    | High             | 4                 |
| 2606       | The Paul R. McLaughlin Center                            | Child Care            | Moderate         | No                    | Low              | 4                 |
| 2607       | UCCC @ Bird Street Youth Center                          | Child Care            | Moderate         | No                    | Low              | 0                 |
| 2608       | Yawkey Konbit Kreyol Center                              | Child Care            | Moderate         | No                    | High             | 0                 |
| 2609       | Hyde Park YMCA @ E. Greenwood                            | Child Care            | Low              | No                    | High             | 0                 |
| 2610       | Hyde Park YMCA OST Program                               | Child Care            | Low              | No                    | High             | 0                 |
| 2611       | Little Voices Early Care and Education                   | Child Care            | Low              | No                    | High             | 0                 |
| 2612       | South Side Head Start II                                 | Child Care            | Low              | No                    | High             | 0                 |
| 2613       | Basics Tutorial - Mattahunt School                       | Child Care            | Moderate         | No                    | High             | 0                 |
| 2614       | Galivan Community Center                                 | BCYF community center | Moderate         | No                    | High             | 0                 |
| 2615       | Grove Hall Child Development Center                      | Child Care            | Moderate         | No                    | High             | 0                 |

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| 2616       | Hyde Park YMCA @ Chittick School  | Child Care            | Low              | No                | High             | 0                 |
| 2617       | Jubilee Academy Preschool   | Child Care            | Moderate         | No                | High             | 0                 |
| 2618       | La Ronde De Marie Claire Early Learning Center                                  | Child Care            | Moderate         | No                | High             | 0                 |
| 2619       | Marie Claire Quality Childcare Center Infant Palace                             | Child Care            | Moderate         | No                | High             | 0                 |
| 2620       | Mattapan Head Start   | Child Care            | Moderate         | No                | High             | 0                 |
| 2621       | Mildred Ave Community Center ASP  | BCYF community center | Moderate         | No                | High             | 0                 |
| 2622       | NECUB - Day Care  | Child Care            | Moderate         | No                | High             | 0                 |
| 2623       | Spark Center / Group and School Age Program                                     | Child Care            | Moderate         | No                | High             | 0                 |
| 2624       | St.Paul's Victory Assembly of God Learning Resource Center                      | Child Care            | Moderate         | No                | High             | 0                 |
| 2625       | The Tabitha House   | Schools               | Moderate         | No                | High             | 0                 |
| 2626       | Children's Learning Center  | Schools               | Low              | No                | High             | 0                 |
| 2627       | Alliance for Inclusion & Prevention Inc.  | Schools               | Low              | No                | High             | 0                 |
| 2628       | Haley School & Boston Nature Center Afterschool Program                         | Child Care            | Moderate         | No                | High             | 0                 |
| 2629       | Little People's Playhouse   | Child Care            | Moderate         | No                | High             | 0                 |
| 2630       | Little People's Playhouse SACC  | Child Care            | Low              | No                | High             | 0                 |
| 2631       | Roslindale Community Center After School  | Child Care            | Low              | No                | High             | 0                 |
| 2632       | Southside Head Start  | Child Care            | Low              | No                | High             | 0                 |
| 2633       | The Hill School   | Child Care            | Low              | No                | High             | 0                 |
| 2634       | Therapeutic After School Program (TASP)   | Child Care            | Low              | No                | High             | 0                 |
| 2635       | Village Preschool   | Child Care            | Low              | No                | High             | 0                 |
| 2636       | West Roxbury YMCA @ Phineas Bates   | Child Care            | Low              | No                | High             | 0                 |
| 2637       | West Roxbury YMCA@Sacred Heart Preschool & School Age                           | Child Care            | Low              | No                | High             | 0                 |
| 2638       | ABCD Head Start   | Child Care            | Moderate         | No                | Low              | 0                 |
| 2639       | ABCD Head Start @ Lenox Street  | Child Care            | Moderate         | No                | Low              | 0                 |
| 2640       | Above & Beyond SACC Program @ Moreland Street                                   |                       | Moderate         | No                | Low              | 0                 |
| 2641       | Bird Street Before and After school Program @ Orchard Gardens                   | Child Care            | Moderate         | No                | Low              | 0                 |
| 2642       | Bird Street Cmty Ctr. ASP@ Higginson-Lewis K2-8 Before and After School Program | Child Care            | Moderate         | No                | Low              | 0                 |

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| 2643       | Boys and Girls Clubs @ Yawkey Club                           | Child Care  | Moderate         | No                | Low              | 0                 |
| 2644       | Children's Services of Roxbury Early Care & Education Center | Child Care  | Moderate         | No                | Low              | 0                 |
| 2645       | Dimock Early Headstart                                       | Child Care  | Moderate         | No                | High             | 0                 |
| 2646       | Eliot Educational Center                                     | Schools     | Moderate         | No                | Low              | 0                 |
| 2647       | Goodwill Mellon Academy                                      | Schools     | Moderate         | No                | Low              | 2                 |
| 2648       | Hawthorne After School Program                               | Child Care  | Moderate         | No                | Low              | 0                 |
| 2649       | Huntington Avenue YMCA @ Mason School                        | Child Care  | Moderate         | No                | Low              | 4                 |
| 2650       | Paige Academy  | Schools     | Moderate         | No                | Low              | 0                 |
| 2651       | Paige Academy School Age Child Care                          | Child Care  | Moderate         | No                | Low              | 0                 |
| 2652       | Rosa Parks Day Care Center                                   | Child Care  | Moderate         | No                | Low              | 0                 |
| 2653       | Roxbury Weston Programs Inc. SACC/CATCH                      | Child Care  | Moderate         | No                | Low              | 0                 |
| 2654       | Roxbury YMCA Child Care Center                               | Child Care  | Moderate         | No                | Low              | 0                 |
| 2655       | S.M.I.L.E Pre School Team                                    | Schools     | Moderate         | No                | Low              | 0                 |
| 2656       | Smile Preschool  | Child Care  | Moderate         | No                | Low              | 0                 |
| 2657       | Sunnyside Day Nursery  | Child Care  | Moderate         | No                | Low              | 0                 |
| 2658       | The Abantwana Learning Center                                | Schools     | Moderate         | No                | High             | 0                 |
| 2659       | The Edgerley Family Community Children's Center              | Child Care  | Moderate         | No                | High             | 0                 |
| 2660       | The Gate House Head Start Program                            | Child Care  | Moderate         | No                | High             | 0                 |
| 2661       | Twelfth Baptist Church After School Program                  | Child Care  | Moderate         | No                | Low              | 0                 |
| 2662       | UCCC @ Ellis   | Child Care  | Moderate         | No                | High             | 0                 |
| 2663       | UCCC @ Emerson   | Child Care  | Moderate         | No                | Low              | 0                 |
| 2664       | UCCC @ Nathan Hale   | Child Care  | Moderate         | No                | Low              | 0                 |
| 2665       | Vine St. Community Centers - SACC Program                    | Child Care  | Moderate         | No                | Low              | 0                 |
| 2666       | Children's Happy Day School                                  | Child Care  | Low              | No                | High             | 0                 |
| 2667       | Kids Club Childcare and Preschool Center Inc                 | Child Care  | Low              | No                | High             | 0                 |
| 2668       | Kids Stop  | Child Care  | Low              | No                | High             | 0                 |
| 2669       | May Behavioral Health Children's After Sch. Pro              | Child Care  | Low              | No                | High             | 0                 |
| 2670       | Ohrenberger Community Center School Age Child Care           | Child Care  | Low              | No                | High             | 0                 |
| 2671       | Parkway Preschool Center                                     | Child Care  | Low              | No                | High             | 0                 |

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| 2672       | Sunny Bear Academy                                       | Schools               | Low              | No                | High             | 0                 |
| 2673       | The Childrens House of Owls Head                         | Child Care            | Low              | No                | High             | 0                 |
| 2674       | The Light House Early Learning Center                    | Schools               | Low              | No                | High             | 0                 |
| 2675       | Tot Spot Child Development Center                        | Child Care            | Low              | No                | High             | 0                 |
| 2676       | W.Roxbury/Roslindale YMCA @ Joyce Kilmer                 | Child Care            | Low              | No                | High             | 0                 |
| 2677       | Welcome Child Care & Preschool Center, Inc               | Child Care            | Low              | No                | High             | 0                 |
| 2678       | West Roxbury YMCA @ Lyndon                               | Child Care            | Moderate         | No                | Low              | 0                 |
| 2679       | Willow Path Childcare                                    | Child Care            | Low              | No                | High             | 0                 |
| 2680       | Scamper Camp   | Child Care            | Low              | No                | High             | 0                 |
| 2681       | East Boston - Head Start/Elbow                           | Child Care            | Moderate         | No                | Low              | 1                 |
| 2682       | East Boston Head Start Social Center                     | Child Care            | Moderate         | No                | Low              | 1                 |
| 2683       | East Boston Head Start St. Johns                         | Child Care            | Moderate         | No                | Low              | 0                 |
| 2684       | East Boston Head Start-Bennington                        | Child Care            | Moderate         | No                | Low              | 0                 |
| 2685       | East Boston Montessori School                            | Child Care            | Moderate         | No                | Low              | 2                 |
| 2686       | East Boston YMCA @ Alighieri                             | Child Care            | Moderate         | No                | Low              | 2                 |
| 2687       | East Boston YMCA @ Curtis Guild                          | Child Care            | Moderate         | No                | Low              | 0                 |
| 2688       | East Boston YMCA @ Samuel Adams                          | Child Care            | Moderate         | No                | Low              | 0                 |
| 2689       | East Boston YMCA Children's Center & O.S.T. @ Bremen St. | Child Care            | Moderate         | AE                | Low              | 1                 |
| 2690       | East Boston YMCA O.S.T. @ Kennedy School                 | Child Care            | Moderate         | No                | Low              | 0                 |
| 2691       | East Boston YMCA O.S.T. @ McKay                          | Child Care            | Moderate         | No                | Low              | 2                 |
| 2692       | Harbor Area Early Childhood Service                      | Child Care            | Moderate         | No                | Low              | 0                 |
| 2693       | Jeffries Point Child Care                                | Child Care            | Moderate         | No                | Low              | 0                 |
| 2694       | Oh Yes Orient Heights Young Explorers                    | Child Care            | Moderate         | No                | Low              | 0                 |
| 2695       | Shining Star Day Care                                    | Child Care            | Moderate         | No                | Low              | 2                 |
| 2696       | Swift Waters After School Programs                       | Child Care            | Moderate         | No                | Low              | 0                 |
| 2697       | Terri's Little Pumpkins II, Inc.                         | Child Care            | Moderate         | No                | Low              | 4                 |
| 2698       | YMCA East Boston @ Ashley Street Camp                    | Child Care            | Moderate         | No                | Low              | 2                 |
| 2699       | Citizen Schools @ The Gavin Middle School                | Schools               | Moderate         | No                | Low              | 0                 |
| 2700       | Condon Community Center                                  | BCYF community center | Moderate         | No                | Low              | 0                 |

**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**

| <b>ID#</b> | <b>NAME</b>                                  | <b>TYPE</b>      | <b>LANDSLIDE</b> | <b>FLOOD ZONE</b> | <b>SNOW FALL</b> | <b>HURR SURGE</b> |
|------------|--|------------------|------------------|-------------------|------------------|-------------------|
| 2701       | Julie's Family Learning Program              | Schools          | Moderate         | No                | Low              | 0                 |
| 2702       | Old Colony Headstart                         | Child Care       | Moderate         | No                | Low              | 2                 |
| 2703       | South Baptist Head Start                     | Child Care       | Moderate         | No                | Low              | 0                 |
| 2704       | South Boston Clubhouse After School Day Care | Child Care       | Moderate         | No                | Low              | 0                 |
| 2705       | South Boston Head Start                      | Child Care       | Moderate         | No                | Low              | 2                 |
| 2706       | South Boston Head Start @ West Broadway      | Child Care       | Moderate         | No                | Low              | 0                 |
| 2707       | South Boston Neighborhood House              | Child Care       | Moderate         | No                | Low              | 0                 |
| 2708       | South Boston Neighborhood House Preschool    | Child Care       | Moderate         | No                | Low              | 2                 |
| 2709       | ALEXANDER HAMILTON                           | Schools          | Low              | No                | High             | 0                 |
| 2710       | BOSTON CHILDREN'S SCHOOL ANNEX               | Schools          | Moderate         | No                | Low              | 2                 |
| 2711       | LITTLE PEOPLE'S PLAYHOUSE II                 | Child Care       | Low              | No                | High             | 0                 |
| 2712       | BRIGHT BEGINNINGS PRESCHOOL                  | Child Care       | Moderate         | No                | High             | 0                 |
| 2713       | NOTRE DAME MONTESSORI SCHOOL                 | Child Care       | Moderate         | No                | Low              | 4                 |
| 2714       | BEACON HILL NURSERY SCHOOL                   | Child Care       | Moderate         | No                | Low              | 0                 |
| 2715       | NAZARETH CHILD CARE CENTER                   | Child Care       | Moderate         | No                | High             | 0                 |
| 2716       | LITTLE FOLKS COMMUNITY DAY CARE              | Child Care       | Moderate         | No                | Low              | 0                 |
| 2717       | WESLEY CHILD CARE CENTER                     | Child Care       | Moderate         | No                | High             | 0                 |
| 2718       | N.I.C.E. INC.                                | Child Care       | Moderate         | No                | High             | 0                 |
| 2719       | TRANSPORTATION CHILDREN'S CENT               | Child Care       | Moderate         | No                | Low              | 0                 |
| 2720       | GROVE HALL CHILD DEVELOPMENT C               | Child Care       | Moderate         | No                | High             | 0                 |
| 2721       | LITTLE SCHOLARS' WORKSHOP, INC               | Schools          | Moderate         | No                | High             | 0                 |
| 2722       | BOSTON CHILDREN'S SCHOOL                     | Schools          | Moderate         | No                | Low              | 0                 |
| 2723       | COOPER COMMUNITY CHILD DEVELOP               | Schools          | Moderate         | No                | Low              | 0                 |
| 2724       | BRIDGE CHILDREN'S CENTER                     | Schools          | Moderate         | No                | Low              | 2                 |
| 2725       | CHILDREN'S AIDS PROGRAM (SPARK)              | Hospitals        | Moderate         | No                | High             | 0                 |
| 2726       | CITY HALL DAY CARE                           | Child Care       | Moderate         | No                | Low              | 0                 |
| 2727       | CITY OF BOSTON/ELLEN JACKSON                 |                  | Moderate         | No                | Low              | 0                 |
| 2728       | CITY OF BOSTON/PERKIN COMM. CTR.             | Community center | Moderate         | No                | High             | 0                 |
| 2729       | ELLEN JACKSON DAYCARE CTR.                   | Child Care       | Moderate         | No                | Low              | 0                 |

**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**

| <b>ID#</b> | <b>NAME</b>                    | <b>TYPE</b> | <b>LANDSLIDE</b> | <b>FLOOD ZONE</b>     | <b>SNOW FALL</b> | <b>HURR SURGE</b> |
|------------|--------------------------------|-------------|------------------|-----------------------|------------------|-------------------|
| 2730       | FANEUIL AFTER SCHOOL           | Child Care  | Low              | No                    | High             | 0                 |
| 2731       | JAMAICA PLAIN FOR FOURS        | Child Care  | Low              | No                    | High             | 0                 |
| 2732       | RED OAK AFTER SCHOOL PROGRAM   | Child Care  | Moderate         | No                    | Low              | 0                 |
| 2733       | SMALL WONDERS                  | Child Care  | Low              | No                    | High             | 0                 |
| 2734       | SPARKS CENTER                  | Hospitals   | Moderate         | No                    | Low              | 2                 |
| 2735       | TINY TOTS                      | Child Care  | Moderate         | 0.2 PCT ANNUAL CHANCE | Low              | 2                 |
| 2736       | CHILD FOCUS CENTER             | Schools     | Moderate         | No                    | Low              | 0                 |
| 2737       | UMASS/BOSTON EARLY LEARNING CE | Child Care  | Moderate         | No                    | Low              | 2                 |
| 2738       | TARTT'S DAY CARE CENTER AND PR | Child Care  | Moderate         | No                    | Low              | 0                 |
| 2739       | PAIGE ACADEMY AT RCC           | Schools     | Moderate         | No                    | Low              | 0                 |
| 2740       | JOHN WINTHROP SCHOOL           | Schools     | Moderate         | No                    | Low              | 2                 |
| 2741       | COPPER BEECH MONTESSORI SCHOOL | Child Care  | Moderate         | No                    | High             | 0                 |

**APPENDIX E  
Description of Faraday Cages  
(Solar Strom Mitigation)**

# CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN 2014 UPDATE

## Faraday Cages

A Faraday Cage is described as an enclosure made of conducting materials that will block external electric fields that are both static and non-static. This cage is used to protect sensitive electronic equipment from electrostatic discharges that can occur during solar storms and Nuclear Electromagnetic Pulse (EMP) events.

An Electromagnetic Pulse will induce a voltage in sensitive electronic equipment even if the equipment is powered down. Since this voltage can be quite large in an EMP it can cause damage in the sensitive components that make up circuit boards. This voltage will permanently damage those electronic devices.

Faraday cages can be built out of a lot of material. Used microwaves (cord must be cut off), galvanized steel trash cans, old ammo cans and Conex boxes are some of the materials that can be used. The key is to wrap each item that you want to protect in an electrostatic bag or heavy duty aluminum foil and then insulate it further with a bubble wrap protective barrier. Then this “protected” device can be placed into the galvanized steel container (microwave, ammo can etc...). The individual protected item cannot directly touch any of the steel container. This is why the device is wrapped in the protective bubble wrap.

The best approach is a layered approach of placing smaller items in a smaller container like an ammo can and then placing this receptacle in a larger container like a galvanized steel trash can. The trash receptacle can then be placed in the Conex box. Since we will never know when an EMP can occur from either a Solar Pulse or a Nuclear detonation, the best method of protection is to place redundant equipment into a Faraday Cage. Items that should be considered would include the following:

- 1.) Licensed Radio Equipment
- 2.) Amateur Radio Equipment
- 3.) FRS/GMRS radios
- 4.) Solar Battery Chargers
- 5.) Computer equipment (laptops)
- 6.) Portable Hard drives with key information on it
- 7.) Generators
- 8.) Digital Cameras
- 9.) LED Flashlights
- 10.) Inverters
- 11.) Electronic Medical Equipment
- 12.) Batteries for the Electronic equipment

Local preparations for this type of event should revolve around public safety departments ensuring that they have redundant communications gear, laptop computers and charging devices for both stored in localized Faraday cages. At a minimum the redundant devices mentioned plus other mentioned above should be wrapped in heavy duty aluminum foil and then wrapped in bubble wrap. Once items are secured, these devices can then be stored in a galvanized steel trash can with a tight fitting lid. For extra protection these trash cans can then be stored in a steel Conex box. This layered approach will provide the best opportunity for these devices to survive the EMP.



## **APPENDIX F**

### **DOCUMENTATION OF THE PLANNING PROCESS**

- Metro Boston Hazard Mitigation Team
- Hazard Mitigation Executive Steering Committee
- Boston Water and Sewer Commission
- Regulation Working Group
- Facilities Working Group
- Infrastructure Working Group
- Public Safety Working Group
- Attendance at the Collaborative Working Group Meetings
- Natural Hazard Mitigation Meeting on the NOAA Tide Gauge during Hurricane Sandy

CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE



Don Boyce  
DIRECTOR



Edward M. Lambert Jr.  
COMMISSIONER



Marc D. Draisen  
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 BOSTON NATURAL HAZARD MITIGATION PLAN 2014 UPDATE



*Smart Growth & Regional Collaboration*

## Meeting Agenda Boston Hazard Mitigation Plan Steering Committee

February 8, 2012 10:30 AM - 12:00 PM  
Boston City Hall  
Conference Room 608

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1. Explain the Hazard Mitigation Planning process and purpose
2. Discuss and Confirm Goals & Objectives (2008 Goals & Objectives on reverse)
3. Discuss public engagement under this process
4. Discuss the schedule and staff participation
5. Share maps and SERI process

---

**Project Overview** - MAPC received a grant to update *Hazard Mitigation Plans* for the communities of Boston, Brookline, Cambridge, Chelsea, Everett, Malden, Medford, Melrose, and Somerville. MAPC is working with the eight communities to update 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 and update those plans every five years, in order to remain eligible for FEMA Hazard Mitigation Grants.

This FEMA planning program is separate from new or ongoing homeland security initiatives, floodplain mapping, or a community's Comprehensive Emergency Management Plan (CEMP) 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.

60 Temple Place, Boston, MA 02111 • 617-451-2770 • Fax 617-482-7185 • [www.mapc.org](http://www.mapc.org)

Michelle Ciccolo, *President* • Lynn Duncan, *Vice President* • Marilyn Contreas, *Secretary* • Taber Keally, *Treasurer* • Marc Draisen, *Executive Director*

**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**



*Smart Growth & Regional Collaboration*

**Meeting Agenda  
Boston Hazard Mitigation Plan  
Steering Committee**

September 6, 2012 10:30 AM - 12:00 PM  
Boston City Hall  
Conference Room 608

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1. Overview of the Hazard Mitigation Planning purpose and process
2. Discuss Hazard Mitigation Measures for the plan
  - a. Review, modify as needed, and confirm list of Hazard Mitigation measures
  - b. Identify additional information needed by department
  - c. Review, modify as needed, and confirm priorities for Hazard Mitigation measures
3. Additional information needed on status of existing Hazard Mitigation Measures
4. Discuss public engagement
  - a. City web site
  - b. Outreach to stakeholders & neighboring communities
  - c. Second public meeting
5. Next steps

---

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**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**



*Smart Growth & Regional Collaboration*

**Meeting Agenda  
Boston Hazard Mitigation Planning Team**

January 30, 2012 11:00 AM - 2:00 PM

Boston Water & Sewer Commission

980 Harrison Avenue

3rd Floor Engineering Conference Room

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The purposes of this meeting are to:

1. Explain the Hazard Mitigation Planning process and purpose,
2. explain the VCAPS process as it is broadly used to characterize vulnerability to climate change in different places,
3. work with meeting attendees to build template diagram(s) that will serve as the baseline for describing vulnerability to flooding in Boston in terms of the causes and impacts, and
4. decide how to move ahead with constructing more detailed VCAPS diagrams with larger group of participants that will focus on identifying mitigation actions across a range of physical improvements, management activities, and regulatory changes.

11:00 Introductions (10 min)

11:10 Clarify purpose and agenda (5 min)

11:15 Explain VCAPS and give examples, answer questions (15 min)

11:30 Build VCAPS template diagram (1 hour)

12:30 BREAK (15 min)

12:45 Build second/third VCAPS template diagram(s) or continue to refine first diagram (45 min)

1:30 Discuss next steps: How to move ahead? Strategy and logistics. Who will be involved in moving these diagrams to the next level? When will it happen? How will it feed the HMP process?

2:00 Adjourn

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**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**



*Smart Growth & Regional Collaboration*

**Meeting Agenda  
Boston Hazard Mitigation Plan Update  
Infrastructure Group  
Boston, MA**

March 28, 2012 10:00 AM - 12:30 PM  
Boston City Hall  
BRA Boardroom, 9<sup>th</sup> Floor, Room 900

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In order to make this meeting time as efficient as possible, we ask that all meeting participants review the following materials in advance of the meeting:

- Attendance list
- Worksheet on existing mitigation measures and those proposed in the 2008 plan
- HAZUS info sheet and outcomes summary
- SERI Stormwater Narrative

1. Overview of Project Scope and Status – 5 minutes
2. Introduce Boston Hazard Mitigation Planning map series and digitized ortho photo – 10 minutes
3. Boston HAZUS Results -15 minutes
4. Review SERI's diagramming process and present outcomes from BWSC meeting – 20 minutes
5. Characterize hazards from flooding, extreme temps, winter storms – 45 minutes
6. List Potential Mitigation Measures utilizing the diagram and maps – 30 minutes
7. Present outcomes of group work – 20 minutes
8. Wrap up – 5 min

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**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**



*Smart Growth & Regional Collaboration*

**Meeting Agenda  
Boston Hazard Mitigation Plan Update  
Regulation Group  
Boston, MA**

April 4, 2012 10:00 AM - 12:30 PM  
Boston City Hall  
BRA Boardroom, 9<sup>th</sup> Floor, Room 900

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In order to make this meeting time as efficient as possible, we ask that all meeting participants review the following materials in advance of the meeting:

- Worksheet on existing mitigation measures and those proposed in the 2008 plan
  - SERI Stormwater Narrative
1. Overview of Project Scope and Status – 5 minutes
  2. Introduce Boston Hazard Mitigation Planning map series and digitized ortho photo – 10 minutes
  3. Boston HAZUS Results -15 minutes
  4. Review SERI’s diagramming process and present and discuss outcomes from previous meetings – 40 minutes
  5. Characterize the real estate development process as it relates to the potential impacts of flooding and hurricanes/northeasters – 35 minutes
  6. List Potential Mitigation Measures utilizing the diagram– 30 minutes
  7. Present outcomes of group work –10 minutes
  8. Wrap up – 5 min

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**Project Overview** - MAPC received a grant to update *Hazard Mitigation Plans* for the communities of Boston, Brookline, Cambridge, Chelsea, Everett, Malden, Medford, Melrose, and Somerville. MAPC is working with the eight communities to update 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 and update those plans every five years, in order to remain eligible for FEMA Hazard Mitigation Grants.

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**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**



*Smart Growth & Regional Collaboration*

**DRAFT  
Meeting Agenda  
Boston Hazard Mitigation Plan Update  
Regulation Group  
Boston, MA**

April 25, 2012 10:00 AM - 12:30 PM

Boston City Hall

BRA Boardroom, 9<sup>th</sup> Floor, Room 900

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1. Overview of Project Scope and Status
2. Boston HAZUS Results (Potential Impacts of Flooding, Hurricanes, & Earthquakes)
3. Unreinforced Masonry Building Pilot Study (Specific Impacts of Earthquakes & Other Hazards)
4. Discuss Outcomes of Previous Meetings
5. Identify Potential Mitigation Measures
6. Wrap up

---

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**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**



*Smart Growth & Regional Collaboration*

**Meeting Agenda  
Boston Hazard Mitigation Plan Update  
Public Safety Group  
Boston, MA**

May 10, 2012 10:00 AM - 12:30 PM  
Boston City Hall  
BRA Boardroom, 9<sup>th</sup> Floor, Room 900

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1. Overview of Project Scope and Status
2. Boston HAZUS Results (Potential Impacts of Flooding, Hurricanes, & Earthquakes)
3. Presentation: Fire as a Natural Hazard – Hylton Haynes, National Fire Protection Association
4. Discuss Outcomes of Previous Meetings – SERI Presentation
5. Where are the areas of concern for each hazard? – Mapping exercise
  1. Flooding
  2. Wind
  3. Snow
  4. High Temperatures
  5. Fire
  6. Earthquake
6. Wrap up

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**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**

| <b>Attendance at the Collaborative Working Group Meetings</b> |                                     |
|---|-------------------------------------|
| <b>Name</b>   | <b>Representing</b>                 |
| <b>Infrastructure Group, March 28, 2012</b>                   |                                     |
| Donald Burgess  | BTD                                 |
| Chris Busch   | BCC                                 |
| William Foley   | BWSC                                |
| Aldo Ghirin   | Boston Parks and Recreation         |
| Valeria Gingrich  | CZM                                 |
| William Gode  | DCR—Flood Control-Charles River Dam |
| Pat Haswell   | Veolia                              |
| Michael Hornbrook   | MWRA                                |
| Heather Hume  | MBTA                                |
| Para Jayasinghe   | PWD                                 |
| Marcis Kempe  | MWRA                                |
| Joseph Lima   | Houghton Chemical                   |
| Rick McCullogh  | MassDOT                             |
| Joseph Pelczarski   | EEA/CZM                             |
| Don Silvia  | Veolia                              |
| Christian Simonelli   | BGWT                                |
| Maurice Smith   | PWD                                 |
| Carl Spector  | EM                                  |
| John Sullivan   | BWSC                                |
| Brad Wellock  | MASSPORT                            |
| Elaine Sudanowicz   | OEM                                 |
| James Freas   | MAPC                                |
| Martin Pillsbury  | MAPC                                |
| Sarah Danly   | MAPC                                |
| Elizabeth Oriel   | SERI                                |
| Seth Tuler  | SERI                                |
| Tom Webler  | SERI                                |
| <b>Regulation Group<br/>April 4, 2012</b>                     |                                     |
| Kathryn Aldrich   | Disability Comm.                    |
| Chris Busch   | BED                                 |
| John Dalzell  | BRA                                 |
| Neenah Estrella-Luna  | Northeastern University             |
| Lynda Fraley  | OBM                                 |
| Jim Greene  | ESC                                 |
| Elliott Laffer  | BGWT                                |
| Ellen Lipsey  | BLC                                 |
| Michael Mackan  | ISD                                 |
| Tula Mahl   | Elderly Affairs                     |
| Paul Osborn   | BRA/EDIC                            |
| Greg Rooney   | BTD                                 |
| Christian Simonelli   | BGWT                                |

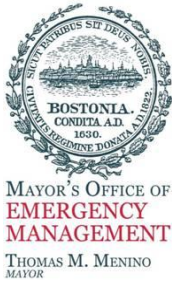
**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**

| <b>Attendance at the Collaborative Working Group Meetings</b> |   |
|---|---|
| Carl Spector  | BED                                     |
| Jack Tracy  | BPHC                                    |
| Elaine Sudanowicz   | OEM                                     |
| James Freas   | MAPC                                    |
| Martin Pillsbury  | MAPC                                    |
| Elizabeth Oriel   | SERI                                    |
| Seth Tuler  | SERI                                    |
| Tom Webler  | SERI                                    |
| <b>Buildings and Facilities Group</b>                         |   |
| <b><i>April 25, 2012</i></b>                                  |   |
| Robert Burger   | UMB                                     |
| Bill Cai  | BHA                                     |
| Mike Catsos   | NESEC                                   |
| Martha Clark  | COSTEP MA                               |
| Michael Comeau  | COSTEP MA                               |
| Robert Dillon   | BPHC                                    |
| Lori Foley  | COSTEP MA                               |
| Lynda Fraley  | OBM                                     |
| Ed Fratto   | NESEC                                   |
| Ben Haavik  | Historic New England                    |
| James Lane  | ISD                                     |
| Carlene Laurent   | PCMD                                    |
| Harold McGonagle  | ISD                                     |
| Anne Marie McLaughlin   | UMB                                     |
| Jim Meade   | BPL                                     |
| Steve O'Brien   | BPHC                                    |
| Gordon Otis   | Aon                                     |
| Matt Ottinger   | Boston History Society, Old State House |
| Lisa Pena   | NFS                                     |
| Belkis Roman  | BPHC                                    |
| John Sinagra  | COB PMD                                 |
| James Smith   | DND                                     |
| Joseph Spinelli   | BHA                                     |
| Gregor Trinkaus-Randall                                       | MBLC                                    |
| Kevin Wood  | BHA                                     |
| Elaine Sudanowicz   | OEM                                     |
| James Freas   | MAPC                                    |
| Elizabeth Oriel   | SERI                                    |
| Seth Tuler  | SERI                                    |
| Thomas Webler   | SERI                                    |
| <b>Public Safety Group</b>                                    |   |
| <b><i>May 10, 2012</i></b>                                    |   |
| Lydia Agro  | BHA                                     |
| Michael Colanti   | BPHC/EMS                                |
| Rick Deraney  | BPS                                     |

**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**

| <b>Attendance at the Collaborative Working Group Meetings</b> |               |
|---|---------------|
| Emma DeSimone   | OEM           |
| John Dolan  | BFD           |
| Rene Fielding   | OEM           |
| Richard Gagnon  | BSOB          |
| John Hardman  | BFD           |
| Hylton Haynes   | NFPA          |
| Joseph McNiff   | BPD           |
| Stephen Melia   | BHA           |
| Paul Shoemaker  | BPHC          |
| Albe Simenas  | Mass DEP      |
| Carl Spector  | BED           |
| John Sullivan   | BWSC          |
| Eric Weston   | School Police |
| Elaine Sudanowicz   | OEM           |
| James Freas   | MAPC          |
| Martin Pillsbury  | MAPC          |
| Sarah Danly   | MAPC          |
| Elizabeth Oriel   | SERI          |
| Seth Tuler  | SERI          |

# CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN 2014 UPDATE



## **NOAA National Weather Service – Taunton Natural Hazard Mitigation Meeting with the City of Boston on the NOAA Boston Harbor Tide Gage during Hurricane Sandy**

On December 11, 2012, NWS-Taunton briefed the City of Boston on their concern that a storm like Sandy but a little further north and coincident with a high spring tide could cause the Boston Harbor Tide Gage to exceed its high water mark of 15.25 feet above Mean Lower Low Water (MLLW) established during the 1978 Blizzard.

The timing of super-nor'easter Sandy's move toward Boston during low tide was advantageous to the City of Boston. If it were not for the timing and direction of Sandy, the City of Boston would have experienced greater coastal inundation resulting in damaging flooding. As OEM closely monitored Hurricane Sandy move up the Atlantic coast, there was a very strong Canadian High over Newfoundland and a very strong low pressure system moving west over the Appalachians. Like two gears running opposite of the other the high and the low pushed Sandy into New York and New Jersey and not directly toward the City of Boston. It is well within the realm of possibility that the Boston tide gage will exceed that value to at least the tune of 16 or 17 feet MLLW given a 4 to 6 foot storm surge on a high spring tide. In fact, a 6 foot storm surge (very infrequent but not unheard of) on top of a 12 foot MLLW astronomical high tide, which occurs a few times each year, would result in a very problematic 18 foot MLLW storm tide for Boston Harbor. One would expect to see an increasing risk of attaining such a value in a storm with continued sea level rise.

The meeting was held in the Environment Department at Boston City Hall, Conference Room 603 from 2:00 pm until 4:00pm. The individuals who participated in the meeting include:

Leah Bamberger, Administrative Assistant, Mayor's Office of Environmental and Energy Services  
Nicole M. Belk, Senior Hydrologist, NOAA NWS Forecast Office - Taunton  
Chris Busch, Senior Waterfront Planner, Boston Redevelopment Authority  
Rene Fielding, Mayoral Cabinet Chief and Director, Mayor's Office of Emergency Management  
Stephanie Krueel, Flood Plain Manager and Executive Director, Boston Conservation Commission  
Carl Spector, Executive Director, Air Pollution Control Commission, Environment Department  
Elaine M. Sudanowicz, Interagency Coordinator, Mayor's Office of Emergency Management  
John Sullivan, Chief Engineer, Boston Water and Sewer Commission  
Brian Swett, Mayoral Cabinet Chief and Director, Office of Environmental and Energy Services  
Robert M. Thompson, Meteorologist-in-Charge, NOAA NWS Forecast Office - Taunton

Elaine M. Sudanowicz  
Interagency Coordinator  
Mayor's Office of Emergency Management

## CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN 2014 UPDATE

Friday, November 22, 2013 from 8:00am to 4:30pm at Boston College

### High Water Scenario for Boston

Two events in just the past three years had the potential to produce major, if not more aptly termed, extreme, coastal flooding of the City of Boston. These events, one on February 26, 2010 and another being Hurricane Sandy, had the potential with a relatively modest adjustment in track and/or timing to set a new record high water level in Boston Harbor. Each event had the potential to exceed the Blizzard of February 1978 high water mark by one to one and a half feet. The City of Boston along with state and federal partners have begun to take a serious look at the coastal flood potential due to sea level rise and have begun to establish strategic planning to address and mitigate this threat. Recent events have illustrated, however, that the risk of very debilitating coastal flooding is already with us. The purpose of this seminar is to look at plans and resources to assist with more tactical responses if the City of Boston were to be threatened next week or next month with major coastal flooding exacerbated by heavy rainfall in the lower Charles River Basin.

This seminar is structured about the review of plans and resources to address a 17 to 17.5 foot Mean Lower Low Water (MLLW) storm tide in Boston Harbor. This scenario will assume a storm surge of 5.5 to 6 feet on top of a spring tide of 11 to 11.5 feet MLLW. Spring tides of 11 feet or greater typically occur several times every month when the gravitational pull of the sun and moon are in synch (full and new moon cycles with the highest levels when the moon is also at perigee in its orbit). Inundation maps suggest relatively widespread inundation of normally dry land in Boston with such a scenario. One would also expect serious flooding via backwater in harbor-directed drainage systems – a largely unseen but potentially extreme impact as discovered during Sandy in New York City. Such an event would be expected to have water lapping over at least portions of the Charles River Dam structure given a 1 to 2 foot wind wave in inner Boston Harbor. A tropical cyclone on a track like Sandy only 150 to 200 miles further north or a major winter nor'easter similar to the Blizzard of 2013 during the spring high tide cycle is each capable of yielding such a scenario. Such storms have historically also produced heavy precipitation. For the backdrop scenario to this seminar, we will assume that the storm dumps about 6 inches of rain in the lower Charles River Basin within a 12 hour period just prior to the peak storm tide. Such would be out of the ordinary but definitely plausible. The capability of the Charles River Dam to pump water out of the river is substantial, and this scenario would not be expected to exceed the design capacity of this facility. Nevertheless, such a high water scenario would place operations of the Charles River Dam in uncharted territory with respect to actual experience. Similarly, the combination of such high storm tides and fresh water runoff may place stresses on the Mystic and Neponset basins beyond the memory of most, if not all, people living today.

# CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN 2014 UPDATE



MAYOR'S OFFICE OF  
**EMERGENCY  
MANAGEMENT**  
THOMAS M. MENINO  
MAYOR



## City of Boston Natural Hazard Mitigation Plan Resolution Review Meeting

On Wednesday, January 16, 2013, the City of Boston's Office of Emergency Management (OEM) and the Environment Department met with the Metropolitan Area Planning Council (MAPC) for the purpose of resolving any outstanding issues during the review and preliminary crosswalk of the City of Boston Natural Hazard Mitigation Plan.

The meeting was held in the Environment Department at Boston City Hall, Room 805 from 10:00 am until 11:30am. The individuals who participated in the meeting include:

Emma DeSimone, Regional Catastrophic Planner, OEM

Christina Maryland, Director of Communication and External Affairs, OEM

Cadet Brian C. Mulvey, Massachusetts Maritime Academy, Intern OEM

Martin Pillsbury, Manager of Regional Planning Services, MAPC

Carl Spector, Executive Director, Air Pollution Control Commission, Environment Department

Elaine M. Sudanowicz, Interagency Coordinator, OEM

Elaine M. Sudanowicz  
Interagency Coordinator  
Mayor's Office of Emergency Management

**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**

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**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**

**APPENDIX G  
DOCUMENTATION OF PUBLIC PARTICIPATION**

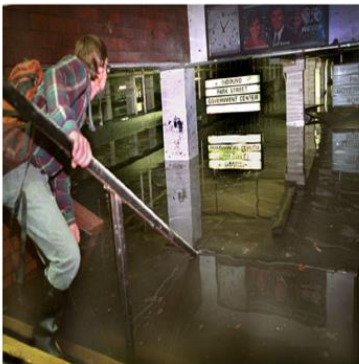
**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**

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# HAZARD MITIGATION PLAN

## PUBLIC MEETING

*Natural hazards can be devastating for the City of Boston and its residents.*



*The Boston 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 Boston Conservation Commission in a discussion about the Boston Hazard Mitigation Plan*

**DATE: WEDNESDAY, APRIL 18, 2012**

**TIME: 6:00PM**

**LOCATION: BOSTON CITY HALL, ROOM 801**

For more information or those requiring special accommodations, please contact: Elaine Sudanowicz via phone 617.635.1400 or email [elaine.sudanowicz@cityofboston.gov](mailto:elaine.sudanowicz@cityofboston.gov)



**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**

| <b>Attendance at Public Meeting<br/>Boston Conservation Commission<br/>April 18, 2012</b> |                                     |
|---|-------------------------------------|
| <b>Name</b>   | <b>Organization or Neighborhood</b> |
| <b><i>First Public Meeting, April 18, 2012</i></b>  |                                     |
| Chris Busch   | Conservation Commission             |
| Charles Button  | Conservation Commission             |
| John Lewis  | Conservation Commission             |
| Vivien Li   | Conservation Commission             |
| Toni Pollak   | Conservation Commission             |
| Glenn Field   | National Weather Service; Taunton   |
| Rene Fielding   | City of Boston                      |
| Lori Foley  | Heritage Preservation               |
| Lorie Hayes   | Boston Climate Action Network       |
| Tucker Husband  | Mission Hill/Longwood               |
| Anne Marie McLaughlin   | UMass Boston                        |
| Richard Parr  | A Better City                       |
| Gregor Trinkaus-Randall   | COSTEP                              |
| Kenneth Ward  | Jamaica Plain                       |
| Zara Zsido  | Roxbury                             |
| Elaine Sudanowicz   | OEM                                 |
| James Freas   | MAPC                                |
| Martin Pillsbury  | MAPC                                |
| Sarah Danly   | MAPC                                |

# PUBLIC MEETING

## HAZARD MITIGATION PLAN REVIEW

*Natural hazards can be devastating for the City of Boston and its residents.*



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

*Join the Boston Conservation Commission in a review of the*  
**BOSTON HAZARD MITIGATION PLAN (DRAFT)**

**DATE:** Wednesday, September 18, 2013

**TIME:** 6:00PM

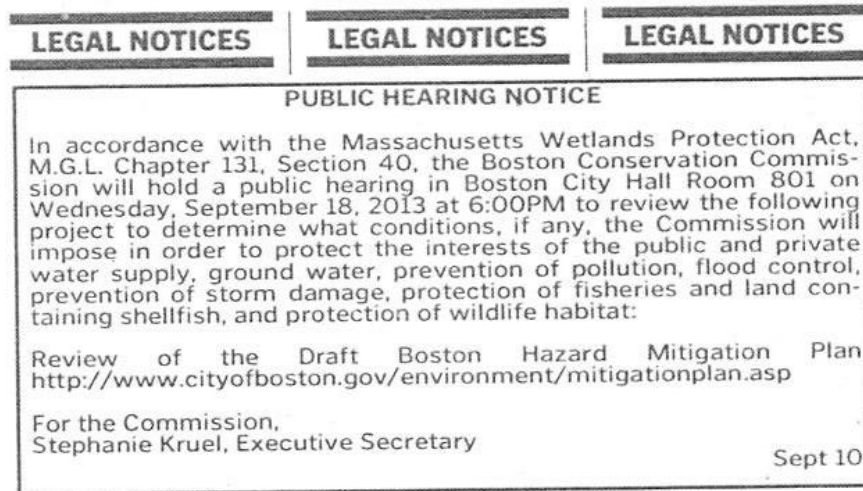
**LOCATION:** Boston City Hall, Room 801

*For more information or those requiring special accommodations, please contact:*  
*Elaine Sudanowicz via phone: 617.635.1400 or*  
*email: [elaine.sudanowicz@cityofboston.gov](mailto:elaine.sudanowicz@cityofboston.gov)*



# CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN 2014 UPDATE

## Facebook Posting for Sept. 18, 2013 Public Meeting



Boston Herald Legal Notice, September 10, 2013

**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**



**CITY OF BOSTON  
THE ENVIRONMENT DEPARTMENT**

Boston City Hall, Room 805 • Boston, MA 02201 • 617/635-3850 • FAX: 617/635-3435

**PUBLIC HEARING  
September 18, 2013**

In accordance with the Massachusetts Wetlands Protection Act, M.G.L. Chapter 131, Section 40, the BOSTON CONSERVATION COMMISSION will hold a public hearing in Boston City Hall, Room 801 on September 18, 2013 to review the following projects to determine what conditions, if any, the Commission will impose in order to protect the interests of the public and private water supply, ground water, prevention of pollution, flood control, prevention of storm damage, protection of fisheries and land containing shellfish, and protection of wildlife habitat:

6:00 PM Review of the Draft Boston Hazard Mitigation Plan

7:00 PM Notice of Intent for DEP File No. 006-1359 from Shipyard Quarters Marina, Rehabilitation and Reconfiguration of berth slips, access docks and wave attenuators, 1 13<sup>th</sup> St, Piers 6 & 8, Charlestown, Boston Harbor (Land Under Ocean)

7:30 PM Request for Extension of OOC for DEP File No. 006-0971, Charles River Basin Shoreline Vegetation Management Plan

7:35 PM *Updates and General Business*

- Requests for Certificates of Compliance
  - o DEP File No. 006-1185 from Massport for Boston Fish Pier Parking Modifications, 212 Northern Ave
  - o DEP File No. 006-1194 from Massport for Electrification of Berths at Fish Pier, 212 Northern Ave
  - o DEP File No. 006-1217 from Massport for Cruiseport Terminal Interior Enhancements, One Black Falcon Ave
  - o DEP File No. 006-1226 from Massport for Conley Terminal Electrical Infrastructure Modernization and Expansion
  - o DEP File No. 006-1242 from Massport for Castle Island Shoreline Improvements
  - o DEP File No. 006-1270 from Massport for Fish Pier Repairs, 212 Northern Ave (fenders, bollards, & ladders)
  - o DEP File No. 006-1272 from Massport for Seafarer's Way Project, Conley Terminal
  - o DEP File No. 006-1319 from Massport for State Police Trailer Installation, Fish Pier, 212 Northern Ave
  - o DEP File No. 006-1327 from United States Postal Service for Loading Dock Improvements at 25 Dorchester Ave
  - o DEP File No. 006-1245 from Harbor Towers Trustees, Seawall Repairs & Maintenance, 85 East India Row
- Meeting Minutes: August 7, 2013

Sign Language interpreters are available upon prior request. The Commission will hold a public meeting immediately following the last hearing or as appropriate following any hearing. Plans and filings with the Commission may be viewed at the Environment Department, Boston City Hall, Room 805, during regular business hours, 9 AM to 5 PM Monday through Friday. For more information, call 617-635-4417.

For the Commission,

*Stephanie Kruei, Executive Secretary*

---

Nancy L. Girard, Commissioner

Thomas M. Menino, Mayor

**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**

| <b>Attendance at Public Meeting<br/>Boston Conservation Commission<br/>September 18, 2013</b> |  |
|---|--|
| <b>Name</b>   | <b>Organization or Neighborhood</b>            |
| Charles Button  | Conservation Commission / West Roxbury         |
| Stephen Kunian  | Conservation Commission / Back Bay             |
| John Lewis  | Conservation Commission / Back Bay             |
| Vivien Li   | Conservation Commission / Back Bay             |
| Antonia Pollak  | Conservation Commission / Charlestown          |
| John Sullivan   | Conservation Commission / Dorchester           |
| Stephanie Krueel  | Executive Secretary / Roslindale               |
| Rick Corsi  | MA Dept of Conservation & Recreation           |
| Judy Kolligian  | Boston Climate Action                          |
| Nan Johnson   | FEMA Region 1 / Financial District / Cambridge |
| Brigitte Ndikum-Nyada   | FEMA Region 1/ Financial District              |
| Julia Sable   | Museum of Science                              |
| Lorie Hayes   | Boston Climate Action Network / Mission Hill   |
| Tucker Husband  | Mission Hill / Longwood                        |
| Melissa Daes  | MIT / Jamaica Plain                            |
| Zara Zsido  | Lower Roxbury                                  |
| Tom Palmer  | Newton / Boston                                |
| Peter Davidoff  | Boston   |
| Richard Gagnon  | State House                                    |
| Anthony DeOliveira  | Roxbury  |
| Nancy Nee   | Dorchester                                     |
| Ninya Loeppky   | Jamaica Plain                                  |
| Dean Matsuno  | Roslindale                                     |
| Stephen Mitchell  | Downtown / Financial District                  |
| Justin Porter   | West End                                       |
| Sherry Grancy   | Charlestown                                    |
| Jack Boyle  | Charlestown                                    |
| Deborah DelBuono  | Charlestown                                    |
| Karen Zell  | Charlestown Navy Yard                          |
| Tanya Guidi   | Flagship Wharf                                 |
| Richard Burttt  | Charlestown                                    |
| Elaine Sudanowicz   | OEM / Dorchester                               |
| Martin Pillsbury  | MAPC   |



**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**

**List of Cooperative Stakeholders Invited to the Public Meetings**

| <b>First Name</b> | <b>Last Name</b> | <b>Title/Role</b>                   | <b>Organization</b>   |
|-------------------|------------------|-------------------------------------|---|
| Brian             | Swett            | Mayor's Cabinet Chief and Director  | Mayor's Office of Environmental and Energy                            |
| Rene              | Fielding         | Mayor's Cabinet Chief and Director  | Mayor's Office of Emergency Management                                |
| Jim               | Hunt             | Mayor's Cabinet Chief (former)      | Mayor's Office of Environmental and Energy                            |
| Don               | McGough          | Mayor's Cabinet Chief (former)      | Mayor's Office of Emergency Management                                |
| Vivian            | Li               | President                           | The Boston Harbor Association, et.al.                                 |
| Sarah             | Hamilton         | Vice President MASCO                | Longwood Medical Area   |
| Kelley            | Brilliant        | Executive Director                  | Fenway Alliance   |
| Claire            | Ramsbottom       | Executive Director                  | Colleges of the Fenway  |
| Michael           | Dolan            | Emergency Property Management       | Colleges of the Fenway  |
| Greg              | Vasil            | CEO                                 | Greater Boston Real Estate Board                                      |
| Paul              | Guzzi            | President and CEO                   | Greater Boston Chamber of Commerce                                    |
| Rick              | Dimino           | President and CEO                   | A Better City   |
| Richard           | Parr             | Director of Policy                  | A Better City   |
| Kairos            | Shen             | Director of Planning                | Boston Redevelopment Authority  |
| John              | Erwin            | Executive Director                  | Conference of Boston Teaching Hospitals                               |
| Patricia          | Noga             | Senior Director - Clinical Affairs  | Massachusetts Hospital Association                                    |
| Barry             | Wante            | Director of Emergency Management    | Brigham and Women's Hospital  |
| Megan             | McClaire         | Health Impact Assessment HIA        | Boston Public Health Commission                                       |
| Shannon           | O'Malley         | Health Impact Assessment HIA        | Boston Public Health Commission                                       |
| PJ                | McCann           | Health Impact Assessment HIA        | Boston Public Health Commission                                       |
| Edward            | Fratto           | Executive Director                  | Northeast States Emergency Consortium                                 |
| Glenn             | Field            | Warning Coordination Meteorologist  | National Weather Service - Taunton                                    |
| Robert            | Thompson         | Meteorologist-in-Charge             | National Weather Service - Taunton                                    |
| Matthew           | Walsh            | Civil Engineer                      | US Army Corps of Engineers - New England                              |
| David             | Aronstein        | Program Director                    | Boston Alliance for Community Health                                  |
| June              | Kevorkian        | Director of Programs                | Boston Consortium of Higher Education                                 |
| John              | Tommaney         | Director Emergency Management       | Boston College  |
| AnneMarie         | McLaughlin       | Emergency Mgt and Bus Continuity    | UMASS Boston  |
| George            | Noonan           | Director/Chief Public Safety        | Emerson College   |
| Stephen           | Morash           | Dir. of Emergency Response Planning | Boston University   |
| Julia             | Sable            | Education Associate                 | Museum of Science - Boston  |
| Nora              | Donnelly         | Conservation and Collections Mgr    | Museum of Fine Arts - Boston  |
| Lori              | Foley            | Vice President - Emergency Programs | Heritage Preservation and COSTEP                                      |
| Ellen             | Douglas          | Assistant Professor of Hydrology    | UMASS Boston  |
| Uri S.            | ten Brink        | Professor of Geophysics (Tsunami)   | U.S. Geological Survey; Woods Hole Oceanographic Institution          |
| Laurie            | Baise            | Professor of Civil Engineering      | Tufts Dept of Civil and Environmental Engineering                     |
| John              | Ebel             | Director of Seismology              | Weston Observatory - Earth and Environmental Sciences, Boston College |

**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**

| <b>First Name</b> | <b>Last Name</b>  | <b>Title/Role</b>                | <b>Organization</b>   |
|-------------------|-------------------|----------------------------------|---|
| Justin            | Starr             | Associate Director of OPS        | Weston Observatory - Earth and Environmental Sciences, Boston College |
| Dr. James         | Kaklamanos        | Merrimack College                | Dept. of Civil and Environmental Engineering                          |
| Richard           | Vogel             | Professor                        | Tufts Dept of Civil and Environmental Engineering                     |
| Brian             | Thomas            | Doctoral Candidate               | Tufts Dept of Civil and Environmental Engineering                     |
| Elliott           | Laffer            | Executive Director               | Boston Groundwater Trust  |
| Christian         | Simonelli         | Technical Recharge Coordinator   | Boston Groundwater Trust  |
| Paul              | Kirshen           | Professor                        | University of New Hampshire (Sea Level Rise)                          |
| Marcia            | Brooks            | Project Director                 | Media Access Group WGBH (Disabilities All Access)                     |
| Barry             | Wante             | Director of Emergency Management | Brigham and Women's Hospital  |
| Paul              | Guzzi             | Chamber President and CEO        | Greater Boston Chamber of Commerce                                    |
| Catherine         | D'Mato            | President and CEO                | Greater Boston Food Bank  |
| Carol             | Tienken           | Chief Operating Officer          | Greater Boston Food Bank  |
| Henry             | Lee               | Founder and Beacon Hill Activist | Friends of the Public Garden  |
| David             | Eppstein          | Vice President of Operations     | MASCO   |
| Craig             | Altemose          | Founder and Executive Director   | Better Future Project (350.org)                                       |
| Katie             | Reed              | Executive Director               | Allston Village Main Streets  |
| Sandra            | Kennedy           | Executive Director               | Bowdoin Geneva Main Streets   |
| Rosie             | Hanlon            | Executive Director               | Brighton Main Streets   |
| Courney           | Ho                | Executive Director               | Chinatown Main Streets  |
| Joyce             | Stanley           | Executive Director               | Dudley Square Main Streets  |
| Clark             | Moulaison         | Executive Director               | East Boston Main Streets  |
| Betsy             | Cowan             | Executive Director               | Egleston Square Main Streets  |
| Evelyn            | Darling           | Executive Director               | Fields Corner Main Streets  |
| Shelly            | Goehring          | Executive Director               | Four Corners Main Streets   |
| Axel              | Starke            | Executive Director               | Grove Hall Main Streets   |
| Carlos            | Schillaci         | Director                         | Hyde/Jackson Square Main Streets                                      |
| Patrice           | Gattozzi          | Executive Director               | Hyde Park Main Streets  |
| Randace           | Rauscher<br>Moore | Executive Director               | Jamaica Plain Centre/South Main Streets                               |
| Christine         | Rose              | Executive Director               | Mission Hill Main Streets   |
| Jody              | Burr              | Executive Director               | Roslindale Village  |
| Dan               | Larner            | Executive Director               | St. Mark's/Ashmont Area Main Streets                                  |
| Zach              | Cohen             | Executive Director               | Upham's Corner Main Streets   |
| Jennifer          | Effron            | Executive Director               | Washington Gateway Main Streets                                       |
| Joni              | Walter            | Executive Director               | West Roxbury Main Streets   |
| Lorraine          | Downey            | Environmental/community activist | Member of the Board TBHA  |
| Carole            | Mathieson         | Associate Director               | Jamaica Plain   |
| Ken               | Ward              | Neighborhood Activist            | Jamaica Plain   |
| Ellen             | Spring            | Neighborhood Activist            | Dorchester  |
| Paul F.           | Sullivan          | Neighborhood Activist            | Mission Hill  |

**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**

| <b>First Name</b> | <b>Last Name</b> | <b>Title/Role</b>                  | <b>Organization</b>  |
|-------------------|------------------|------------------------------------|--|
| Pat               | Simpson          | Boston Citizen's Corp Volunteer    | Charlestown  |
| Stephen           | Spinetto         | Boston Citizen's Corp Volunteer    | Charlestown  |
| Elizabeth         | Charney          | Boston Citizen's Corp Volunteer    | Jamaica Plain  |
| Joel R.           | Wolf             | Neighborhood Activist              | Back Bay   |
| Jan               | Galkowski        | Quantitative Engineer - Climate    | Westwood Environmental Action Committee                          |
| Loie              | Hayes            | Coordinator                        | Boston Climate Action Network (BostonCAN)                        |
| Zara              | Zsido            | Environmental Community Activist   | Boston Climate Action Network (BostonCAN)                        |
| Ninya             | Loeppky          | Environmental Community Activist   | Boston Climate Action Network (Boston CAN)                       |
| Petra             | Hall             | Environmental Community Activist   | Boston Climate Action Network (Boston CAN)                       |
| Viki              | Bok              | Environmental Community Activist   | Boston Climate Action Network (Boston CAN)                       |
| Sheila M.         | Green            | Director of Public Relations       | Conventures, Inc. (Boston Harbor Waterfront)                     |
| Matthew           | Cahill           | Program Coordinator                | Boston Natural Areas Network (BNAN), Boston Urban Forest Program |
| Kyle              | Greaves          | Director                           | Urban Ecology Institute, Sustainable Cities Program              |
| Bill              | Toomey           | Director                           | The Nature Conservancy, Forest Health Protection Program         |
| Dr. Neenah        | Estrella-Luna    | Professor of Law and Policy        | Northeastern University, Sustainability and Climate Change       |
| Ulla              | Hester           | Area Planner and Development       | MASCO, Longwood Medical Area                                     |
| George D.         | Naslas           | Vice President                     | Weston and Sampson, Inc.   |
| Anthony           | Dutzik           | Senior Policy Analyst              | Frontier Group (Extreme Weather)                                 |
| Mishac            | Yegian           | Professor                          | Northeastern University (Soil Liquefaction Mitigation)           |
| Carl              | Spector          | Director of Air Quality Control    | Office of Environmental and Energy Services                      |
| Elaine M.         | Sudanowicz       | Interagency Coordinator            | Office of Emergency Management                                   |
| James             | Freas            | Regional Planner (former)          | Metropolitan Area Planning Council                               |
| Martin            | Pillsbury        | Director of Environmental Planning | Metropolitan Area Planning Council                               |

**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**

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**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**

**APPENDIX H  
DOCUMENTATION OF PLAN ADOPTION**

**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**

**OFFERED BY COUNCILOR STEPHEN J. MURPHY**

**Flaherty, Ciommo, McCarthy, O'Malley, Pressley, Wu, Linehan, Jackson and Baker**

**CERTIFICATE OF ADOPTION  
CITY COUNCIL  
CITY OF BOSTON, MASSACHUSETTS**

**RESOLUTION FOR THE ADOPTION OF THE CITY OF BOSTON  
NATURAL HAZARD MITIGATION PLAN 2014 UPDATE**

WHEREAS, the City of Boston, MA established an Executive Steering Committee to prepare the *City of Boston Natural Hazard Mitigation Plan 2014 Update*;

WHEREAS, the *City of Boston Natural Hazard Mitigation Plan 2014 Update* contains recommendations for several potential projects to mitigate impacts from natural hazards in the City of Boston;

WHEREAS, FEMA has issued a conditional approval of the *City of Boston Natural Hazard Mitigation Plan 2014 Update*;

WHEREAS, MEMA requires localities to adopt formally their respective Natural Hazard Plans; and

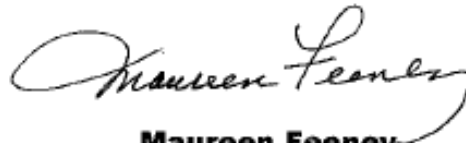
WHEREAS, adoption of the *City of Boston Natural Hazard Mitigation Plan 2014 Update* by the Boston City Council will make the City of Boston eligible for FEMA grant programs including Pre-Disaster Mitigation Assistance, Flood Mitigation Assistance, and the Hazard Mitigation Grant Program.

THEREFORE, BE IT RESOLVED that the Boston City Council adopts the *City of Boston Natural Hazard Mitigation Plan 2014 Update*.

ADOPTED AND SIGNED this Date. **September 16, 2015**

**In City Council September 16, 2015: Adopted**

**Attest:**



**Maureen Feeney  
City Clerk**

# **APPENDIX I**

**Climate Ready Boston**  
Municipal Vulnerability to Climate Change  
October 2013

[Published separately]

**CITY OF BOSTON NATURAL HAZARD MITIGATION PLAN  
2014 UPDATE**