



# Town of Marblehead

## **Natural Hazards Mitigation Plan**

June 2013



**DRAFT**

**Horsley Witten Group**  
*Sustainable Environmental Solutions*

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## **Acknowledgements**

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**Approved by Jeffrey Chelgren**

**Adopted by the Marblehead Board of Selectmen**

**Adopted by the Town of Marblehead Planning Board**

### **Additional Acknowledgements**

Mitigation planning has been successfully initiated in Marblehead with the continuing support and resources provided by the Massachusetts Emergency Management Agency. The guidance and assistance provided by the Massachusetts State Hazard Mitigation Committee is essential for implementing the strategy presented in this plan. Marblehead is also grateful for the efforts of the Hazard Mitigation Plan Implementation/Monitoring Team in preparing this plan.

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Geographic Information Systems Maps: Craig Pereira, Horsley Witten Group, Inc.

**Cover photo credits: Marblehead Patch**

**Formal Adoption Letter  
(Town Administrator/Board of Selectmen)  
Comes after MEMA/FEMA approval of DRAFT**

DRAFT



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## Section 1 Introduction

*Natural hazard mitigation is an action taken to permanently reduce or eliminate long-term risk to people and their property from the effects of natural hazards, technological or man-made hazards.*

### 1.1 Introduction

The Town of Marblehead, with the assistance of the Horsley Witten Group, developed this update to the Natural Hazards Mitigation Plan with funds provided through a Hazard Mitigation Assistance Grant from the Massachusetts Emergency Management Agency (MEMA). The Marblehead Hazard Mitigation Plan Implementation/Monitoring Team from the 2004 Plan was again, re-energized and re-organized to provide a broad spectrum of local knowledge and experience to complete this 2013 Update.

The Horsley Witten Group conducted a series of meetings from July 2012 through March 2013 with the appointed Marblehead Hazard Mitigation Plan Implementation/Monitoring Team, the community, and representatives of the Massachusetts Emergency Management Agency (MEMA). All meetings were held in an open public forum and in accordance with M.G.L. c. 30a, Sections 18-25 in complying with the requirements of the Federal Disaster Mitigation Act of 2000 (DMA 2000).

### 1.2 Purpose

Natural hazard mitigation is any sustained attempt to lessen the impact that a natural hazard poses to life, property, infrastructure, or other valuable resources. A plan to mitigate natural hazards includes a variety of preventative actions in the form of policies, community programs and capital projects targeted at minimizing the risk or impact of future severe weather or geological occurrences.

The purpose of this 2013 Update is to validate both known and potential hazard risks, evaluate the status of the primary and secondary mitigation measures identified in the 2004 Plan, and develop a new priority listing of community actions to carry forward. Each of these actions is intended to either mitigate the susceptibility of the community to a natural disaster or to better prepare the community to protect and manage the public once a natural disaster has occurred.

The community benefits of the implementation of an effective Natural Hazard Mitigation Plan may include:

- Reduction of public and private damage costs,
- Reduction of social, emotional, and economic disruption;
- Increased access to funding sources for hazard mitigation projects, and
- Increased access to funding sources for post-disaster recovery projects.

### 1.3 Planning Process

A hazard mitigation plan should be considered a living document that must grow and adapt, keeping pace with a community's growth and change. The Disaster Mitigation Act of 2000 (DMA) places high priority on the continuation of the planning process after the initial submittal, requiring communities to seek and receive re-approval from the Federal Emergency Management Agency (FEMA) in order to remain eligible for assistance. The evaluation, revision and update process is also a means to create an institutional awareness and involvement in hazard mitigation as part of daily activities.

In April 2010, the Town submitted a Pre-Disaster Mitigation grant application to the Massachusetts Emergency Management Agency (MEMA) for funds to update the local Town of Marblehead Natural Hazards Mitigation Plan. FEMA obligated funds to support the grant application and the Town contracted with the Horsley Witten Group, Inc. to facilitate the update.

Members of the Marblehead Hazard Mitigation Plan Implementation/Monitoring Team include:

- Jeff Chelgren, Town Administrator
- Chuck Cerrutti, Emergency Management Coordinator
- William Conly, Historical Commission
- Rebecca Curran, Town Planner
- Jason Gilliland, Fire Chief
- Bob Ives, Building Commissioner
- Willy Lanphear, Town Engineer/Conservation Commission Representative
- Chuck McCollum, Superintendent Water/Sewer Dept.
- Amy McHugh, Assistant Superintendent Water/Sewer Dept.
- Bob Picariello, Police Chief

A Kickoff Meeting was conducted on July 26, 2012 to review the project scope and revised schedule, discuss project coordination (data collection, municipal coordination and public outreach), review proposed revisions to the Update's mitigation measures layout (utilization of hazard mitigation categories) and identification of risks content (to include climate change and sea level rise), and coordinate the agenda and logistics for the first Public Workshop. The meeting Agenda, Revised Schedule and Sign-In Sheet are included in Appendix B.

A Project Webpage was designed and hosted on the Town's municipal website to announce the project, inform and engage the community before, during and after plan development, and to serve as a repository of project documents, presentations, and summaries. A PDF of the Project Webpage layout is included in Appendix B.

A series of Municipal Interviews (in-person, telephone and email correspondence) were conducted early in the Update process for the development of the 2004 Plan report card (Table 1-1), identification of accomplishments since the 2004 Plan, and preliminary identification of mitigation measures for consideration in the Update. Meeting Memorandums of the Municipal Interviews (October 12, 2012 and October 18, 2012 are included in Appendix B.

#### In-Person Interviews:

Chuck McCollum – Superintendent Water/Sewer Department.  
Amy McHugh – Assistant Superintendent Water/Sewer Department  
Jeff Chelgren – Town Administrator  
Bob Picariello – Police Chief  
Willy Lanphear - Engineering/Conservation  
Jason Gilliland – Fire Chief  
Emergency Management Director – Chuck Cerruti  
Tax Assessor – Mike Tumulty  
Harbormaster – Webb Russell  
Bob Ives – Building Commissioner  
Doug Gordon – Tree Warden

#### Telephone Interviews:

Bill Conley – Marblehead resident

The project consultant also coordinated with Richard Zingarelli, State Floodplain Manager regarding NFIP program coordination and repetitive flood loss properties.

The first Public Workshop, originally scheduled for October 29, 2012 was cancelled due to the arrival of Hurricane Sandy along the east coast. The Workshop was rescheduled to December 5, 2012 at the Abbot Public Library. Announcements were posted on the project webpage, emailed to Marblehead Boards, Commissions and interested citizens, ran in the Marblehead Reporter and was featured on Wicked Local – Marblehead (copies included in Appendix B). The presentation included an overview of the project, a review of the 2004 Risk Assessment Matrix Report Card, and preliminary revisions to the update (based on personal interviews with municipal officials, boards, and commissions). Participants were provided the opportunity to comment and also mark up town-wide maps with specific issues at identified locations. The Workshop agenda, PowerPoint Presentation and Sign-In Sheet are included in Appendix B.

The Marblehead Hazard Mitigation Plan Implementation/Monitoring Team met on January 15, 2013 to review the results of the public workshop, review the Risk Assessment, and review mitigation actions for consideration in the Update. A complete set of meeting materials is included in Appendix B.

Table 1-1  
2004 Risk Assessment Matrix (Report Card), Marblehead, Massachusetts

<i>Mitigation Measure</i>	<i>Location</i>	<i>Ownership</i>	<i>Natural Hazard</i>	<i>Primary Problem/Effect</i>	<i>Mitigation Objective</i>	<i>Risk</i> <i>H-Historical</i> <i>P- Potential</i>	<i>2013 Status</i>
<b>Priority Measures</b>							
Enroll in the Community Rating System	Town-wide	Public and Private	Flooding	Public and Private property damage	Protection of Public and Private property through discounted insurance premiums	H and P	Not Completed - Carry Forward
Official Town of Marblehead Website	<a href="http://www.marblehead.org/">http://www.marblehead.org/</a>	Public	N/A	Uninformed general public	Increase safety and institutional awareness of hazard mitigation measures	H and P	Completed - request to carry forward, expand information
Construct a New Sea Wall at the Causeway	The Causeway	Public	Flooding and Sand/Cobble Overwash	Public and Private property damage from overtopping of sea wall, and residents of the Neck are cut-off	Protection of Public and Private property, secured evacuation routes	H and P	Completed
Install Warning Lights at the Causeway	The Causeway	Public	Flooding and Sand/Cobble Overwash	Residents of the Neck are cut-off	Secured evacuation routes	H and P	Not Completed - Carry Forward
Install Water Tight Hatches at Wastewater Pump Stations	Pump Stations: Norman St., Fort Sewall, Phillips St., Harbor Avenue, Sargent Rd., Shorewood, May St., Clifton St.	Public	Flooding	Disruption of essential services	No interruption in essential services	H and P	Completed

Table 1-1  
2004 Risk Assessment Matrix (Report Card), Marblehead, Massachusetts

<i>Mitigation Measure</i>	<i>Location</i>	<i>Ownership</i>	<i>Natural Hazard</i>	<i>Primary Problem/Effect</i>	<i>Mitigation Objective</i>	<i>Risk</i> <i>H-Historical</i> <i>P- Potential</i>	<i>2013 Status</i>
<b>Secondary Measures</b>							
Advise Homeowners in the Floodplain	FEMA Flood zones	Private	Flooding: coastal and interior	Private property damage	Protection of Private property	H and P	Completed - request to expand information provided - linked to website measure
Provide Backup Generator	Middle School, Village Street	Public	All	Disruption of shelter/emergency services, public health and safety at risk	Protection of shelter/emergency services, protection of public health and safety	H and P	Completed
Pet Shelters	Town-wide	Public	All	Disruption of evacuation, public health and safety, lives at risk	Protection of secure evacuation, protection of public health and safety and lives	H and P	Not Completed - carry forward and expand to include identification of local and regional pet shelters
Investigate Breakwater	Marblehead Harbor from Marblehead Lighthouse on the Neck heading westward towards the mainland	Public	Flooding: Coastal Storm Surges, Hurricanes/Nor'e asters	Public and Private property damage	Protection of Public property	H and P	Completed - request to re-consider and carry forward into plan Update
Develop a Storm Water Master Plan	Town-wide	Public	Flooding: coastal and interior	Public and Private property damage	Protection of Public property	H and P	Completed - continue to implement
Investigate Shoreline Protection Measures at Devereux Beach	Devereux Beach	Public	Flooding: Coastal Storm Surges, Hurricanes/Nor'e asters	Public and Private property damage	Protection of Public property	H and P	Completed - request to re-consider and carry forward into plan Update



Table 1-1  
2004 Risk Assessment Matrix (Report Card), Marblehead, Massachusetts

<i>Mitigation Measure</i>	<i>Location</i>	<i>Ownership</i>	<i>Natural Hazard</i>	<i>Primary Problem/Effect</i>	<i>Mitigation Objective</i>	<i>Risk</i> <i>H-Historical</i> <i>P- Potential</i>	<i>2013 Status</i>
<b>Secondary Measures</b>							
Install Sand Fences	Marblehead coastline	Public	Flooding: Coastal Storm Surges, Hurricanes/Nor'easters	Public and Private property damage	Protection of Public and Private property	H and P	Completed - no longer considered an effective remediation measure
Complete the Community Hurricane Preparedness Course	Town-wide	N/A	Hurricanes	Disruption of essential services, risk to public health and safety	No interruption of essential services, protection of public health and safety, improvement of service efficiency	H and P	Completed - request to carry forward for all new hires in Town

The Marblehead Hazard Mitigation Plan Implementation/Monitoring Team met again on March 12, 2013 to review the results of the outreach efforts/draft Natural Hazards Mitigation Plan, and conduct the benefit cost review. The project consultant reviewed the draft 2013 Risk Assessment Matrix (Table 4-1) (updated 2004 Risk Assessment Matrix) which identified those actions: On-going – initially addressed but requires ongoing maintenance/attention, therefore, carried forward from the 2004 plan; Not addressed/partially addressed - revised from the 2004 plan; and, New - completely new action items. The Implementation/Monitoring Team completed the cost benefit review to prioritize/rank the action items, assigned time frames and responsible parties, and agreed on the proposed methodology/schedule for plan maintenance and update (based on FEMA requirements). A complete set of meeting materials is included in Appendix B.

With this information, the project consultant prepared the draft Natural Hazards Mitigation Plan which was available for public comment mid May 2013 through mid June 2013, and then submitted to the Marblehead Board of Selectmen for consideration. The Marblehead Board of Selectmen held a public hearing on \_\_\_\_\_, advertised \_\_\_\_\_ and then passed a resolution approving the draft plan on \_\_\_\_\_ (Appendix \_\_\_\_\_). The draft was then submitted to MEMA for review/consideration on \_\_\_\_\_. The Board of Selectmen approved the Multi-Hazard Mitigation Strategy Update on \_\_\_\_\_.

#### **1.4 Environmental Setting**

The Town of Marblehead is a picturesque seacoast town located 17 miles northeast of Boston and bordering Salem to the west (see Figure 1-1). The Town is approximately 4.3 square miles of total land area with approximately 20,000 residents.

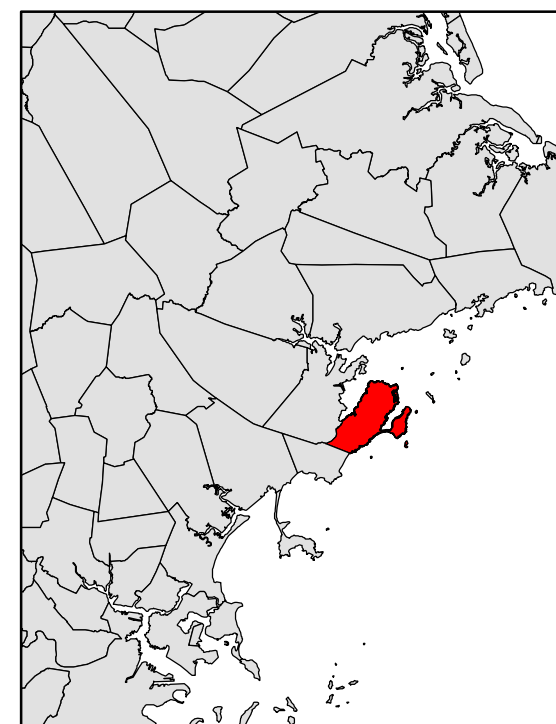
Marblehead neck is a rocky peninsula that is connected to the mainland solely by the Ocean Avenue Causeway and is bounded by Marblehead Harbor on the west and the Atlantic Ocean on the east. The Neck is characterized mainly by residential properties as well as the Audubon Bird Sanctuary located in the south-central portion of the Neck. Several yacht clubs also dot the landscape here, while the Neck's geographic location gives it both an idyllic quality and susceptibility to severe weather conditions. The Causeway provides the only entrance and egress to residents of the Neck and the north and eastern shores of the Neck are directly exposed to the Atlantic Ocean.

The mainland of the Town is bordered by Marblehead Harbor on the east, Salem on the west, Swampscott to the south and is directly exposed to the Atlantic Ocean on the north. The mainland is also predominantly residential with some commercial properties including some unique retail stores. It is located in the North Coastal Watershed and is interspersed with pockets of salt marsh and vibrant estuary. The majority of the soil that makes up the sub-base of the Town is Chatfield-Hollis-Rock Outcrop which is characterized by loamy soils formed in glacial till that are moderate to shallow in depth, gentle to steep in slope, and well drained. There are also numerous areas of exposed bedrock found on both the mainland and the Neck.



## Town of Marblehead, MA

0 21,250 42,500 85,000  
Feet



**Figure 1-1  
Location Map**

April 10, 2013 CSP  
Source: MassGIS

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This map is not the product of a Professional Land Survey. It was created by the Horsley Witten Group, Inc. for general reference, information, planning, and guidance use, and is not a legally authoritative source as to the location of natural or manmade features. Property interpretation of the map may require the assistance of appropriate professional services. Horsley Witten Group, Inc. makes no warranty, express or implied, related to the spatial accuracy, reliability, completeness, or correctness of this map.



## 1.5 Brief History

Marblehead was founded in 1629 by fishermen from Southeast England and the Channel Islands. Marblehead's fame and fortune steadily grew thereafter and in 1660 a Royal Agent declared in London that Marblehead was "the greatest Towne for fishing in New England."

The original settlers were joined by dissidents from the Pilgrims, Anglicans, and Puritans. This mix of people created a town government similar to today's town government that conducts Town Meetings to vote in by-laws, and annually elects a Board of Selectmen and officials to enforce the laws, conduct town affairs, and set the tax rate.

Marblehead claims the title, "Birthplace of the American Navy" because the original fishing and trade fleet from Marblehead provided the basis of our nation's first navy. In addition, the Hannah, built and manned in Marblehead, was commissioned by George Washington as the first U.S. naval vessel. Furthermore, in the historic moment when George Washington led the American revolutionary troops across the Delaware River in order to surprise the English and Hessian troops in the Battle of Trenton the day after Christmas in 1776, the boat was manned by Marblehead residents. After the victory, President Washington visited Marblehead to thank the soldiers, sailors, and townspeople for their support.

## 1.6 History of Disaster Declarations

Since 1953, FEMA Region 1 (the New England States) has endured more than 150 federal emergency and disaster declarations. The following information gives an overview of the most significant past Federal Emergency and Disaster Declarations for Massachusetts (and in particular Essex County, and including Marblehead):

Hurricane Diane and Flood	August 1955
Blizzard 1978	February 1978
Hurricane Gloria	September 1985
Hurricane Bob	August 1991
Nor'easter	October 1991
Nor'easter	December 1992
March Blizzard	March 1993
January Blizzard	January 1996
Sever Storm/Floods	October 1996
Heavy Rain/Floods	June 1998
Winter Storm/Floods	March 2001
Winter Storm	March 2001
Snowstorm	February 2003
Snowstorm	December 2003
Floods	April 2004
Snowstorm	January 2005
Hurricane Katrina	August 2005
Mother's Day Floods	May 2006
Nor'easter	April 2007

Ice Storm	December 2008
Severe Storm/Floods	December 2008
Flooding	March 2010
Superstorm Sandy	October 2012

## 1.7 Recent Disaster Declarations

The communities of Essex County (including Marblehead) have experienced significant losses during several recent storms that have warranted the Federal Emergency Management Agency (FEMA) to declare these storms as disasters.

Marblehead has experienced several repetitive flood loss structures during many of these recent disaster declarations. Individual properties that carry flood insurance policies are monitored by the Federal Insurance Administration for claims over \$1,000. Any property that has filed two or more claims over \$1,000 during a rolling 10-year period is classified by FEMA as a repetitive loss property.

The following are descriptions of each of the recent storms that have been declared as disasters by FEMA and which have affected the Town of Marblehead.

### 1.7.1 Winter Storm/Flooding – March 2001 (FEMA-1364)

A major winter storm impacted the Bay State with near blizzard conditions, high winds, and coastal flooding. The slow-moving storm, which tracked south of New England, dumped over two feet of snow across the interior, knocked out power to about 80,000 customers, and shut down businesses and schools for several days. There were also many reports of downed trees and wires during the height of the storm, along with reports of lightning and thunder. In magnitude, it was the worst storm to affect the state since 1992, and a state of emergency was in effect for three days. No injuries were reported. Damage from this storm was estimated to be in the tens of millions of dollars. Greater Boston received between 12 and 22 inches of snow, but Logan International Airport received 9.8 inches from this storm. The strong surf slammed sea walls and flooded beachfront homes and roadways, and damaged a part of the sea wall in Winthrop. In Marblehead, Ocean Avenue and Front Street were flooded, as was Nahant Road in Nahant. In its wake, the flooding left behind piles of seaweed, pieces of deck and lawn furniture, and even lobsters and fish.

### 1.7.2 Flooding - April 2004 (FEMA-1512)

Connecticut River at Montague Widespread minor to moderate flooding impacted many rivers in southern New England, as a result of 2 to 4 inches of rain over a three day period. Locally, as much as 7 inches of rain fell in parts of the Merrimack Valley. Flooding of mainstem rivers occurred along the Connecticut and Merrimack Rivers, as well as many of the tributaries to the Merrimack in northeast Massachusetts. Flood waters closed many roads along the river banks and affected several nearby homes. Some residents in northeast Massachusetts were forced to leave their homes due to flooding. Estimates of flood damage were not available.

### **1.7.3 Severe Storms/Flooding – May 2006 (FEMA-1642)**

Heavy rainfall, most of it falling over a 100 hour period, caused widespread flooding across much of eastern Massachusetts of small streams and main stem rivers. Major flooding of a number of small streams and main stem rivers occurred in Essex County of Massachusetts. At some locations, this was the worst flooding recorded since the 1938 Hurricane and the great rain/snowmelt floods in March 1936. The focus of heavy rain shifted to eastern Massachusetts late Friday night through Monday morning with Essex and eastern Middlesex Counties impacted the greatest. Storm rainfall totaled 8 to 12 inches across the area with a few locations in Essex County even exceeding 12 inches. The event prompted the evacuation of several thousand people in northeast Massachusetts and numerous road closures, including U.S. Route 1, a major artery for Boston-bound commuters. A number of schools were closed for several days due to the flooding. At least two communities have had issues with sewage running directly off into nearby rivers due to washed out culverts and roads. A major sewage release into the Merrimack River impacted shellfish beds along the northeast Massachusetts coast. Record flows were recorded along some streams, including the Spicket, Ipswich and Parker Rivers in Essex County Massachusetts. Other crests were the highest since the 1938 Hurricane or 1936 floods.

### **1.7.4 Severe Storms/Flooding – April 2007 (FEMA-1701)**

April 16, 2007 forecasts included watches for rain showers and low temperatures, which elevated to a much more intense storm quickly. Heavy rains and high winds continued throughout the day combined with extraordinary high tide cycles. The most severe impacts were to public infrastructure including access roadways, bridges, seawalls, sand barriers and revetments impacting hundreds of residents. Coastal flood and high winds caused severe erosion along most of the coastline, washing several homes into the ocean, while also leaving hundreds more at risk. Rivers and streams rose to levels above flood stage resulting in road closures, power outages and numerous evacuations. This storm was of particular note due to increased financial hardship to those communities and residents that experienced flood events of May 2006 and October 2005 still recovering from damages of those events.

### **1.7.5 Severe Storms/Flooding – March 2010 (FEMA-1895)**

A stacked low pressure system moved southeast of Nantucket, spreading rain across Southern New England. In eastern Massachusetts, a strong southeasterly low level jet pumped ample moisture into the area, resulting in rainfall totals on the order of six to ten inches. This resulted in major flooding across eastern Massachusetts and Rhode Island, including small stream, urban, and poor drainage flooding. Strong winds associated with the low pressure system and the low level jet affected both the east and south coasts, resulting in numerous downed trees and wires and some minor structural damage to a few buildings. Several small streams rose above flood stage across Essex County, including the Ipswich River at Ipswich and South Middleton, the Shawsheen River at Andover, and the Parker River at Byfield. Numerous streets were closed and basements flooded across the county.

#### **1.7.6 Superstorm Sandy – October 2012 (FEMA-3350)**

The hybrid storm Sandy hammered Massachusetts with fierce winds and heavy surf, knocking out power to hundreds of thousands and forcing evacuations in the coastal communities that absorbed the worst of the mammoth storm. Mandatory evacuations were ordered in low-lying sections of Dartmouth and Fall River in the southeastern part of the state, while voluntary evacuations were suggested in other coastal communities including parts of Scituate, Lynn, New Bedford and Plum Island. Officials had shut down Boston's public transportation by early afternoon Monday, while flights were grounded and schools and municipal buildings closed down statewide. In Marblehead, a total of 600 people were without power over the course of the evening, but almost all were back on by midnight. In addition to power outages, the Light Department had to deal with downed live wires all over town, of which there were "quite a few". Winds blew at 50-60 mph with falling trees perhaps the biggest issue for Marblehead municipal departments, accounting for most of the damage and lost power. High tides under a full Hunter's moon Monday night created rough waters that caused several boats and docks to come loose. But the tides did not cause as much damage as originally predicted. Besides branch and leaf cleanup, the municipal departments had to fix some minor fence damage over by Fort Sewall Beach and remove rocks from the causeway and Grace Oliver's Beach area.

## Section 2 Risk Assessment

### 2.1 Introduction

Identifying potential hazards is the first step in any effort to reduce community vulnerability. The subsequent identification of the risk and vulnerability for a community are the primary factors in determining how best to allocate finite resources to address what mitigation might take place. The FEMA document titled Multi-Hazard Mitigation Planning Guidance, dated March 2004 was used in developing this strategy plan as a basic template to identify the various natural hazard types. The hazard identification and analysis involves all of those hazards that potentially threaten the Town of Marblehead.

By collecting and analyzing information for each potential hazard that may affect Marblehead, several determinations have been made:

- which hazards merit special attention
- what actions might be taken to reduce the impact(s) of those hazards
- what resources are likely to be needed

The New England Town of Marblehead, with its beautiful beaches, charming harbor, and waterfront properties reaps the benefits of its ideal location adjacent to the Atlantic Ocean. However, Marblehead's geographic location also subjects the community to significant weather related hazards, in particular ocean storm surges resulting from blizzards, nor'easters, tropical storms, and hurricanes. For the purposes of the Natural Hazards Mitigation Plan, the following hazards are addressed:

- ✓ Coastal Storm Surge
- ✓ Interior Flooding/Stormwater Runoff
- ✓ Coastal Erosion
- ✓ Climate Change
- ✓ Sea Level Rise
- ✓ Sever Winter Storm
- ✓ Hurricane
- ✓ Nor'easter
- ✓ Tornado/Sever Wind Storm
- ✓ Urban Fire
- ✓ Earthquake

The Marblehead Hazard Mitigation Plan Implementation/Monitoring Team delineated additional areas of both coastal and inland flooding not identified on the FEMA mapping but collectively understood to be flood prone areas. Additionally, the Team evaluated each of the flood, wind, fire and geologic-related hazards and collectively determined the likelihood of occurrence, locations affected, and potential impacts of each. This information was used to establish a hazard index (HI) value (HI=1 being lowest impact and HI=10 being highest impact) for each of the types of natural hazards and is presented in Table 2-1.

The highest hazard index values were assigned to those natural hazards that were deemed to have the highest level of impact to the community. These hazards include flood related hazards such as coastal storms or nor'easters (HI=10), interior flooding due



to storm runoff (HI=9), and wind related hazards from coastal storms (HI=8). The Hazard Mitigation Plan Implementation/Monitoring Team formed a consensus that flood related hazards, both coastal due to the ocean storm surge and inland due to stormwater collection deficiencies, are the major causes of risk to the community. The Hazard Index for this 2013 Update remains fairly constant from the 2004 Plan, the only changes being the addition of Climate Change/Sea Level Rise, and adapting the language used in the FEMA State and Local Mitigation Planning How-to-Guide Series for frequency and severity categorization.

For the purposes of the 2013 Update's Risk Assessment, the Marblehead Hazard Mitigation Plan Implementation/Monitoring Team decided to organize natural hazards into the following categories and listed in order of frequency and impact, beginning at the top of the list with the most frequently occurring natural hazards. The Team also felt the addition of climate change and sea level rise would round out a comprehensive listing of natural hazards affecting the Town of Marblehead today.

- Flood-Related Hazards
- Winter-Related Hazards
- Wind-Related Hazards
- Urban Fire-Related Hazards
- Geologic-Related Hazards

The Horsley Witten Group (HW) updated available town-wide Geographical Information Systems (GIS) mapping with flood zone delineations (1985) identified on the Flood Insurance Rate Maps (FIRM) from the Federal Emergency Management Agency (FEMA). HW also updated visuals to present the hurricane tracks, tornadoes, annual snowfall, and earthquakes for the Marblehead area as provided by the Metropolitan Area Planning Council (MAPC), as well as coastal erosion areas identified from the 2004, the Massachusetts Coastal Zone Management (MCZM) Shoreline Change Analysis Project and from the Public Workshop.

## **2.2 Profiling Hazards: Location, History and Probability of Future Occurrence**

In assessing the hazards to a community, both the risk and the vulnerability must be taken into account. A hazard is the actual event that poses the danger to the community, (e.g. the hurricane, tornado, earthquake, etc. that threatens the Town). The term "risk" refers to the predicted impact that a hazard would have on people, services, specific facilities and structures in the community. The term "vulnerability" refers to the characteristics of the society or environment affected by the event that resulted in the costs from damages (Heinz Center Report, 1999, p. 105). The vulnerability of an area refers to its susceptibility to a hazard. The areas of the town affected by extreme natural events are identified by hazard risk assessment. In determining the risk and vulnerability of the town, the likelihood, frequency and magnitude of damage from identified hazards are assessed.

In developing an updated Risk Assessment, Marblehead defined the risks that the town could face and followed up with an assessment of the vulnerability of the at-risk areas, and the implications of experiencing natural disasters (e.g., loss of life, damage to the natural environment, property damage, and economic losses). NOAA's National

Table 2-1  
Hazard Index, Marblehead, Massachusetts

<i>Natural Hazard</i>	<i>Frequency (i.e. Very Low, Low, Medium, High)</i>	<i>Location (i.e. local/small, medium/regional, large/multiple communities)</i>	<i>Severity (i.e. minor, serious, extensive, catastrophic)</i>	<i>Hazrd Index (i.e. ranked by combining frequency and severity; 10 - high, 1 - low)</i>
<b>Flood-Related Hazards</b>				
- Riverine	Very Low	Local	Minor	2
- Coastal Erosion	Medium	Local	Serious	6
- Climate Change/Sea Level Rise	Medium	Local	Serious	5
- Dam Failures	Not Applicable	Not Applicable	Not Applicable	Not Applicable
- Thunderstorms	Medium	Local	Serious	6
- Winter Storms	Medium	Local	Serious	6
- Coastal Storm Surge/Nor'easters	High	Local	Extensive	10
- Hurricanes	Low	Local	Extensive	6
- Interior Flooding/Stormwater Runoff	High	Local	Extensive	9
<b>Winter-Related Hazards</b>				
- Ice Jams	Very Low	Local	Minor	1
- Heavy Snow	Medium	Medium/Regional	Serious	6
<b>Wind-Related Hazards</b>				
- Hurricanes	Low	Local	Serious	5
- Coastal Storms	High	Local	Serious	8
- Winter Storms	High	Local	Serious	7
- Downspouts	Very Low	Local	Minor	1
- Tornados	Very Low	Local	Minor	2
<b>Fire-Related Hazards</b>				
- Drought	Very Low	Local	Minor	2
- Wildfires	Very Low	Local	Minor	1
- Urban Fires	Low	Local	Extensive	6
- Flooding	Low	Local	Serious	5
<b>Geologic-Related Hazards</b>				
- Earthquakes	Low	Local	Serious	5
- Landslides	Very Low	Local	Minor	1
- Sink Holes	Very Low	Local	Minor	1

Climatic Data Center was used to update significant weather events that have occurred since the 2004 plan. Risk assessment is the determination of the likelihood of adverse impacts associated with specific natural hazards, and vulnerability assessment is concerned with the qualitative or quantitative examination of the exposure of some societal component (i.e. economy, environment).

### **2.2.1 Flood-Related Hazards**

Flooding is the accumulation of water within a water body and the overflow of excess water onto adjacent floodplain lands (FEMA, Multi Hazard Identification and Risk Assessment, 1997). The floodplain is the land adjoining the river/stream channel, ocean or other watercourse or water body that is susceptible to flooding.

Flooding results from: large-scale weather systems generating prolonged rainfall; on-shore winds; locally intense thunderstorms; dam failures; or significant snow melt. Floods are capable of undermining buildings and bridges, eroding shorelines and stream banks, uprooting trees, washing out access roads, and causing loss of life and injuries. Also, flash floods (characterized by rapid onset and high velocity waters) carry large amounts of debris that further exacerbate conditions.

Under the National Flood Insurance Program (NFIP), FEMA is required to develop flood risk data for use in both insurance rating and floodplain management. FEMA develops this data through Flood Insurance Studies (FIS). Detailed analyses are used to generate flood risk data only for developed or developing areas of communities. For undeveloped areas FEMA uses approximate analyses to generate flood risk data. Flood hazard areas are identified in the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs). Flood hazard areas are divided into zones (V, C, AO, etc.) depending on the severity and type of flood threat. These zones are those areas subject to inundation (shallow or deep) by a flood (and/or velocity wave action) that has a 1 percent chance of occurring during any given year. This type of flood is referred to as a 100-year flood. A 100-year flood has a 26% chance of occurring during a 30-year period (the length of many home mortgages). The 100-year flood is a regulatory standard used by federal agencies and most states to administer floodplain management programs and is also used by the National Flood Insurance Program (NFIP) as the basis for insurance requirements nationwide. An initial identification was performed for the Town of Marblehead in 1974 with the first map issued in June 1976. Since then, complete revisions, including changes to 100-year flood elevations and special flood hazard areas, were executed in 1985 to account for the effects of velocity wave action.

FEMA continues to complete its Flood Map Modernization effort of updating their Flood Insurance rate Map (FIRM) inventory for the country, to account for outdated base maps, development in watersheds, and advancements in flood modeling, and to provide updated flood hazard data to assist communities in land development and to assist businesses and homeowners in making more informed financial decisions to protect their property. According to the National Flood Insurance Program (NFIP), and as of February 19, 2013, the Preliminary Completion Date (date when new preliminary DFIRMS will be presented to community officials) for the Town of Marblehead is anticipated as April 28, 2013. Following this, there is an official 90-day Appeal Period,

then an 'LFD Date' (date when community officials will be notified that a new or updated DFIRM will take effect in six months), and finally an effective date.

### Coastal Storm Surge

Coastal storm surge is typically defined as the abnormal rise in water level caused by the wind and pressure forces of a hurricane and/or nor'easter. Many of the current hazard risks in the Town of Marblehead are associated with flooding, especially in coastal areas where the 100-year floodplain encroaches inland from the ocean. Marblehead experiences significant coastal flooding several times per year due to coastal storm surges resulting mainly from winter storms and nor'easters. Additionally, several interior locations experience flooding due to inadequate drainage during significant storm events.

### Interior Flooding/Stormwater Runoff

Other flood hazards not found on the FIRM are ones that involve stormwater related issues. Thunderstorms, winter storms, coastal storms and nor'easters, and hurricanes all contribute to interior flood related hazards due to the large amounts of precipitation associated with them. Development has exacerbated the magnitude and frequency of urban flooding by increasing impervious surfaces, also increasing the rate of drainage collection, reducing the carrying capacity of the land, and often overwhelming sewer systems/combined sewer overflows (CSOs).

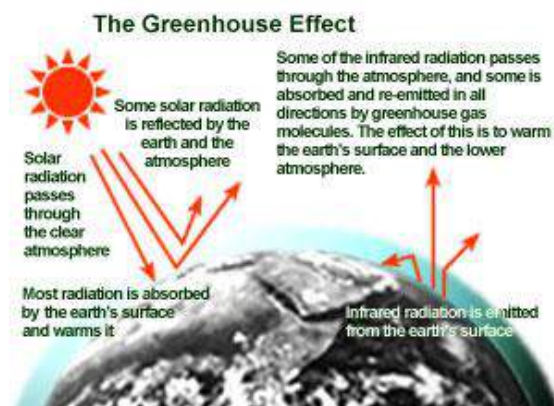
### Coastal Erosion

Coastal erosion is another hazard that occurs during large coastal storm events and through nature's natural processes. Shorelines change constantly in response to wind, waves, tides, sea level fluctuation, seasonal and climatic variations, human interaction, and other factors that move sand and material within a coastal shoreline system. There are segments of coastline along both the Neck and mainland in the Town of Marblehead that undergo between 6 inches and 18 inches of erosion per year. The magnitude and extent of coastal erosion was identified using the results of the Massachusetts Coastal Zone Management (MCZM) Shoreline Change Analysis Project. This mapping presents the long-term shoreline change rate calculated over the past 140 years, with an approximate uncertainty range of +/- 0.4 feet per year (see Appendix A, Figure A-4).

### Climate Change

The Environmental Protection Agency (EPA) indicates there is recent, strong evidence that most of the warming of the Earth's surface temperature over the past 50 years is a direct result of human behavior.

Human activities have been contributing to natural background levels of greenhouse gases since the Industrial Revolution. The primary source of emissions is the burning of fossil fuels for energy. Although increases in



the atmosphere's heat-trapping ability can be predicted, resulting impacts on climate are more uncertain. By 2100, Massachusetts could see a temperature increase by about 4 degrees F (with a range of 1-8 degrees F) in the winter and spring and by about 5 degrees F (with a range of 2-10 degrees F) in the summer and fall.

Increased temperatures and frequency of heat waves could also impact the number of heat-related illnesses and deaths in Massachusetts. The same high temperatures could also result in an increase in ground-level ozone (a major component of smog). Ground-level ozone facilitates respiratory illnesses such as asthma and respiratory inflammation, as well as reducing general lung functioning. The very same warming and climate increases could also expand the habitat and infectivity of disease-carrying insects, increasing the potential for malaria, Eastern Equine Encephalitis and Lyme Disease.

### Sea Level Rise

The Intergovernmental Panel on Climate Change (IPCC) continues to better understand the science and implications of climate change and sea level rise. Rising sea levels, as a direct result of warmer temperatures and glacial ice melt, threaten low-lying coastal areas through coastal flooding, coastal erosion, wetland inundation and saltwater intrusion. Recent projections of sea level rise by the end of the century range from 20 to 55 inches. Localized land subsidence, also on the rise, also contributes to accelerated impacts of sea level rise. Standard management approaches to address these issues include:

- Coastal Armoring
- Rolling Easements
- Setbacks
- Re-nourishment
- Post-storm reconstruction Policies

### Global Warming Solutions Act

In August 2008, Governor Patrick signed into law the Global Warming Solutions Act (GWSA), making Massachusetts one of the first states in the nation to implement a comprehensive regulatory program that addresses climate change. The GWSA requires the Commonwealth to set economy-wide greenhouse gas (GHG) emission reduction goals for Massachusetts that will achieve:

- A reduction of between 10 and 25-percent below statewide 1990 GHG emission levels by 2020, and
- A reduction of 80 percent below statewide 1990 GHG emission levels by 2050

Energy and Environmental Affairs Secretary Ian Bowles has established two advisory committees to provide input on the implementation of the GWSA, the Climate Protection and Green Economy Advisory Committee (created under the GWSA) - charged with advising the Executive Office of Energy and Environmental Affairs on measures to reduce greenhouse gas emissions in accordance with the GWSA, and the Climate Change Adaptation Advisory Committee (also created under the GWSA) - charged with studying and making recommendations regarding strategies for adapting to climate

change. See <http://www.mass.gov/dep/air/climate/> for more information on any of these above initiatives or Massachusetts work on climate change adoption.

### Dam Failure

A dam is any artificial barrier with the ability to impound water, wastewater, or any liquid-borne material for the purpose of storage or water control. Dam failure can be a catastrophic type of failure characterized by the sudden, immediate, and uncontrolled release of impounded water, or the likelihood of such an uncontrolled release with secondary impacts to downstream structures within the inundation zone. There are no identified dams at risk of failure within Marblehead.

Since the 2004 plan, there have been 34 significant flood-related events impacting Marblehead by way of coastal storm surges (two events/\$50 K in damages), flash floods (two events/\$2.5 million in damages) and coastal floods (thirty events/\$155 K in damages).

### **Property at Risk from Flood-Related Hazards in Marblehead**

The Marblehead Hazard Mitigation Plan Implementation/Monitoring Team established geographic areas of the town as having the highest risk of impacts to natural disasters. Although these high risk areas are also susceptible to high winds and other natural hazards, the flooding of these areas (both coastal due to ocean surge and the interior due to stormwater collection deficiencies) has been determined to be the primary cause of risk to the community.

The Horsley Witten Group, Inc. updated the Flood Hazard Areas and Critical Facilities maps (see Appendix A, Figures A-1 and A-2), as well as detailed enlargements of each of the eleven coastal and interior high risk flood areas, as presented in the following sections.

### Critical Facilities

Critical facilities are those public or private facilities that possess added value to the community and deserve additional consideration when determining mitigation strategies to protect these resources from natural hazard risks.

A list of critical facilities provided by the Massachusetts Emergency Management Agency (MEMA) was reviewed and approved with minor modifications by Town officials. One hundred and twenty seven (127) critical facilities have been identified and are presented in Appendix A, Figure A-1. Only a portion of the Town's critical facilities are located in high hazard areas, however, many of these facilities such as emergency shelters and nursing homes are still critical in ensuring the health and safety of the entire community during a natural disaster.

### Coastal Flood Hazard Areas

Coastal flooding caused by storm surges on the exposed northern and eastern coastlines of both the Marblehead mainland and Marblehead Neck have been determined as possessing the highest risk of natural disaster to the community. Eight



specific geographic areas identified as having the highest risk of coastal flooding are described in the following paragraphs.

#### *Beacon Street/Norman Street*

The **Marblehead Hazard Mitigation Plan Implementation/Monitoring Team** indicates that the neighborhood located on the northeast corner of the mainland and adjacent to Grace Oliver Beach has experienced significant flooding several times in recent memory. There is also a larger portion of this area that experiences shallow flooding during a 100-year flood in accordance with FEMA FIRMs (see Figure 2-1).

Flooding of structures, yards, beaches and streets occur in several locations throughout this area especially at the intersection of Norman and Beacon Streets. **The Norman Street Wastewater Pump Station** is a critical facility that was previously susceptible to damage/becoming disabled from flooding inundation. Since the 2004 Plan, the Sewer Department has installed new Bilco floodproof doors. In addition, the sea wall at Grace Oliver Beach is another critical facility (No. 103) which remains at risk if damaged or undermined, could cause more frequent problems in this area in the future.

**The following critical facilities are located within this flood hazard area:**

- Sea wall at Grace Oliver's Beach
- Grace Oliver Beach
- Gas House Beach
- Old Burial Hill Cemetery (not directly within FEMA Floodplain)
- Norman Street Wastewater Pump Station (not directly within FEMA Floodplain)

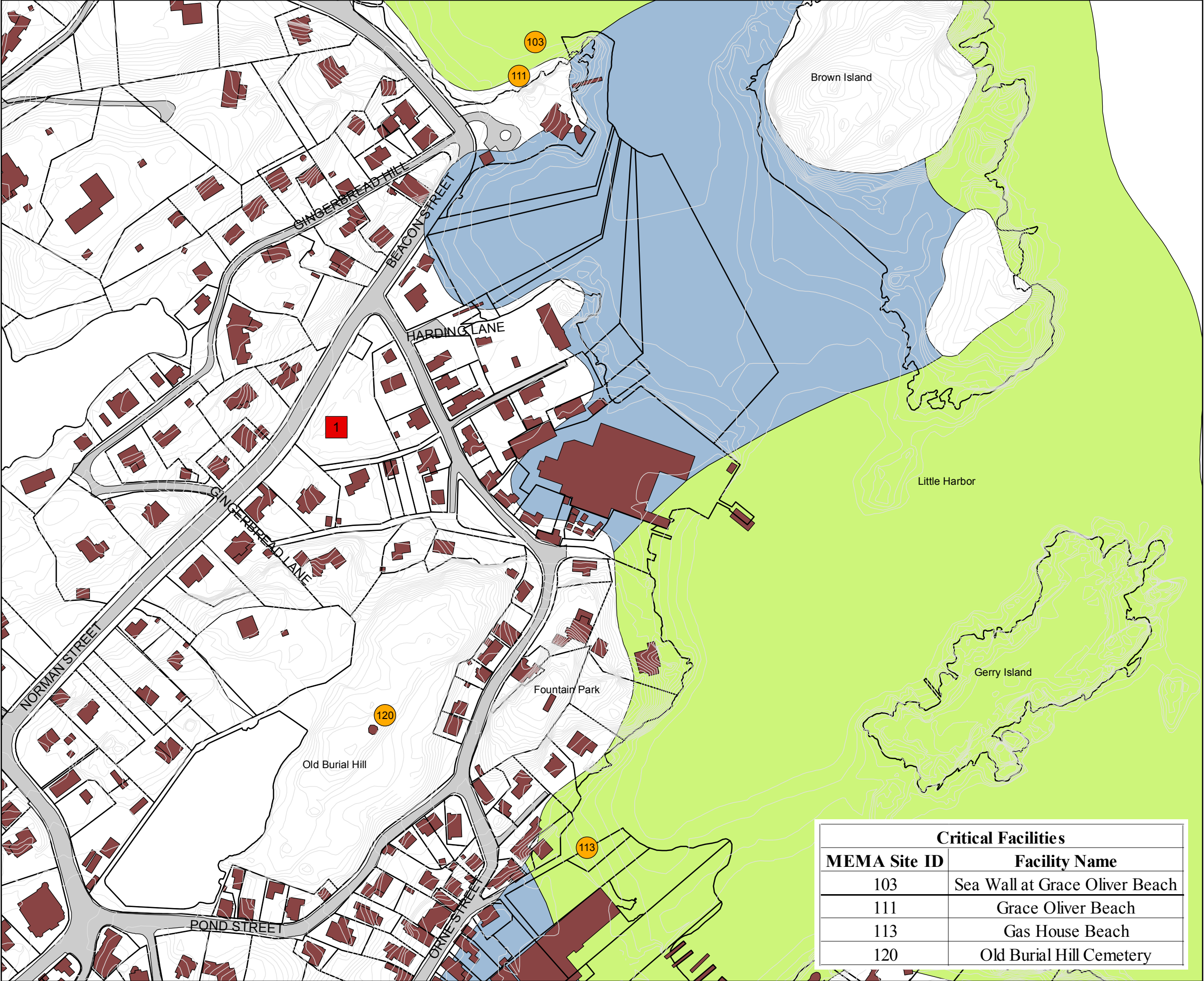
#### *Front Street/Doaks Lane*

The area in the northeast coast of the mainland around Fort Sewall, including Gas House Beach and Fort Beach experiences flooding from velocity wave action, shallow flooding and/or sheet flow flooding approximately three times a year (see Figure 2-2).

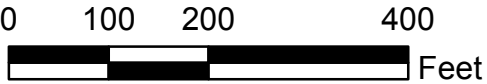
Flooding of structures, yards, beaches and streets occur in various locations throughout this area on a yearly basis. **The Fort Sewall Wastewater Pump Station** is a critical facility that was previously susceptible to damage/becoming disabled from flooding inundation. Since the 2004 Plan, the Sewer Department has installed new Bilco floodproof doors. Approximately 300 linear feet of coastline extending southward from the Fort Sewall peninsula experiences an estimated coastal erosion of 6 inches to 17 inches annually.

**The following critical facilities are located within this flood hazard area:**

- Old North Nursery School (not directly within FEMA Floodplain)
- Old North Congregation Church (not directly within FEMA Floodplain)
- Fort Beach
- Franklin Fire House (not directly within FEMA Floodplain)
- Fort Sewall Wastewater Pump Station



Town of Marblehead, MA



Legend








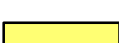
-  Critical Facilities
-  Pump Stations
-  Structures
-  Area of 100-year flood, shallow flooding
-  Area of 100-year flood (usually sheet flow on sloping terrain)
-  Area of 100-year coastal flood with velocity
-  500-year flood and 100-year flood with depths < 1ft., or drainage areas less than one square mile, or protected by a levee
-  Area of stormwater related flooding (Identified by Community Team)

Figure 2-1  
Beacon St./Norman St.  
Flood Hazard Area

April 10, 2013 CSP  
Source: MassGIS, Marblehead municipal database

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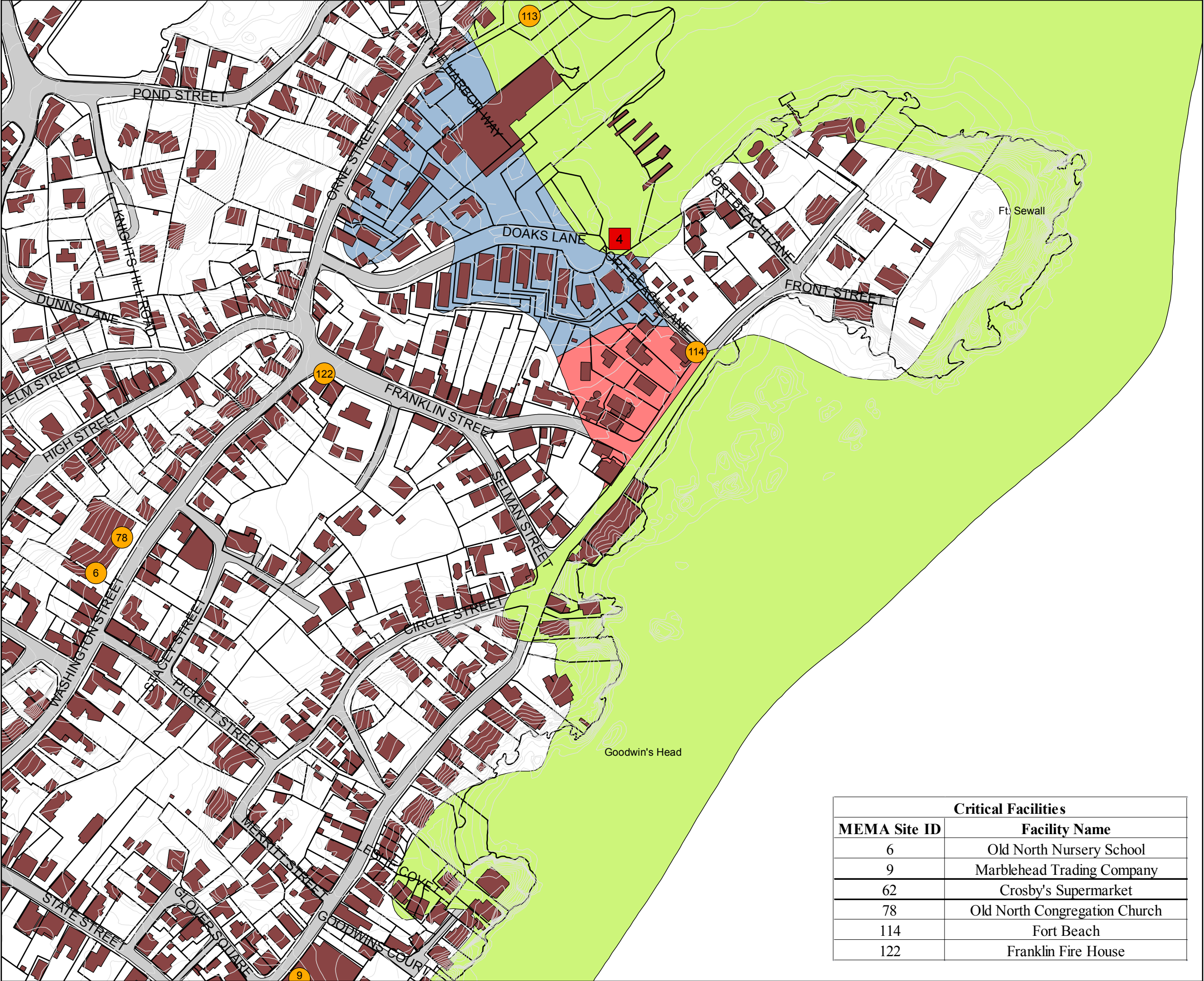
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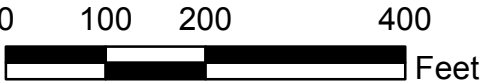
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Critical Facilities	
MEMA Site ID	Facility Name
103	Sea Wall at Grace Oliver Beach
111	Grace Oliver Beach
113	Gas House Beach
120	Old Burial Hill Cemetery





Town of Marblehead, MA



**Legend**

- Critical Facilities
- Pump Stations
- Structures
- AE Area of 100-year flood, shallow flooding
- AO Area of 100-year flood (usually sheet flow on sloping terrain)
- VE Area of 100-year coastal flood with velocity
- X500 500-year flood and 100-year flood with depths < 1ft., or drainage areas less than one square mile, or protected by a levee
- AS Area of stormwater related flooding (Identified by Community Team)

Figure 2-2  
Front St./Doaks Lane  
Flood Hazard Area

Critical Facilities	
MEMA Site ID	Facility Name
6	Old North Nursery School
9	Marblehead Trading Company
62	Crosby's Supermarket
78	Old North Congregation Church
114	Fort Beach
122	Franklin Fire House

April 10, 2013 CSP  
Source: MassGIS, Marblehead municipal database

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### *Devereux Beach/Tucker's Beach*

Approximately 2,000 linear feet of beach, residences, and saltwater marshland extending south from the southwestern shore of the Causeway westerly to Goldthwait Road experiences "semi-frequent" flooding from velocity wave action, shallow flooding, and/or sheet flow (see Figure 2-3).

Flooding of structures, yards, beaches and streets of the surrounding neighborhood have occurred on many occasions. In the past, there have been some tidal surges here that completely destroyed homes in its path that were rebuilt in accordance with FEMA regulations at the time. Devereux Beach is a community asset for families in the Marblehead community that frequent this location during the summer months. The Phillips Street Wastewater Pump Station is a critical facility that was previously susceptible to damage/becoming disabled from flooding inundation. Since the 2004 Plan, the Sewer Department has completed the full replacement of the Phillips Street pump station. Coastal erosion estimated at 6 inches to 10 inches annually remains a concern along the Devereux Beach area.

Faulty tide gates remain the recognized potential source for the inland flooding problems in this area. Past proposals for replacing the existing tide gates have been denied due to environmental concerns with the saltwater marsh and its ecosystem.

It is also understood that flooding in Tucker's Beach area is exacerbated by water entering through the Marblehead Harbor side through Riverhead Beach.

The following critical facilities are located within this flood hazard area:

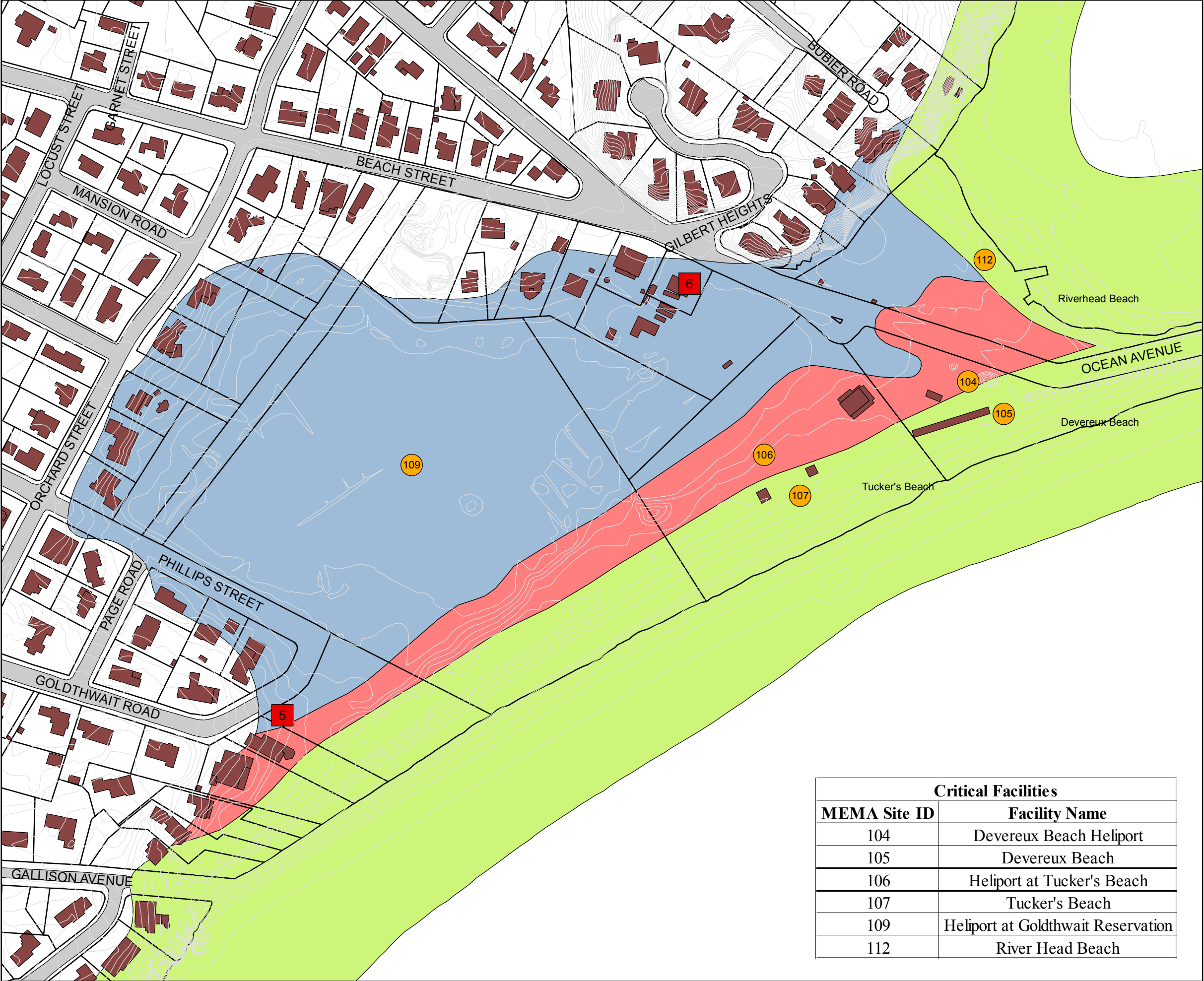
- Heliport at Devereux Beach
- Devereux Beach
- Heliport at Tucker's Beach
- Tucker's Beach
- Heliport at Goldthwait Reservation
- Rivers Head Beach
- Phillips Street Wastewater Pump station (not directly within FEMA Floodplain)

### *Front Street/Ferry Lane*

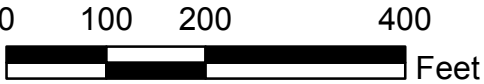
Various public boat landings, restaurants, and commercial properties characterize this area of Marblehead's eastern coastline located adjacent to Marblehead Harbor.

The boundaries of the 100-year floodplain shown on Figure 2-4, indicates the potential to experience significant flooding during periods of heavy storm surge and high velocity wave action. This hazard area contains public and municipal sites such as Clark Landing and Tucker's Wharf.





Town of Marblehead, MA



Legend

- Critical Facilities
- Pump Stations
- Structures
- AE Area of 100-year flood, shallow flooding
- AO Area of 100-year flood (usually sheet flow on sloping terrain)
- VE Area of 100-year coastal flood with velocity
- X500 500-year flood and 100-year flood with depths < 1ft., or drainage areas less than one square mile, or protected by a levee
- AS Area of stormwater related flooding (Identified by Community Team)

Figure 2-3  
Devereux Beach/Tucker's Beach  
Flood Hazard Area

April 10, 2013 CSP  
Source: MassGIS, Marblehead municipal database

Horsley Witten Group  
Sustainable Environmental Solutions

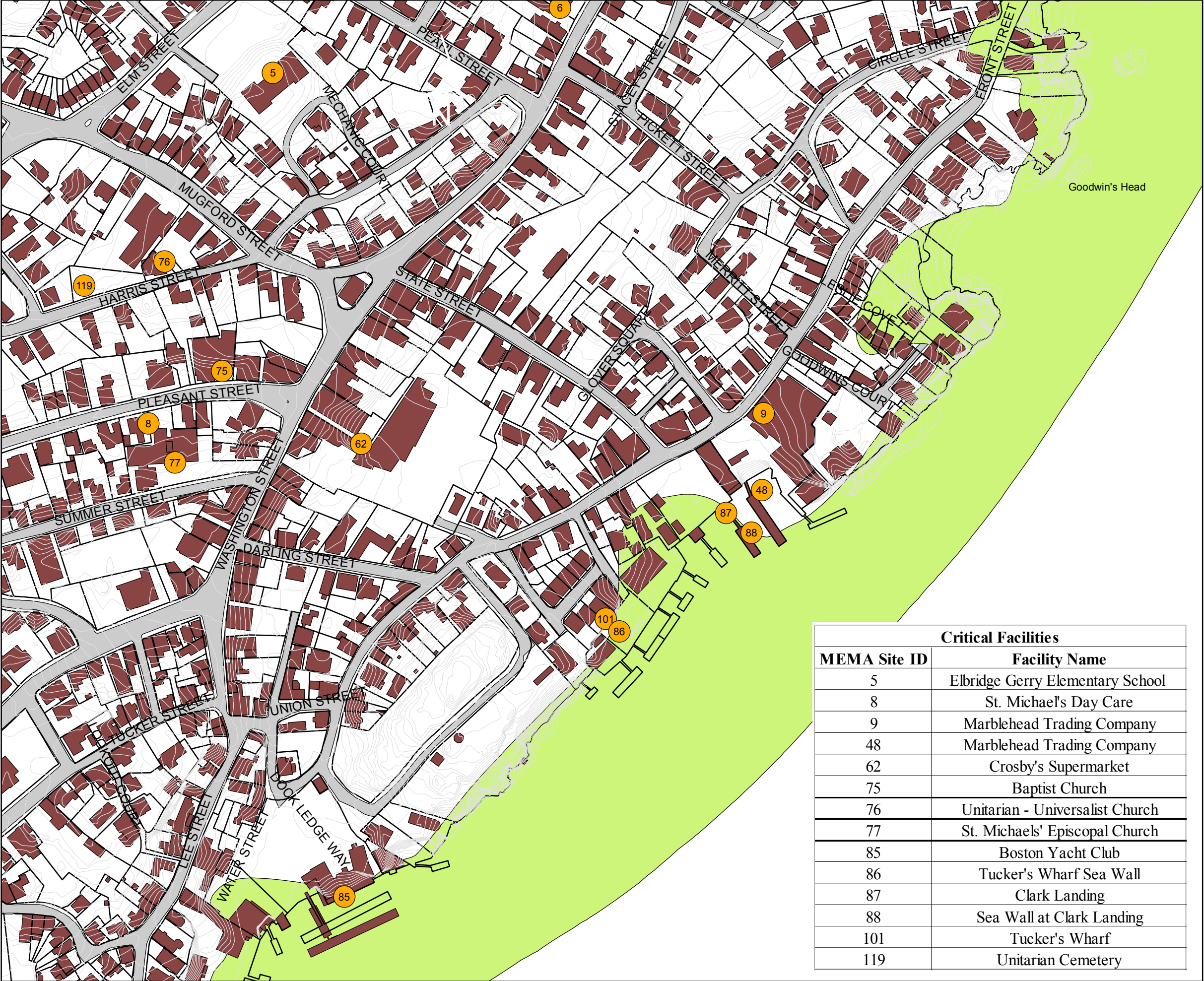
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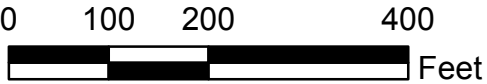
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Critical Facilities	
MEMA Site ID	Facility Name
104	Devereux Beach Heliport
105	Devereux Beach
106	Heliport at Tucker's Beach
107	Tucker's Beach
109	Heliport at Goldthwait Reservation
112	River Head Beach





Town of Marblehead, MA



Legend

- Critical Facilities
- Pump Stations
- Structures
- AE Area of 100-year flood, shallow flooding
- AO Area of 100-year flood (usually sheet flow on sloping terrain)
- VE Area of 100-year coastal flood with velocity
- X500 500-year flood and 100-year flood with depths < 1ft., or drainage areas less than one square mile, or protected by a levee
- AS Area of stormwater related flooding (Identified by Community Team)

Figure 2-4  
Front St./Ferry Lane  
Flood Hazard Area

April 10, 2013 CSP  
Source: MassGIS, Marblehead municipal database

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Critical Facilities	
MEMA Site ID	Facility Name
5	Elbridge Gerry Elementary School
8	St. Michael's Day Care
9	Marblehead Trading Company
48	Marblehead Trading Company
62	Crosby's Supermarket
75	Baptist Church
76	Unitarian - Universalist Church
77	St. Michaels' Episcopal Church
85	Boston Yacht Club
86	Tucker's Wharf Sea Wall
87	Clark Landing
88	Sea Wall at Clark Landing
101	Tucker's Wharf
119	Unitarian Cemetery



The Marblehead Hazard Mitigation Plan Implementation/Monitoring Team indicated that flooding of structures, parking lots, and streets occurred on numerous occasions in this area. The following critical facilities are located within this flood hazard area:

- Elbridge Gerry Elementary School (not directly within FEMA Floodplain)
- St. Michael's Day Care (not directly within FEMA Floodplain)
- Marblehead Trading Company
- Crosby's Supermarket (not directly within FEMA Floodplain)
- Baptist Church (not directly within FEMA Floodplain)
- Unitarian-Universalist Church (not directly within FEMA Floodplain)
- St. Michael's Episcopal Church (not directly within FEMA Floodplain)
- Boston Yacht Club
- Tucker's Wharf
- Tucker's Wharf sea wall
- Clark Landing
- Sea wall at Clark Landing
- Unitarian Cemetery (not directly within FEMA Floodplain)

#### *Boston Yacht Club*

The Boston Yacht Club, surrounding commercial area, and portions of Crocker Park experience significant flooding roughly once every two years from coastal storm surges with velocity wave action (see Figure 2-5).

The Boston Yacht Club, also designated as a critical facility, experiences flooding of structures and the parking lot area. The Club, founded in 1866, has a storied history and today retains 500 members and more than 400 yachts.

#### *The Causeway*

The Causeway is the roadway that is the only non-water source of entrance or regress from the mainland for Marblehead neck residents (see Figure 2-6). The Causeway frequently experiences significant storm surges with velocity wave action that overtops the existing seawall located at the southern shore of the roadway (ocean side), both engulfing the roadway and over-washing cobbles, requiring the roadway to be closed. The closing of the Causeway, required during most large storm events, strands the residents of Marblehead Neck until after the storm has subsided and the cobbles can be removed from the streets. The flood hazard on the Causeway is clearly the most significant natural hazard risk to Marblehead and frequently affects approximately 3,000 residents of the Neck.

The Causeway routinely requires temporary closure in order to ensure the safety of the community. As detailed in Section 3.2, Marblehead personnel initiate a plan to ensure public safety during flooding episodes on the Causeway.

Coastal erosion is also of concern on the ocean side of the Causeway in which 9 inches to 10 inches of shoreline is eroded annually – encroaching on the existing seawall, designated as a critical facility.

Houses located on Marblehead Neck near the southeastern shore of the Causeway experience frequent flooding. These homes experience flooding from sheet flow as well as shallow flooding during large storm events. Flood waters have been known to flow over Ocean Avenue and into backyards of homes in this area. Coastal water also floods Flint Street and the yards of homes on Harbor Avenue.

#### *Foster Street/Sean Way*

This neighborhood located on the south western shore of the Neck experiences infrequent shallow flooding (see Figure 2-7).

Flooding of structures, yards, beaches and streets infrequently occurs in various locations throughout this area. The Harbor Avenue Wastewater Pump Station is a critical facility that was previously susceptible to damage/becoming disabled from flooding inundation. Since the 2004 Plan, the Sewer Department has installed new Bilco floodproof doors.

The following critical facility is located within this flood hazard area:

- Harbor Avenue Wastewater Pump Station

#### *Sargent Road/Ocean Avenue*

The southernmost tip of Marblehead Neck experiences flooding from velocity wave action and sheet flow flooding approximately once every ten years (see Figure 2-8). The Marblehead Hazard Mitigation Plan Implementation/Monitoring Team indicates significant flooding in this area has occurred three to four times since 1972.

Flooding of residential structures, yards and streets is experienced over a large area on Ocean Street and to the south of Ocean Street. Typically, water entering this area from the ocean surge collects in the low lying area near Sargent Road. The Sargent Road Wastewater Pump Station is a critical facility that was previously susceptible to damage/becoming disabled from flooding inundation. Since the 2004 Plan, the Sewer Department has installed new Bilco floodproof doors.

The following critical facility is located within this flood hazard area:

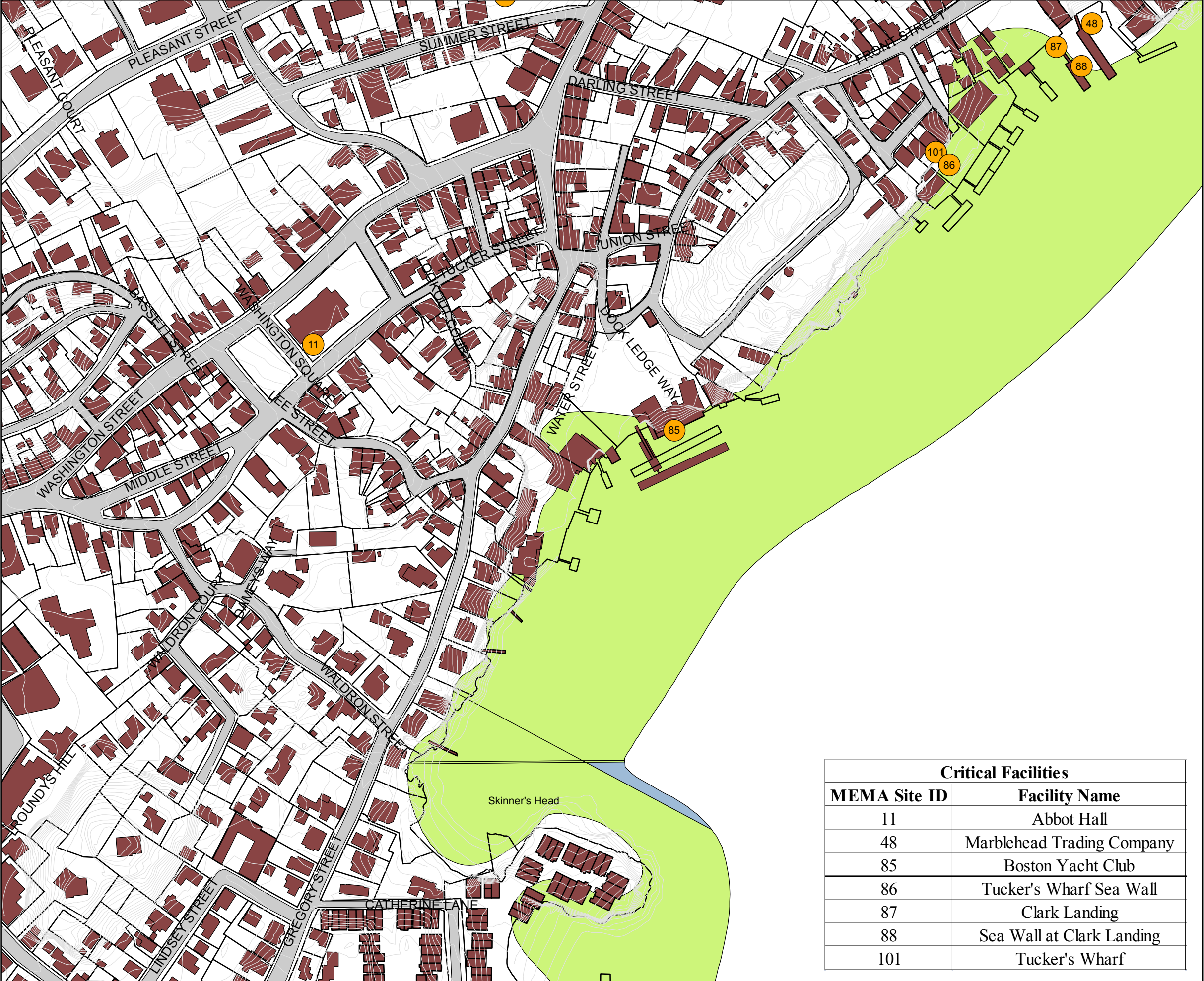
- Sargent Road Wastewater Pump Station

Coastal erosion estimated at 10 inches of coastline annually is also a concern.

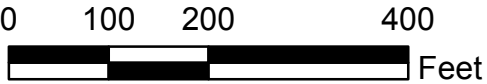
#### Interior Flood Hazard Areas

Interior flooding caused by deficiencies in the community's storm water collection system have been identified by the Marblehead Hazard Mitigation Plan Implementation/Monitoring Team as a high risk to the community, second only to coastal flooding.





**Town of Marblehead, MA**



**Legend**

- Critical Facilities
- Pump Stations
- Structures
- AE Area of 100-year flood, shallow flooding
- AO Area of 100-year flood (usually sheet flow on sloping terrain)
- VE Area of 100-year coastal flood with velocity
- X500 500-year flood and 100-year flood with depths < 1ft., or drainage areas less than one square mile, or protected by a levee
- AS Area of stormwater related flooding (Identified by Community Team)

**Figure 2-5  
Boston Yacht Club  
Flood Hazard Area**

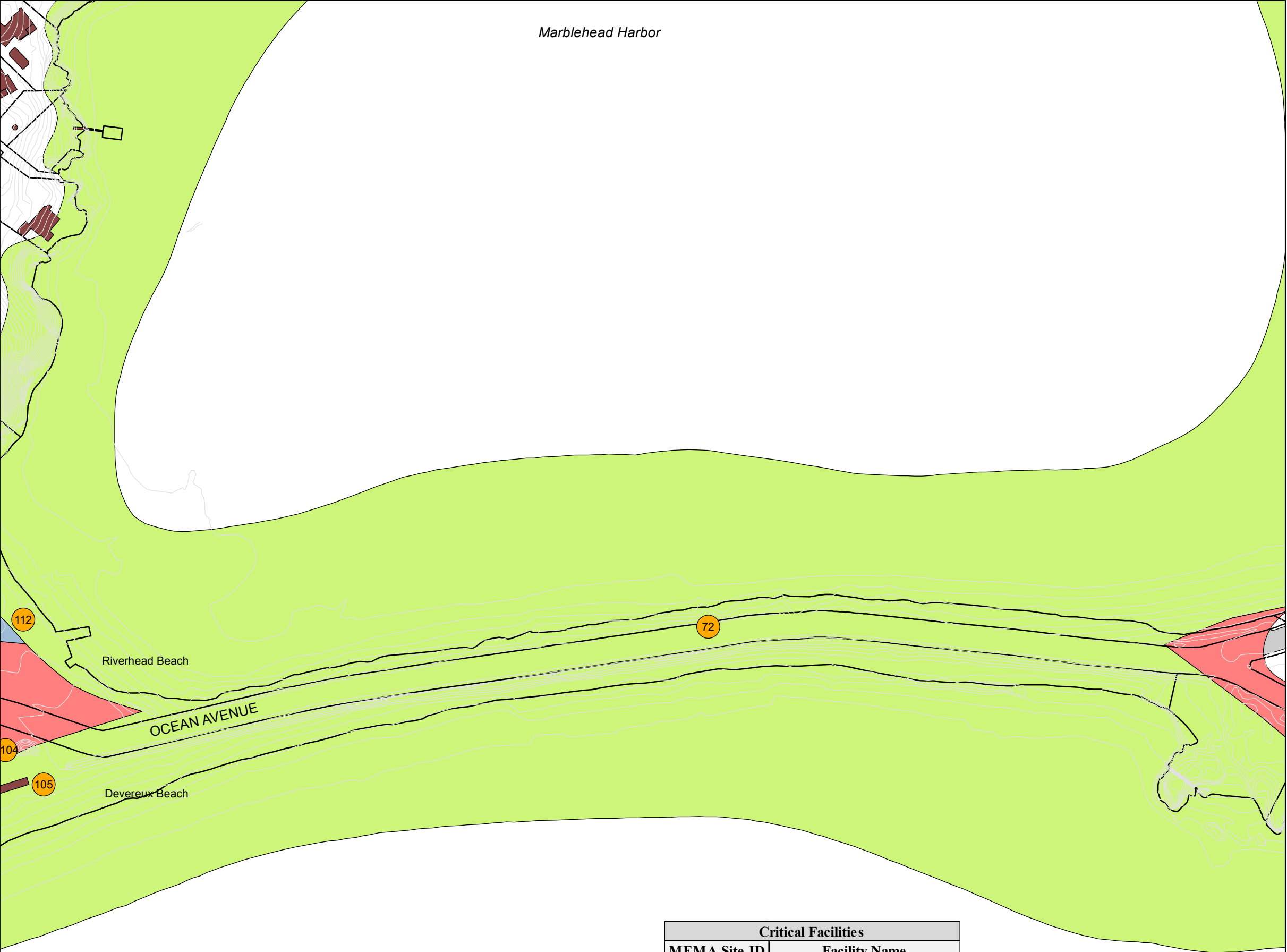
Critical Facilities	
MEMA Site ID	Facility Name
11	Abbot Hall
48	Marblehead Trading Company
85	Boston Yacht Club
86	Tucker's Wharf Sea Wall
87	Clark Landing
88	Sea Wall at Clark Landing
101	Tucker's Wharf

April 10, 2013 CSP  
Source: MassGIS, Marblehead municipal database

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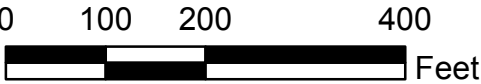












Marblehead Harbor



**Town of Marblehead, MA**



**Legend**

-  Critical Facilities
-  Pump Stations
-  Structures
-  AE Area of 100-year flood, shallow flooding
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-  AS Area of stormwater related flooding (Identified by Community Team)

**Figure 2-6**  
**The Causeway**  
**Flood Hazard Area**

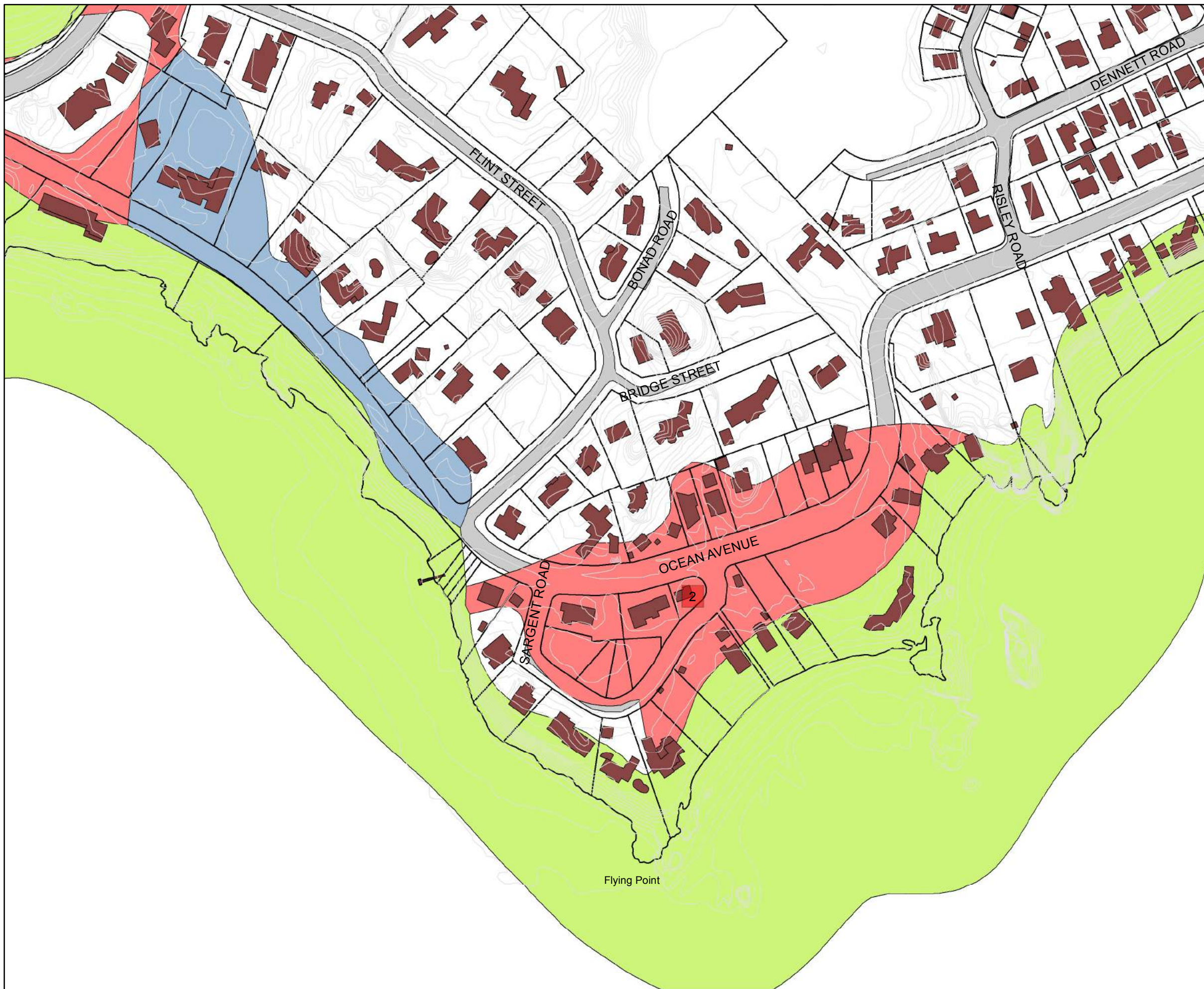
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## Town of Marblehead, MA

0 100 200 400  
Feet



### Legend

- 100 Critical Facilities
- 12 Pump Stations
- Structures
- AE Area of 100-year flood, shallow flooding
- AO Area of 100-year flood (usually sheet flow on sloping terrain)
- VE Area of 100-year coastal flood with velocity
- X500 500-year flood and 100-year flood with depths < 1ft., or drainage areas less than one square mile, or protected by a levee
- AS Area of stormwater related flooding (Identified by Community Team)

## Figure 2-8 Sargent Rd/Ocean Ave Flood Hazard Area

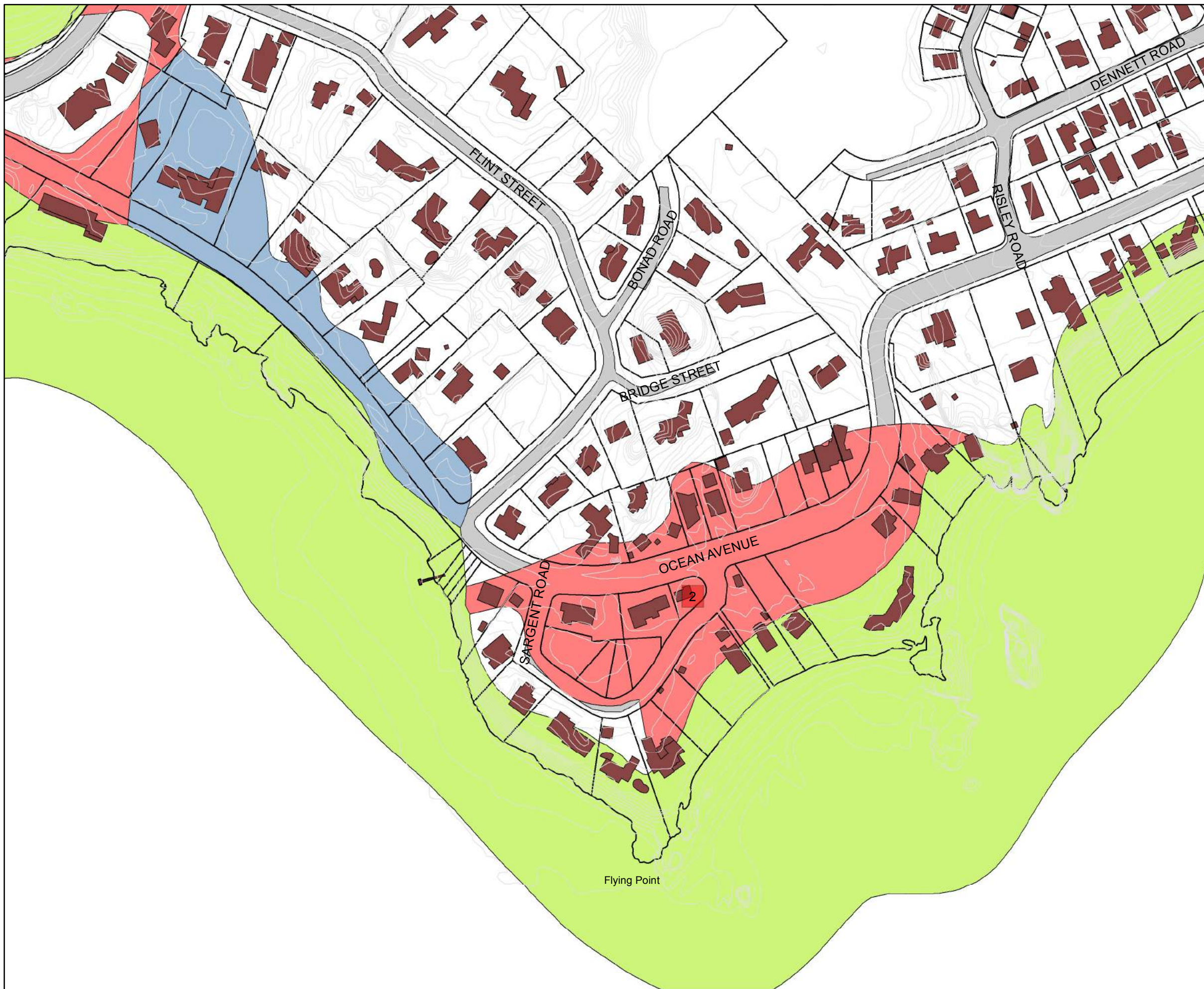
April 10, 2013 CSP  
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## Town of Marblehead, MA

0 100 200 400  
Feet



### Legend

- 100 Critical Facilities
- 12 Pump Stations
- Structures
- AE Area of 100-year flood, shallow flooding
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- AS Area of stormwater related flooding (Identified by Community Team)

**Figure 2-8**  
**Sargent Rd/Ocean Ave**  
**Flood Hazard Area**

April 10, 2013 CSP  
Source: MassGIS, Marblehead municipal database

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In 1998 and 1999 several storm events caused major flooding problems, resulting in a recommendation at Town Meeting to transfer stormwater responsibilities to the Water and Sewer Department. The storm drainage maintenance and rehabilitation program was transferred to the Marblehead Water and Sewer Commission in fiscal year 2000, by vote at Town Meeting. At that time, \$4.6 million was bonded to help address areas of severe flooding, including Commercial Street; Central Street and Chestnut Street; and an area between Glendale Road and Leicester Road. New, larger drains have since been constructed in each of these areas to minimize the flooding that occurs.

Additional areas of interior flooding concern were also identified and remediated. In the past, the areas listed had the potential of experiencing flooded basements, flooded lower levels and threatened utilities. The following list includes areas remediated and the project type implemented:

- *Maverick Street/Pleasant Street* (see Figure 2-9) ...neighborhood (including the Abbot Library) previously experienced frequent stormwater flooding. Large storm events had caused flooding in the children's wing of the Abbot Public Library, flooding on Bubier Road, and at the Sundance Day Care (critical facility). Completed work includes a newly constructed storm drain installed on Bubier Road intended to reduce or eliminate the problem.
- *Thompson Road/Leo Road* (see Figure 2-10) ...several residential properties previously experienced stormwater related flooding approximately three times a year, causing considerable damage, including loss of utilities/services. Completed work includes a storm drain construction project intended to mitigate/eliminate the problem.
- Various locations...including Pleasant Street near Sewall Street, Rockaway Avenue, Crown Way (outfall), Cornell Road, Dunn's Lane, Ocean Avenue at Flint Street, William Road, Blanchard Street and Waldron Street. Completed work includes installation of larger drain pipes and new outfalls, cleaning of existing drain lines, replacement of defective pipes, addition of increased inlet capacity, and redirection of flows to other areas/outfalls.

Both the Maverick St./Pleasant St. and Thompson Rd./Leo Rd. Flood Hazard Areas remain in the Plan as areas of concern. Although the Town has not experienced a storm event which has resulted in flooding in any of these areas since the completion of remediation efforts, it is thought that conclusive results will take time to determine.

#### *Pleasant Street Drainage Project*

The Water and Sewer Department is continuously working to identify and remedy interior flood problems. After the completion of the above mentioned projects, the Water and Sewer Commission undertook review and preliminary design work in the area of Evans Road, Roosevelt Street, Sewall Street, and Pleasant Street interior flooding issues - the Pleasant Street Drainage Project. A result of many studies, the Pleasant Street Drainage Project was approved at Town Meeting in June 2012. Flooding in the study area has caused extensive damage to residential and commercial structures, in addition to business disruption/lost revenue in recent years. Municipal departments spend thousands of dollars and countless hours during storm events. Flooding frequently causes traffic delays and the closure of public areas. Improvement projects include:

- Green Street/Reynolds Playground

- Evans Road and Roosevelt Avenue
- Sewall Street/Ambulance Barn
- School Street – water passes through stone wall foundations that are often shared, flooding basements and public utility structures
- Pleasant Street – open stone structures are over 100 years old and difficult to maintain
- Sewall to Pleasant Street and School Street – Utilities passing through the culverts restrict water flow
- Atlantic Avenue – additional capacity is needed to remove water from the Pleasant Street area, allowing improvements to the upstream areas of the drainage basin

The Pleasant Street Drainage Project is a preliminary design and construction plans/specifications for Phase I are due out in early 2013, with a late spring 2013 construction start anticipated.

#### Pleasant Street Area Drainage Improvements

The Water and Sewer Department is also looking to remedy additional interior flooding problems associated with the Pleasant Street area, currently seeking FEMA Hazard Mitigation Grant Program (HMGP) funding associated with the federal disaster declarations for the October 29-30, 2011 Snow Storm event. The Project includes the replacement of existing mains, rehabilitation of several underground culvert, and some sections of new storm sewer installation to increase the inlet and conveyance capacity of the drainage system through the Pleasant Street area reducing the inland flooding of roadways, businesses and homes. The Project area includes Pleasant Street, Atlantic Avenue, Spring Street, Essex Street, Sewall Street, Evans Road, Washington Street and School Street, see Figure 2-11.

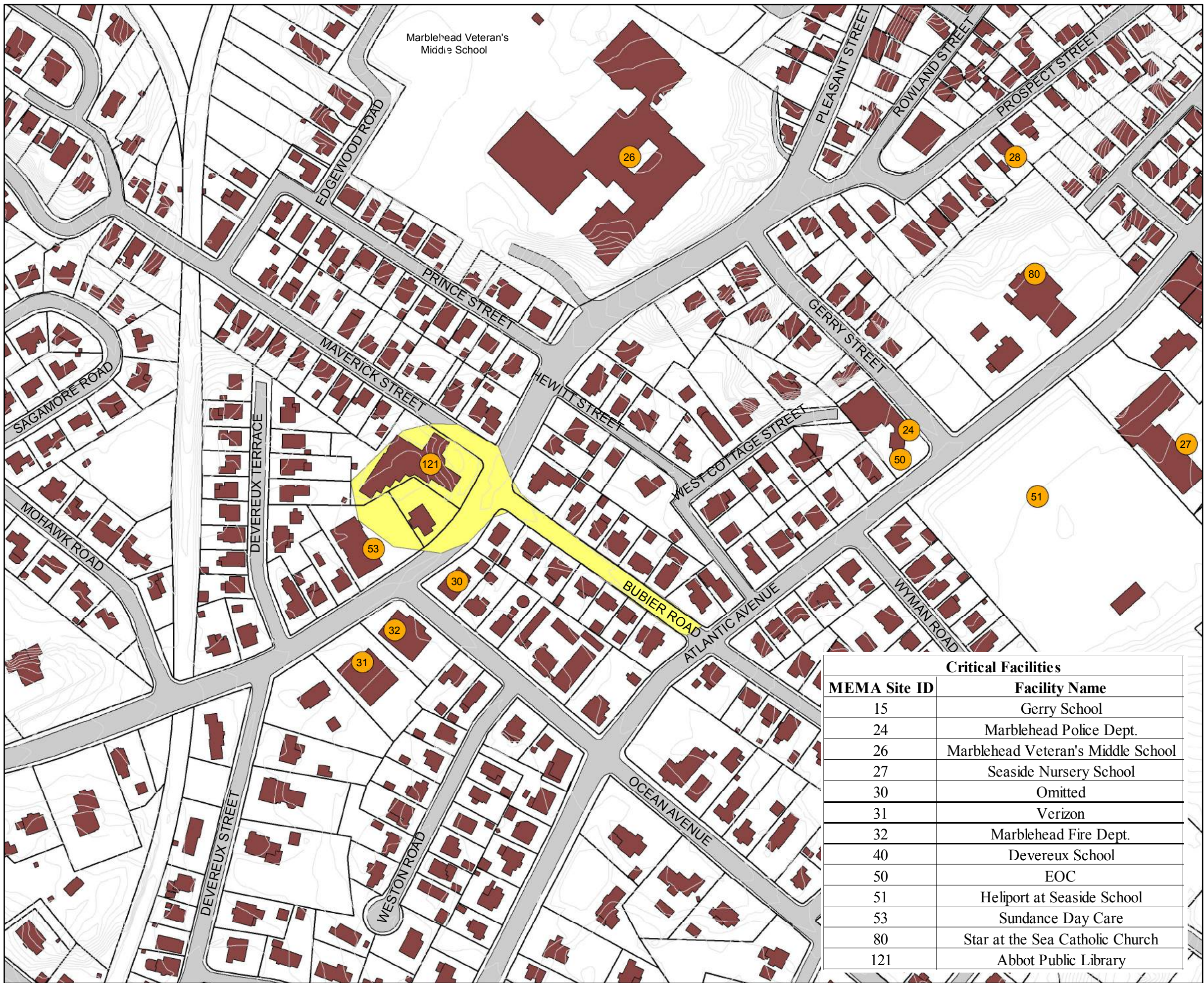
### **Probability of Future Occurrence of Flood-Related Hazards in Marblehead**

As development in floodplains and urbanization continues, increasing impervious surfaces, increasing the rate of drainage collection, and reducing the carrying capacity of the land, it is likely flooding will also increase on a more frequent basis with even lower storm events. Until the Town is able to address the continuously overwhelmed sewer system (CSO), Marblehead will likely continue to 'band-aid' localized flooding. Most evident in predictions of future flooding occurrences are the impacts due to rising sea levels and climate change. Considering the continuation of urbanization, increases in significant rain events (and timing of events - saturated ground levels), it should be expected that the coastal waters will continue to surge, at increasingly higher and likely historic flood levels/stages.

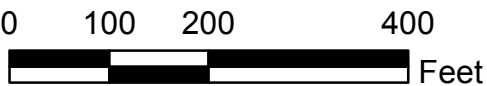
#### **2.2.2 Winter-Related Hazards**

Winter storms can have many of the same effects as hurricanes, bringing with them high winds, coastal erosion, and flooding. The principal hazard associated with snow is its accumulation on roofs causing failure to roof trusses and supports. Accumulated snow and ice, along with accompanying high winds, can break power and utility lines, risking loss of heat, power, communications and water in both residential and commercial areas. Snow melt can also cause flooding problems.





## Town of Marblehead, MA



### Legend

- Critical Facilities
- Pump Stations
- Structures
- AE Area of 100-year flood, shallow flooding
- AO Area of 100-year flood (usually sheet flow on sloping terrain)
- VE Area of 100-year coastal flood with velocity
- X500 500-year flood and 100-year flood with depths < 1ft., or drainage areas less than one square mile, or protected by a levee
- AS Area of stormwater related flooding (Identified by Community Team)

**Figure 2-9**  
**Maverick St./Pleasant St.**  
**Flood Hazard Area**

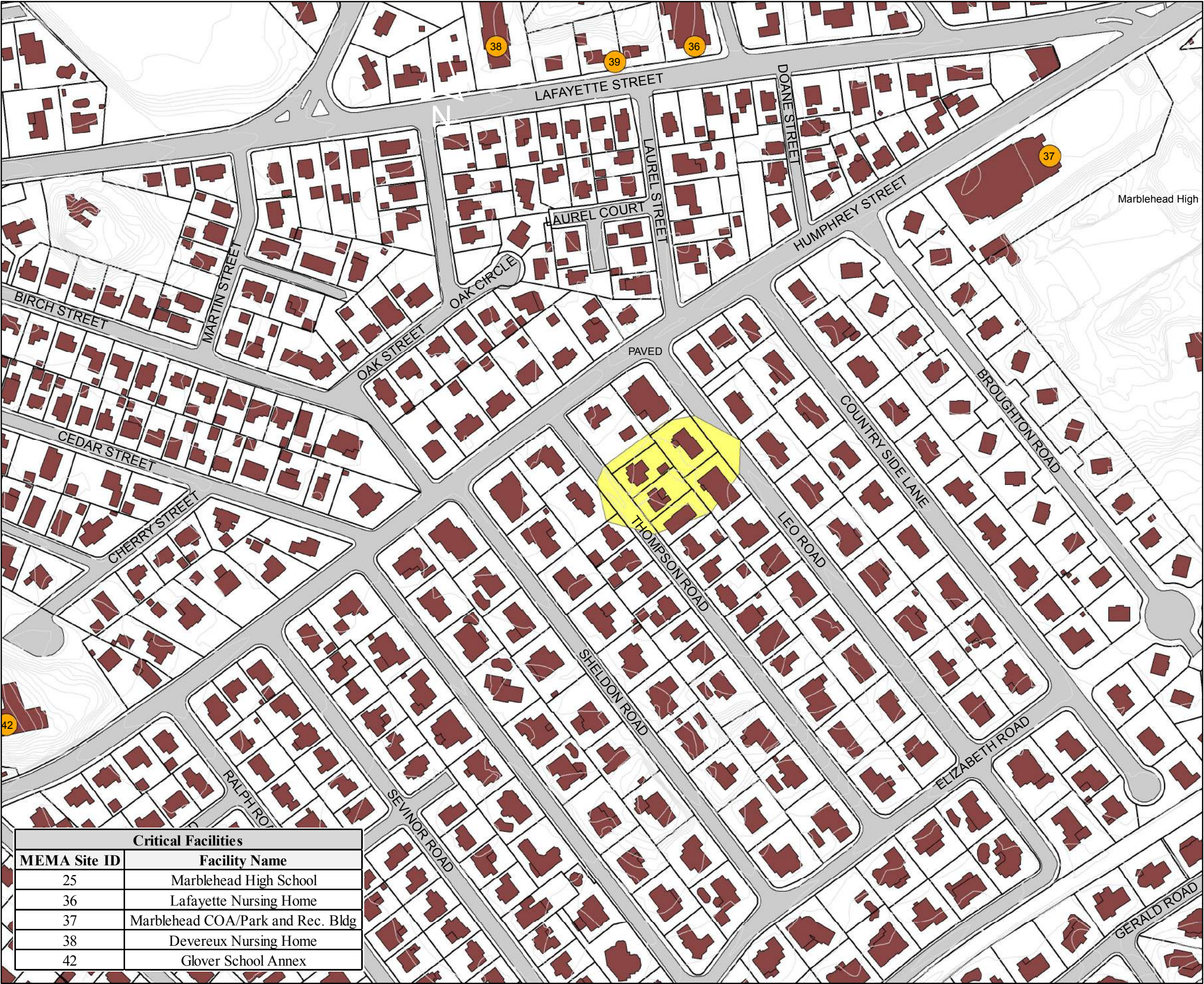
April 10, 2013 CSP  
Source: MassGIS, Marblehead municipal database

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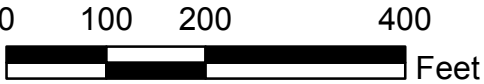
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Critical Facilities	
MEMA Site ID	Facility Name
15	Gerry School
24	Marblehead Police Dept.
26	Marblehead Veteran's Middle School
27	Seaside Nursery School
30	Omitted
31	Verizon
32	Marblehead Fire Dept.
40	Devereux School
50	EOC
51	Heliport at Seaside School
53	Sundance Day Care
80	Star at the Sea Catholic Church
121	Abbot Public Library





Town of Marblehead, MA



Legend

- Critical Facilities
- Pump Stations
- Structures
- AE Area of 100-year flood, shallow flooding
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Figure 2-10  
Thompson Rd./Leo Rd.  
Flood Hazard Area

April 10, 2013 CSP  
Source: MassGIS, Marblehead municipal database

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Critical Facilities	
MEMA Site ID	Facility Name
25	Marblehead High School
36	Lafayette Nursing Home
37	Marblehead COA/Park and Rec. Bldg
38	Devereux Nursing Home
42	Glover School Annex










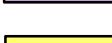



## Town of Marblehead, MA

0 120 240 480  
Feet



### Legend

-  Critical Facilities
-  Pump Stations
-  Structures
-  Area of 100-year flood, shallow flooding
-  Area of 100-year flood (usually sheet flow on sloping terrain)
-  Area of 100-year coastal flood with velocity
-  500-year flood and 100-year flood with depths < 1ft., or drainage areas less than one square mile, or protected by a levee
-  Area of stormwater related flooding (Identified by Community Team)
-  Pleasant Street Area Drainage Improvements

**Fig. 2-11**  
**Pleasant Street Area**  
**Drainage Improvements**

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## Ice Jams

Ice jams occur in winter or early spring as normally flowing water begins to freeze. There are two types of ice jams; a freeze up - forms in the winter as ice formation begins and can hold back flowing water behind it, and a breakup jam – forms as a result of the breakup of ice cover, causing large pieces to move downstream. Marblehead has had very little history with ice jams, if any at all, and is considered to be at low risk of any future ice jam events.

Since the 2004 plan, there have been 20 significant winter-related events impacting Marblehead by way of winter weather (two events), winter storms (six events/\$589 K in damages) and heavy snow (twelve events/\$43 K in damages).

## **Property at Risk from Winter-Related Hazards in Marblehead**

Winter weather events can include heavy snows, ice, and extreme cold and can affect the entire Town of Marblehead. Heavy snow can bring the community to a standstill by inhibiting mobility (transportation networks, pedestrian travel), knocking down trees and utility lines, and cause structural collapses in older buildings. Ice buildup can down utility lines and communication towers. The impacts of both events can cause indirect issues such as freezing/rupturing pipes from lack of heat, while also changing the ground's frost level, creating problems for underground infrastructure.

New England experiences winter storms in more extreme ways than most of the rest of the country. The Town of Marblehead receives between 36 inches to 72 inches of snow per year (see Appendix A, Figure A-3). The most dangerous hazard associated with winter storms, as it concerns Marblehead, is the possibility of citizens becoming stranded on the Neck. Flooding caused by the ocean's storm surge or blizzard conditions where snow fall is too rapid to be cleared efficiently often triggers closure of the Causeway. Other minor hazards include flooding during snow melt and treacherous roadways due to ice and snow.

## **Probability of Future Occurrence of Winter-Related Events in Marblehead**

According to past history and climatic conditions, and the inability to predict extreme snow/temperature events, it is likely that winter-related hazards will continue to impact the Town to varying degrees.

## **2.2.3 Wind-Related Hazards**

### Hurricanes/Nor'easters

Hurricanes are defined as a large circulating windstorm covering hundreds of miles that forms over warm ocean water. To be officially classified as a hurricane, the wind speeds must exceed seventy-four (74) miles per hour. In the northern hemisphere winds circulate in a counter clockwise direction. A great dome of water as much as fifty miles in diameter (called the "storm surge") is pushed ahead of the storm by its winds. This can result in tides twenty (20) feet higher than usual. This storm surge is responsible for many hurricane related deaths.



The winds that accompany hurricanes have the potential to cause serious damage. Downed power lines leave residents without electricity, and can impede business for days. Fallen trees can damage buildings and block roadways. Unsecured building components including gutters, screened enclosures, roof coverings, shingles, car ports, porch coverings, overhangs, siding, decking, windows, walls, gables can be blown off structures and carried by the wind to cause damage in other places. Wind driven rain often causes water damage in roof and wall envelopes.

The Massachusetts State Building Code 780 CMR requires building permits prior to construction. Marblehead has adopted the Massachusetts building code standards, which focuses on where and how residential and commercial buildings are constructed, and includes measures that require buildings to be able to withstand extreme weather events. More recently in response to Hurricane Katrina, Massachusetts strengthened its code, requiring newly installed windows to meet higher wind load thresholds.

### *Measuring the Intensity of a Hurricane*

Hurricane damages come from wind, rain, tornadoes, floods/storm surge, and the effects of very low air pressure. The Saffir-Simpson Hurricane Wind Scale (SSHWS) intensity category system was developed in the 1970's to characterize a hurricane's destructive potential. The SSHWS category system measures sustained wind speed, central pressure, storm surge height, and coastal damage potential within five intensity categories.

The National Weather Service (NWS) will issue a hurricane warning when sustained winds of 74 mph or higher are reached and expected within a coastal area within 24 hours. On average, there are approximately 10 named tropical storms along the east coast of the U.S. each year, six of which are likely to develop into hurricanes, with only two or three likely to reach category 3 on the SSHWS. The SSHWS has undergone a minor modification for 2012 in order to resolve awkwardness associated with conversions among the various units used for wind speed in advisory products. The change broadens the Category 4 wind speed range by one mile per hour (mph) at each end of the range, yielding a new range of 130-156 mph.

### Tornados/Severe Wind Events

Tornados are violently rotating columns of air in contact with and extending between a cloud and the surface of the earth. Generally, winds in most tornadoes are 100 mph or less, but can exceed 250 mph in the most violent and least frequent tornadoes. Several conditions are required for the development of tornadoes and associated thunderstorm clouds, including abundant low level moisture to contribute to the development of a thunderstorm, along with a trigger/cold front to lift the moist air. Tornadoes usually form in areas where strong winds are turning in a clockwise direction and can be in the traditional funnel shape, or in a slender rope-like form. They typically begin in a supercell (severe thunderstorm), primarily in the month of May.

### *Measuring the Intensity of a Tornado*

Typically, tornadoes are categorized by frequency values from historic data and area impacted based on the length and width of the damage path. Intensity scores are a factor of the Enhanced Fujita Scale.

Although Marblehead has not experienced any tornadoes to date, it is not completely out of the realm of possibility. In June 2011, multiple tornadoes slammed western and central Massachusetts destroying buildings, flipping vehicles, and leaving three people dead and 200 more injured.

Since the 2004 plan, there have been 32 significant wind-related events impacting Marblehead by way of lightning (three events/\$45 K in damages), strong/thunderstorm winds (twenty-five events/\$1.1 million in damages), storm surges (two events/\$50 K in damages), and tropical/super storms (two events/\$1.6 million in damages).

### **Property at Risk from Wind-Related Events in Marblehead**

Wind events are quite normal in New England and happen regularly each year. In the winter months, the area, including the Town of Marblehead is susceptible to high winds from nor'easters and winter storms. Spring and summer seasons usually bring a number of severe thunderstorms to the region. During the late summer and fall seasons, the area is at risk from a hurricane or tropical event which has happened on average every 7.8 years. Fortunately, Marblehead has not received the brunt of a hurricane since Hurricane Bob in August 1991 (see Appendix A, Figure A-5). Since the 2004 plan, the Town has experienced approximately 63 significant high-wind events.

### **Probability of Future Occurrence of High Wind Hazards in Marblehead**

Marblehead, as with the entire coast of Massachusetts, is particularly vulnerable to hurricanes given its geographic location in relation to the Atlantic seaboard. Marblehead Neck is especially vulnerable to hurricane surges and high wind hazards being directly exposed to the Atlantic Ocean, while at the same time, also providing a degree of shelter/buffer from direct impacts entering Marblehead Harbor. As previously stated, wind events are quite normal in New England, as evidenced throughout the year. Given the increase in frequency and severity of high wind events realized over the last several years, and considering the presence of isolated microburst (June 2011 tornado), high-wind hazards will continue to impact the Town to varying degrees.

### **2.2.4 Urban Fire-Related Hazards**

Marblehead's town center is crowded with old and historic buildings, many of which are wooden structures, posing a moderate/high risk for urban fire given the number and proximity of structures in defined areas.

There have been no significant fire-related events in Marblehead since the 2004 Plan. The majority of fires that have occurred have been small-scale, isolated fires.

## **Property at Risk from Urban Fire-Related Hazards in Marblehead**

Many of the wooden residential and commercial structures built close together would allow fire to spread easily. In addition, the town center includes many buildings attached to one another, also allowing fire to spread easily.

## **Probability of Future Occurrence of Urban Fire Hazard in Marblehead**

Due to the closely-built residential and commercial structures located within the town center, it is likely that one isolated fire could spread rapidly. Environmental factors such as drought conditions, high winds or inadequate fire suppression systems, as with vacant buildings, a fire in a densely developed area can rapidly become a major hazard.

### **2.2.5 Geologic-Related Hazards**

An earthquake is the sudden release of strain energy in the Earth's crust, resulting in energy waves that radiate outward from the earthquake source. The point on the Earth's surface directly above the focus is called the earthquake epicenter. The severity of earthquake effects is dependent upon: magnitude of energy released; proximity to the epicenter; depth to the epicenter; duration; geologic characteristics; and, type of ground motion.

When earthquakes occur, much of the damage is a result of structures falling under the stress created by the ground movement. Another significant effect is damage to the public and private infrastructure (i.e. water service, communication lines, drainage system). Because earthquakes are highly localized it is difficult to assign regional boundaries that share the same relative degree of risk.

#### *Measuring the Intensity of an Earthquake*

An earthquake's severity can be expressed in terms of intensity and magnitude. Intensity is defined by the observed effects of groundshaking on people, buildings, and the natural environment, which varies dependent upon the location of the observer with respect to the epicenter. Currently in the U.S., the Modified Mercalli (MMI) Intensity Scale is used to evaluate the effects of earthquakes. Magnitude is defined by the amount of seismic energy released at the hypocenter of the earthquake, based on the amplitude of the earthquake waves recorded on seismographs (using the Richter Magnitude Scale). Another measure of the relative strength of an earthquake is the expanse of area the shaking is noticed.

There have been no significant geologic-related events in Marblehead since the 2004 Plan.

## **Property at Risk from Geologic-Related Hazards in Marblehead**

Buildings that are most at risk from earthquakes are the old masonry buildings and older, large wooden structures.

## **Probability of Future Occurrence of Geologic-Related Hazards in Marblehead**

New England is not considered to be a hot spot for earthquakes, especially when compared to the western United States. However, Marblehead is located in one of the highest risk zones in Massachusetts. Although there is not a high frequency of occurrence, earthquakes do occur from time to time and were therefore considered during the development of the 2013 Update. Historical earthquake epicenters with date and intensities based on the Richter Scale are shown on Figure A-6 in Appendix A.

### **2.2.6 Other Hazards**

#### **Extreme Temperatures**

The term is relative to the 'typical' weather in the region for both extreme heat and extreme cold, defined generally as a prolonged period of one extreme. It is important to be aware of who is at greatest risk (most often the elderly, children, and people with certain medical conditions) and what actions can be taken to prevent a temperature extreme. Some behaviors also put people at greater risk including drinking alcohol and certain medications. There has been one recorded case of extreme heat (excessive heat, 2011) since the 2004 Plan. The Town of Marblehead is considered at low risk of future extreme temperature events.

#### **Wildland Fire**

Defined as any non-structure fire that occurs in the wildland, and include wildfire (naturally occurring or human caused), and prescribed fire. Most susceptible to the hazard are pitch pine, scrub oak, and oak forests – the most flammable vegetative fuels. Over the last several years, wildland fires reported to the Department of Conservation and Recreation are trending downward. In kind with Marblehead's topography and vegetative cover, it is considered at low risk of the hazard.

#### **Drought**

Defined as a temporary irregularity, characterized by long durations of below normal precipitation, relative to the normal precipitation of the region. It can affect agriculture, water supply, aquatic ecology, wildlife and plantlife. Massachusetts is often considered a 'water rich' state with western Massachusetts more vulnerable than eastern Massachusetts to severe drought conditions.

### **2.3 Vulnerability**

Vulnerability indicates what is likely to be damaged by the identified hazards and how severe that damage could be. A vulnerability chart was developed based on the identification and profile of the natural hazards that have occurred throughout Marblehead over time. The following criteria adapted from the FEMA State and Local Mitigation Planning How-to-Guide Series were utilized for frequency and severity categorization:

### **Criteria for Frequency Categorization:**

<b>Very low frequency:</b>	events that occur less frequently than once in 1,000 years (less than 0.1% per year).
<b>Low frequency:</b>	events that occur from once in 100 years to once in 1,000 years (0.1% to 1% per year).
<b>Medium frequency:</b>	events that occur from once in 10 years to once in 100 years (1% to 10% per year).
<b>High frequency:</b>	events that occur more frequently than once in 10 years (greater than 10% per year).

The criteria used for severity categorization, based on past hazard events includes:

### **Criteria for Severity Categorization (based on past hazard events):**

<b>Minor:</b>	Limited and scattered property damage; no damage to public infrastructure; contained geographic area; essential services not interrupted; no injuries or fatalities.
<b>Serious:</b>	scattered major property damage; some minor infrastructure damage; wider geographic area; essential services are briefly interrupted; some injuries/fatalities.
<b>Extensive:</b>	Consistent major property damage; major damage to public infrastructure; essential services are interrupted for several hours to several days; many injuries and fatalities.
<b>Catastrophic:</b>	Property and public infrastructure destroyed; essential services stopped; thousands of injuries and fatalities.

Below, Table 2-2 *Vulnerability Matrix 2013 Update* describes the expected frequency of occurrence, and the potential severity of the damage resulting from each individual hazard evaluated for this update. Coordination with the State Plan was also a consideration in the development of the updated Vulnerability Matrix.

**Table 2-2 Vulnerability Matrix 2013 Update**

<b>Hazard</b>	<b>Future Occurrence</b>	<b>Potential Damage</b>
Flood-Related Hazards	High	Extensive
Winter-Related Hazards	Medium	Minor/Serious
Wind-Related Hazards	High	Extensive
Urban Fire-Related Hazards	Low	Minor/Serious
Geologic-Related Hazards	Low	Catastrophic

### **Economic Vulnerability**

**Property Damage** - As seen in Table 2-3, FEMA estimated that the value of property insured by the NFIP in Marblehead is over \$61 million as of November 28, 2012 (MA State Floodplain Coordinator). There are now twenty properties that have experienced repetitive loss damages, of which, over half have experienced three or more individual



claims since 1978. According to the State Floodplain Coordinator and since the 2004 plan, there have been seven repetitive loss claims totaling \$320,000 in payments, town-wide.

**Table 2-3 Summary of National Flood Insurance Program Activity in Marblehead**

Total Policies	Coverage Value	Policies in V-Zone*	Policies in A-Zone*	Claims Since 1978
233	\$61,500,000	61	45	159

\* Source: FEMA, NFIP, Loss Statistics from January 1, 1978 through November, 2012.

\* V-zone refers to the velocity zone, where waves greater than 2.9 feet are feasible during a 100-year flood. A-zone refers to other areas within the 100-year flood zone with less than 2.9-foot waves (FEMA, 1997).

The majority of the NFIP insured properties are located along the coast, along with several interior low-lying commercial and residential areas vulnerable to flooding from stormwater collection deficiencies.

As the primary cause of risk to the community, an evaluation was performed to estimate the total land and building values within each coastal and inland flood hazard area. The number and types of residential, commercial, industrial, historical, and publicly owned structures are described earlier in Section 2.2.1 and quantified in Table 2-4 *Total Vulnerability Summary, Marblehead, Ma.* All flood zone data presented is based on the FEMA Flood Insurance Rate Maps (FIRMs) as revised through 1985. Zone AS indicates those parcels vulnerable to stormwater related flooding.

There are approximately 247 residential structures located within the coastal and inland flood hazard areas. There are also approximately 26 commercial properties and three utility-owned properties (Massachusetts Electric Company). There are 19 publicly-owned properties including both natural and recreational assets such as area beaches (Grace Oliver, Gas House, Fort, Tucker's, Devereux, and River Head), the Abbot Public Library, and critical infrastructure including four wastewater pumping stations, various sea walls and landings associated with the Harbor, four heliports and the South Essex Sewerage District sewerage plant.

**Recent Development Trends** - Today Marblehead is primarily residential with two small business districts and a small industrial park. Seventy percent of the town's land use is residential. The town is almost completely developed. Very little privately owned large parcels of land remain undeveloped. Pre-revolutionary development in Marblehead centered in the "downtown" area. A remarkable number of these buildings are still standing. The downtown area development is characterized by structures on small lots and narrow roads that in some cases were former cow paths. The majority of the town was developed in a more suburban character with single-family homes on larger (quarter acre) lots on wider uniform streets. Marblehead's West Shore consists of small "camps" situated fairly close together, which have been rehabilitated and expanded over the years. Marblehead Neck, an area known as Peach's Point, and the Clifton shorefront were developed as summer communities with large homes on large lots for wealthy summer residents.

Marblehead sees very few nonresidential developments, however, this has increased in the past few years. There is a major commercial development currently occurring on the west side of Pleasant Street south of School Street, on the site of the former Warwick Theater. There are also several redevelopments of areas along Atlantic Ave that have occurred in past few years.

During the 1990s there was an average of 23 building permits for new residential construction per year. The largest subdivision that the town has seen in decades was Westledge, a 22-lot subdivision of single family homes in 1996. The Tedesco Country Club owns the largest tract of privately owned land in the town. This land is zoned residential and is presently used as a golf course. The town is unaware of any plans to discontinue its present use. In the 2000's there were two seven lot subdivisions and one 10 lot subdivision. A 20 unit incentive zoning special permit was recently approved in addition to two 40B Comprehensive permit projects permitted, creating 108 housing units with 27 affordable housing units. In 2009 the town established two smart growth development zoning overlay districts.

Marblehead's long-term development pattern is largely established. The future is likely to continue the pattern of in-fill construction of single-family homes, reuse or replacement of existing structures, and small nonresidential developments because of its proximity to Boston, its strong economy, and its desirable location for young families.

Economic impacts to local boat and marina owners is also significant in the event of a hurricane or other storm with excessive winds and tides. The Marblehead Harbor Plan (2009) states that there are a total of six yacht clubs and nine public dock facilities affiliated with the Town of Marblehead. Further research indicates a total of thirty-five private docks. Also, there are approximately 2,500 moorings inventoried as of March, 2013.

**Impact of Business Interruption** – Notwithstanding the obvious costs of commercial property damage, the impacts of potential business interruption from a natural disaster in Marblehead cannot be under estimated. Business closures result in a reduction of revenues to proprietors and a loss of wages to employees. In addition, State and local tax revenues can be significantly reduced.

Table 2-4  
Total Vulnerability Summary, Marblehead, Massachusetts

<i>Hazard Area Location</i>	<i>Total Buildings by Type R=Residential C=Commercial P=Public U=Utility V=Vacant</i>	<i>Approximate Land Value</i>	<i>Approximate Building Value</i>	<i>Approximate Total Value</i>	<i>Critical Facilities</i>
<b>Coastal Flood Hazard Areas</b>					
Beacon Street/Norman Street	11 R      4 C            5 P 1 V	\$12,080,200 \$3,118,300 \$910,800 \$279,900	\$7,558,000 \$1,383,400	\$19,638,200 \$4,501,700 \$910,800 \$279,900	Grace Olver's Beach, Gas House Beach, Grace Oliver's Sea Wall
Front Street/Doaks Lane	43 R      3 C            4 P 12 V       2 U	\$29,486,000 \$1,422,100 \$8,130,000 \$4,293,400 \$374,200	\$15,421,500 \$2,557,700	\$44,907,500 \$3,979,800 \$8,130,000 \$4,293,400 \$374,200	Fort Sewall Pump Station, Fort Beach
Devereux Beach/Tucker's Beach	25 R      8 5 P            1 U V	\$25,620,800 \$26,979,900 \$9,184,900 \$625,800	\$10,888,900 \$0 \$123,600	\$36,509,700 \$26,979,900 \$9,184,900 \$749,400	South Essex Sewerage District Plant, Heliports at Goldthwait Res./Tucker's/Devereux/Riverhead Beaches
Front Street/Ferry Lane	20 R      1 1 C            1 V P            1 V	\$15,552,700 \$2,181,100 \$1,890,600 \$145,600	\$7,813,200 \$963,400 \$0 \$0	\$23,365,900 \$3,144,500 \$1,890,600 \$145,600	Marblehead Trading Co., Clark Landing, Sea Wall at Clark Landing
Boston Yacht Club	20 R      2 1 C            1 V P	\$21,501,000 \$2,649,400 \$4,784,000 \$1,444,300	\$12,278,500 \$1,486,100 \$216,000 \$0	\$33,779,500 \$4,135,500 \$5,000,200 \$1,444,300	Boston Yacht Club, Tucker's Wharf, Sea Wall at Tucker's Wharf
The Causeway					Sea Wall at the Causeway
Harbor Avenue/Foster Street/Sean Way	19 R      1 1 V	\$28,672,900 \$59,600	\$9,589,000    \$0	\$38,261,900 \$59,600	Harbor Avenue Wastewater Pump Station
Sargent Road/Ocean Avenue	34 R      7 1 P            7 V	\$26,659,700 \$764,300 \$1,408,900	\$41,910,800 \$34,400	\$68,570,500 \$798,700 \$1,408,900	Sargent Road Wastewater Pump Station
<b>Interior Flood Hazard Areas</b>					
Maverick Street/Pleasant Street	8 R      1 1 C            1 P	\$1,688,800 \$471,200 \$388,200	\$1,761,200 \$430,600 \$1,766,000	\$3,450,000 \$901,800 \$2,154,200	Abbot Public Library
Thompson Road/Leo Rd.	7 R	\$1,749,700	\$1,588,800	\$3,338,500	
Pleasant Street Area Drainage Improvements	60 R      3 15 C            3 2 V	\$13,091,200 \$5,125,000 \$466,700	\$15,995,900 \$5,112,700	\$29,087,100 \$10,237,700 \$466,700	Boston Yacht Club, Tucker's Wharf, Sea Wall at Tucker's Wharf
<b>Total</b>	<b>247 R 26 C 19 P 33 V U</b>			<b>\$300,908,800 \$26,901,000 \$45,864,400 \$17,283,300 \$1,123,600</b>	

Of particular note is Marblehead's heritage as a thriving fishing village. The approximate 13.5 miles of coastline support a fleet of 40-50 commercial fishing vessels comprised of lobster fishermen; 2 boats full time ground fish; 4 boats rig over for part time groundfish; and 2 boats utilize hand lines. The commercial fleet moves to Salem Harbor over winter, with the exception of 4 boats, which provides additional protection from natural hazards to the fleet.

Travel and tourism in Marblehead is also a major contributor to the local economy in terms of revenue and employment. Marblehead's historic charm, architecture, and specialty shops sustain the community as a year-round visitor attraction. The influx of tourists and visitors has evolved the local retail market into specialty shops from once neighborhood convenience stores and provisional marine services.

The yacht clubs on Marblehead Harbor (Boston Yacht Club, Dolphin Yacht Club, Marblehead Yacht Club, Pleon Yacht Club, Eastern Yacht Club, and Corinthian Yacht Club) provide club/facility access, floats, parking and launch services for their members.

The Town of Marblehead Recreation, Parks, and Forestry Department, as well as several private sailing schools, offer sailing lessons/classes. The Coast Guard Auxiliary and Marblehead Sail & Power Squadron provide Boating Safety courses.

The Town regulates the use of Marblehead waters mooring space through the permit process. Demand for mooring space far exceeds the present supply, with a current waiting list of 17 – 20 years. The Eastern, Corinthian and Boston Yacht Clubs maintain guest moorings at the entrance to the harbor. Several local mooring companies provide annual mooring services including cleaning and inspection of mooring equipment, replacement of worn equipment and installation of pennants. A number of local marine service companies provide a range of services including mechanical, woodworking, fiberglass repair, boat transportation, rigging and storage, while the Boston Yacht Club and Marblehead Trading Company also provide fuel services in the area. Public landing places within the harbor include the Philip T. Clark Public Landing (State Street), Theodore P. O'Brien Landing (Commercial Street), Richard H. Rockett Landing (Village Street), and Graves Beach Landing (Beacon Street). State Street North is used for the unloading of catch, and also used by a number of boats for the loading of gear. The Commercial Street Landing is used by the majority of commercial users for dinghies, loading and repairs.

In addition to the costs of commercial property damage, the impacts from potential business interruption following a disaster in Marblehead could have long-lasting, even crippling, effects on the local economy, quality of life, and sense of place that has been maintained and revered for generations.

## **Social Vulnerability**

A critical step in assessing risk and vulnerability of Marblehead to natural hazards is to identify the links between the potential destructive impacts to the built and natural environments and that relationship to the social structure. The social assets/ potential losses continue to be key components of the community and include the closure of institutions, loss of vital services (communication and transportation systems), and

disruption in the movement of goods and services, and emotional strain from financial and physical losses.

The vulnerability of a community obviously includes the potential for direct damage to residential, commercial and industrial property, as well as, schools, government and critical facilities. However, it also includes the potential for disruption of communication and transportation following disasters. Any disruption to the infrastructure, such as a loss of electric power or break in gas lines, can interrupt businesses and cause stress to affected families. This is especially the case where residents are forced to evacuate their homes and become subject to shortages of basic supplies.

Another component of the social vulnerability includes the long-standing 'sense of place' or cultural traditions associated with the Town of Marblehead, both as a commercial fishing port and recreational boating/tourist community. Today, Marblehead harbor boasts one of the finest displays of sailing craft anywhere, as both the starting and finishing port for numerous international races – earning the title Yachting Capital of the World (also the disputed title of the Birthplace of the American Navy). Marblehead's historic district is home to over 200 privately owned colonial period homes and buildings representative of this New England fishing port and harbor.

**Population at Risk** - The use of mass care facilities during an emergency is dependent on a variety of circumstances. These include warning time, public awareness of the hazard, the level of encouragement from public officials and the availability of shelters. There are two approved mass care facilities located throughout the town, Marblehead High School and Marblehead Community Center. Both sites have an agreement with the American Red Cross to operate as a mass care facility. Capacity for the two primary shelters is at 500. If required for a large-scale disaster, additional, secondary shelters have been identified including Marblehead Middle School (Village Street) and the Veteran's School (Pleasant Street), capacity is also at 500. The Town of Marblehead owns 150 cots and 200 blankets/toilet kits. Additional cots and supplies would be provided through the American Red Cross and established mutual aid agreements. None of the shelters are at risk to flood.

In addition to mass care facilities, also identified on the Critical Facilities map, are the Health/Medical Facilities within the Town, including:

- Police Station
- Fire Station
- Devereux House Nursing Home
- Lafayette Convalescent Home
- Salem Hospital Walk-In Center



Also identified as Critical Facilities are the Special Populations – Marblehead Elderly, Special Needs/Disabled and Youth living independently or in group situations within the Town, including:

- St. Andrews Day Care
- Clifton Lutheran Day Care
- Glover School
- Tower School
- Devereux Nursing Home
- Bells Schools
- St. Stephen's Day Care
- Abbot Public Library
- Marblehead High School
- Roads Elderly Housing Unit
- Star of the Sea Community Center
- Farrell Court Elderly Housing Unit

## **Environmental Vulnerability**

Hurricanes, earthquakes, nor'easters, floods or any weather related hazard event will have particular impacts on the natural and built environment. Differences in storm size, speed of movement, wind speeds, storm surge heights, timing with respect to tides and landfall location relative to vulnerable resources makes for high variability in impacts and related costs.

When the natural environment is impacted there are both direct and indirect costs. Impacts of severe weather events to the natural environment include both direct (loss of habitat and salinization of land/ groundwater) and indirect costs (widespread inland damage to built environment, threats to ecosystems/ species, and contamination of potable water supply).

### **2.4 FEMA Disaster Grant Assistance**

FEMA has provided Marblehead with approximately \$650,000 in grant assistance in recent years for the following seven disasters:

- Disaster Number: 0914  
Storm Event: Hurricane Bob (August 19, 1991)  
Main Items for Funding Provided for:
  - Emergency power for pump stations
  - Repair and replace power lines, transformers, poles, etc.
  - Personnel for search and rescue, traffic control and security
  - Replacement of curbs, gutters, and sidewalks damaged by uprooted trees and construction equipment

- Disaster Number: 0920  
Storm Event: No Name Storm (October 30 – November 3, 1991)  
Main Items for Funding Provided for:
  - Sea embankment repair at Surf Street
  - Sea wall repair at Harbor Avenue (behind #26)
  - Repair of public pier at Clark Landing (State Street)
  - Repair of damaged building at Devereux Beach
  - Repair and replace power lines, transformers, poles, etc.
  - Replacement of navigational aids in Harbor
  - Replace playground equipment at Devereux Beach
  - Drainage structure repair
  - Emergency drainpipe clearing
  
- Disaster Number: 0975  
Storm Event: December Blizzard (December 1992)  
Main Items for Funding Provided for:
  - Personnel for search and rescue, traffic control and security
  - Paving of dockyard broken up from storm surge
  - Removal of flood debris on roads, in parks, and buildings
  - Removal of sediment deposits on Devereux Beach and River Head Beach
  - Repair of gangway and dock at Commercial Street Wharf
  - Repair and replace power lines, transformers, poles, etc.
  - Emergency roadway repair at Flint St., Ocean Ave., the Causeway, Phillips St., Atlantic Ave., Beacon St., Moring Rd., Barnegat Rd., and Front St.
  
- Disaster Number: 1142  
Storm Event: Tropical Storm (November 20 – 25, 1966)  
Main Items for Funding Provided for:
  - Various measures to protect the sewer system
  - Personnel for search and rescue, traffic control and security
  - Replacement of a 16-foot ramp, six 40-ft by 16 ft floats, and gangways in the harbor
  
- Disaster Number: 3165  
Storm Event: Snow Storm (March 5 – 7, 2001)  
Main Items for Funding Provided for:
  - Funding for Board of Health, Police Dept., Fire Dept., and Highway Dept. labor, equipment and materials associated with the disaster

- Disaster Number: 3175  
Storm Event: Snow Storm (February 17 – 18, 2003)  
Main Items for Funding Provided for:
  - Costs incurred for emergency protective measures required as a direct result of near record snowfall in accordance with FEMA snow removal policy
- Disaster Number: 3191  
Storm Event: Snow Storm (December 6 – 7, 2003)  
Main Items for Funding Provided for:
  - Costs incurred for emergency protective measures required as a direct result of near record snowfall in accordance with FEMA snow removal policy
- Disaster Number: 1642  
Storm Event: Rainstorm (May 2006)  
Main Items for Funding Provided for:
  - Costs incurred for emergency protective measures required as a direct result of rain fall and flooding including pumping and storm drain failure.
- Disaster Number: 1701  
Storm Event: Nor'easter (April 2007)  
Main Items for Funding Provided for:
  - Cost incurred for debris removal fence repair, sea wall repair and other emergency protective measures required as a direct result of rain and storm surge.
- Disaster Number: 1959  
Storm Event: Snow Storm (January 2011)  
Main Items for Funding Provided for:
  - Costs incurred for emergency protective measures required as a direct result of snowfall in accordance with FEMA snow removal policy.

## **Section 3 Current Hazard Mitigation Activities**

### **3.1 Introduction**

The Town of Marblehead implements several hazard mitigation policies and procedures, current state laws, executive orders, and regulations to promote the safety of its residents and minimize risk to community assets. This section presents a brief description of each of the main mitigation programs currently in place.

### **3.2 Marblehead Emergency Response Team**

The Marblehead Emergency Response Team (MERT) was formed by the Town's Emergency Management Department to respond to any potential public safety concerns. MERT is dispatched on the scene wherever there may be an ongoing or potential risk to the community welfare. For example, if a tree falls onto power lines during a storm, MERT arrives, removes the tree from the wires and if possible prevents a potential power outage or fire. MERT is also dispatched to the Causeway during significant storm events as defined in the Town's Comprehensive Emergency Management Plan (CEMP).

### **3.3 Comprehensive Emergency Management Plan**

The Emergency Management Department has developed the CEMP to properly respond to emergency situations such as the recurrent flooding on the causeway. Town officials review National Weather Service (NWS) forecasts and initiate a pre-storm meeting when winds greater than 40 miles per hour or other significant weather conditions are forecasted. The forecasted storm is discussed and mitigation actions are determined for the particular storm.

When the forecasted storm has the potential for impacts to the Causeway, the roadway is closed to all traffic prior to the storm developing into a hazardous condition. Personnel from the Police Department and the Water and Sewer Department are stationed on Marblehead Neck to ensure public safety and to maintain the operation of water and sewer utilities. Fire Department personnel accompanied by an ambulance are stationed on the Neck to evacuate any residents with medical emergencies or to notify the Coast Guard if needed. Once the storm has passed, public works personnel clear cobbles and other debris from the roadway before the Causeway is reopened for public traffic.

### **3.4 Wetland By-Law**

Marblehead has adopted a wetland by-law and regulations that provide additional restrictions to those stipulated in the State Wetlands Protection Act. Land within the 100 year floodplain is designated as a resource area. Proposed construction within the Marblehead 100 year floodplain and/or within a 100-foot buffer zone beyond the floodplain requires approval from the local Conservation Commission.

### **3.5 Policies for New Construction**

The Town of Marblehead Building Department requires compliance with the building code established by the Commonwealth of Massachusetts. The Department requires that all new buildings be designed to comply with the code's wind, snow and seismic



load requirements. Since Marblehead is located in one of the highest risk zones in Massachusetts for earthquakes, soil testing and geological investigations would be required for locations of new construction in soils where conditions indicate the possibility of liquefaction. However, the soils in Marblehead are generally characterized by loamy soils formed in glacial till that provide more than adequate bearing capacity for the Town's structures.

The Town also participates in National Flood Insurance Program (NFIP) as do most communities in Massachusetts. The Town of Marblehead understands that participation in the NFIP is an essential step in mitigating flood damage and works to consistently to enforce NFIP compliant policies in order to continue its participation in this program.

### **3.6 Emergency Shelter Areas**

During situations when a natural disaster has occurred, citizens of Marblehead have access to designated emergency shelters within the town. The two primary shelters are the Marblehead High School and the Marblehead Community Center. Emergency generators are available at both locations.

The Marblehead Middle School on Village Street and the Veteran's School on Pleasant Street are the designated backup shelters for the community. The middle school also has an emergency backup generator.

### **3.7 Harbor By-Law**

The Harbor By-Law is another vehicle to promote safety for the citizens and visitors of Marblehead when navigating its waters. The Marblehead Harbor By-Law is similar in many ways to a Massachusetts Coastal Zone Management (MCZM) Harbor Plan. The by-law, entitled "Manual for Marblehead Waters", contains phone numbers for emergency responders, law enforcement units, government agencies, mooring companies, and marine services. The manual also reports general policies, rules, and regulations including a safe mooring plan for Marblehead waters. The Marblehead Harbor By-Law provides mooring information, mooring equipment standards, maps, and permit requirements.

### **3.8 Harbor Management Plan**

The Harbor Management Plan is a document which presents the community's goals, objectives and recommendations for guiding public and private use of the land and water of its harbor areas, and establishes an implementation program to achieve the desired outcomes. The plan is designed to be useful to the Town in determining their priorities for the management of the harbor, matching their goals with the vision of the harbor, and for obtaining funding for harbor programs and infrastructure improvements.

Marblehead waters are utilized for a variety of purposes such as recreation, tourism, fishing, and commercial activities. Based on harbor issues and needs presented within the Plan, the following major issue (high priority) items are recommended for improvement:

- Repair/improvement of the Barnegat Landing granite curb sea wall and reconstruction and possible widening of the concrete ramp,
- Rehabilitation of the Philip Clark Wharf (State Street South) timber pier and gangway, and stone sea wall,
- Rehabilitation of the Commercial Street Landing (State Street North) existing stone wall and the replacement of the concrete floats, and
- Rehabilitation of the Cliff Street Boatyard existing stone wall and revetment under the Yacht Club.

### **3.9 Climate Change: Ready or Not – Climate Change Impacts, Vulnerability, Risk and Adaptation Strategies for the Salem Sound Area of Massachusetts**

This report aims to assist the six Salem Sound communities (Marblehead, Salem, Peabody, Danvers, Beverly and Manchester) understand the impacts of climate change, the vulnerabilities they will face, and the strategies they can use to adapt to these impacts. The report (developed by the Salem Sound Coastwatch (SSCW) in partnership with Tufts University UEP students, identifies a framework for addressing the physical and social vulnerabilities, highlighting specific populations and locations susceptible to the impacts of climate change. Key concepts provide a starting point for these communities to incorporate, enhance, and implement adaptation initiatives to foster resilient, safe and sustainable futures.

Based on the completion of the risk assessment and vulnerability mapping, a series of adaptation strategies were developed for Salem Sound communities and include:

- Review hazard mitigation plans and incorporate climate related risks, as well as best management practices,
- Update, review, and strengthen floodplain overlay regulations,
- Review setback regulations for coastal and floodplain development and compare with other Massachusetts communities,
- Review wetland preservation/protection laws and strengthen where necessary,
- Consider a rolling easement program,
- Develop a prioritization list of land acquisition properties,
- Create a master plan for coastal defense (soft and hard-armoring considerations)
- Increase capacity of stormwater collection systems to accommodate future potential impacts,
- Work towards participation in the Community Rating System (CRS), and
- Consider the development of a TDR program to incentivize developers to building appropriate areas.

### **3.10 Stormwater Management and Erosion Control Regulations**

Effective May 5, 2007, the Town of Marblehead has adopted regulations that provide detailed requirements for the submission of a stormwater management plan for land disturbance of 40,000 square feet or more, including 40,000 square feet of area which is comprised of smaller, individual parcels within the same project or unconnected areas which comprise 40,000 square feet or more in the aggregate, in addition to techniques for Low Impact Development (LID). The plan shall contain sufficient information to describe the nature and purpose of the proposed development, pre and post

construction conditions of the site and the adjacent areas, and proposed best management practices for the permanent management and treatment of stormwater. The plan shall be designed to meet the Massachusetts Stormwater Management Standards, as set forth in the Massachusetts Stormwater Management Policy and the *United States Department of Environmental Protection's Stormwater Management Handbook: Volumes I and II*. A Best Management Practices of catch basin cleaning is included, and completed annually. Catch basin reconstruction is also part of the Town's 5-year capital plan. The Town maintains a Memorandum of Understanding (MOU) with a local company for rental equipment (set rates for operators and various machines).

### **3.11 Pleasant Street Drainage Project**

Flooding in the study area has caused extensive damage to residential and commercial structures, in addition to business disruption/lost revenue in recent years. Municipal departments spend thousands of dollars and countless hours during storm events. Flooding frequently causes traffic delays and the closure of public areas. Improvement projects include:

- Green Street/Reynolds Playground
- Evans Road and Roosevelt Avenue
- Sewall Street/Ambulance Barn
- School Street – water passes through stone wall foundations that are often shared, flooding basements and public utility structures
- Pleasant Street – open stone structures are over 100 years old and difficult to maintain
- Sewall to Pleasant Street and School Street – Utilities passing through the culverts restrict water flow
- Atlantic Avenue – additional capacity is needed to remove water from the Pleasant Street area, allowing improvements to the upstream areas of the drainage basin

The Pleasant Street Drainage Project is a preliminary design and construction plans/specifications for Phase I are due out in early 2013, with a late spring 2013 construction start anticipated.

### **3.12 Coordination with Neighboring Municipalities**

The Marblehead Town Planner and consultant coordinated with the adjacent communities of Salem and Swampscott, by reviewing their hazard mitigation plans to identify applicable efficiencies (cost-sharing) and opportunities (Mutual Aid agreements) to be further explored.

### **3.13 The Massachusetts Office of Coastal Zone Management Policy Guide**

The *Massachusetts Office of Coastal Zone Management Policy Guide - October 2011* (Policy Guide) provides the official program policies of the Massachusetts coastal program—as administered by the Massachusetts Office of Coastal Zone Management (CZM)—and includes information on the federal Coastal Zone Management Act, the history and operation of the Massachusetts coastal program, federal consistency review, and the application of coastal policy in other state regulatory programs. Under this

Policy Guide, it is CZM's goal to balance human activities with the protection of the abundant natural, recreational, and economic resources through a number of policies relative to a municipality's capacity for development within coastal areas:

- Coastal engineering structures/Non-structural alternatives
- Erosion and relative sea level rise
- Transportation and hydro-modification
- Installation/expansion of infrastructure
- Federal and/or state funding of public works
- Hazard mitigation as a component of acquisition for recreation and land conservation

### **3.14 Guidelines for Barrier Beach Management in Massachusetts**

The Commonwealth has also identified, designated and mapped 681 barrier beaches throughout Massachusetts, under which, Devereux Beach is listed. The *Guidelines for Barrier Beach Management in Massachusetts* provides guidance to aid in balancing competing uses and to protect the beneficial functions of barrier beaches.

### **3.15 Existing Protection Matrix**

A summary of the main identified existing protection measures presented above are summarized on Table 3-1. These measures constitute the baseline protection that was further evaluated by the Hazard Mitigation Plan Implementation/Monitoring Team to determine gaps in Marblehead's protection from natural disasters. Goal statements and specific actions were then developed to mitigate the identified gaps in the existing protection.



Table 3-1  
Existing Protection Matrix, Marblehead, Massachusetts

<i>Existing Protection</i>	<i>Description</i>	<i>Area Covered</i>	<i>Effectiveness and/or Enforcement</i>	<i>Improvements or Changes Needed</i>
<b>Marblehead Emergency Response Team (MERT)</b>				
	Responds to all types of emergency situations (excluding medical, law enforcement) in Marblehead	Town of Marblehead	Effectiveness: Very Good Enforcement: Managed by EMA Director and Town Administrator	Continue to Operate
<b>Comprehensive Emergency Management Plan (CEMP) for Marblehead Neck</b>				
	Prior to a significant storm event (40 mph wind forecast); Water, Sewer, and Police Departments personnel are stationed at the Causeway and within the Neck to ensure public safety and to maintain the operation of water and sewer utilities. Ambulance and fire Departments are on-site to evacuate and residents with medical emergencies or to notify Coast Guard if needed.	The Causeway and Marblehead Neck	Effectiveness: Good Enforcement: Managed by EMA Director and Town Administrator	Provide additional emergency generators on the Neck
<b>Wetland By-Law</b>				
	Designates all land within a 100-year flood plain as a wetland resource area requiring Conservation Commission approval for construction.	100-year floodplain as shown on FEMA Floodplain Map	Effectiveness: Good Enforcement: Managed by Conservation Commission	Continue to Enforce
<b>Policies for New Construction</b>				
	May require letter from design engineer for any proposed structure to state that the structure has been designed to withstand a 100-year storm. Also geotechnical investigations would be required in known poor soil areas.	Covers all proposed structures in Marblehead	Effectiveness: Good Enforcement: Managed by Building Commissioner	Continue to Enforce
<b>Massachusetts State Building Code</b>				
	Marblehead follows all Massachusetts Building Code requirements and FEMA requirements (within 100-year flood areas)	Covers all proposed structures in Marblehead	Effectiveness: Good Enforcement: All proposed/constructed buildings are reviewed by Building Commissioner	Continue to Enforce
<b>Designated Emergency Shelter Areas</b>				
	High School and Marblehead Community Center (and four designated alternate locations) are used as Shelter Areas. Backup heating and emergency generators are available at High School only.	Shelters are available to all residents	Effectiveness: Fair    Enforcement: Managed by EMA Director	Add pet shelters to the list of shelter areas and provide backup generators to Middle School

Table 3-1  
Existing Protection Matrix, Marblehead, Massachusetts

<i>Existing Protection</i>	<i>Description</i>	<i>Area Covered</i>	<i>Effectiveness and/or Enforcement</i>	<i>Improvements or Changes Needed</i>
<b>Harbor By-Law</b>				
	Vehicle to promote safety for the citizens and visitors of Marblehead when navigating its waters. The by-law, entitled "Manual for Marblehead Waters", reports general policies, rules, and regulations including a safe mooring plan for Marblehead waters.	All of Marblehead Harbor	Effectiveness: Very Good Enforcement: Managed by Harbormaster and Harbor and Waters Board	Continue to Enforce
<b>Harbor Management Plan</b>				
	Document which presents the community's goals, objectives and recommendations for guiding public and private use of the land and water of its harbor areas, and establishes an implementation program to achieve the desired outcomes. Also includes a number of Standard Operating Procedures for severe storms.	All of Marblehead Harbor	Effectiveness: Very Good Enforcement: Managed by Harbormaster and Harbor and Waters Board	Continue to Enforce
<b>Climate Change: Ready or Not - Climate Change Impacts, Vulnerability, Risk and Adaptation Strategies for the Salem Sound Area of Massachusetts</b>				
	Report aims to assist the six Salem Sound communities (Marblehead, Salem, Peabody, Danvers, Beverly and Manchester) understand the impacts of climate change, the vulnerabilities they will face, and the strategies they can use to adapt to these impacts.	Entire Town of Marblehead	Effectiveness: Very Good Enforcement: Across municipal officials/departments	Continue to Utilize
<b>Stormwater Management and Erosion Control Regulations</b>				
	Regulations that provide detailed requirements for the submission of a stormwater management plan for land disturbance of 40,000 square feet or more, including 40,000 square feet of area which is comprised of smaller, individual parcels within the same project or unconnected areas which comprise 40,000 square feet or more in the aggregate.	Covers all proposed structures in Marblehead	Effectiveness: Good Enforcement: Managed by Building Commissioner	Continue to Enforce

Table 3-1  
Existing Protection Matrix, Marblehead, Massachusetts

<i>Existing Protection</i>	<i>Description</i>	<i>Area Covered</i>	<i>Effectiveness and/or Enforcement</i>	<i>Improvements or Changes Needed</i>
<b>Pleasant Street Drainage Project</b>				
	Interior flooding remediation project	Green Street/Reynolds Playground, Evans Road/Roosevelt Avenue, Sewall St./Ambulance Barn, School Street/Pleasant Street, Sewall/Pleasant St./School St., Atlantic Avenue	Effectiveness: N/A: late Spring 2013 construction Enforcement: Water and Sewer Department	Continue to Implement
<b>Coordination with Neighboring Municipalities</b>				
	Coordination to identify applicable efficiencies (resource-sharing/Mutual Aid agreements.	Regional context	Effectiveness: Very Good Enforcement: Planning Depts.	Continue to maintain
<b>Massachusetts Office of Coastal Zone Management Policy Guide</b>				
	Provides the official program policies of the Massachusetts coastal program and includes information on the federal Coastal Zone Management Act, the history and operation of the Massachusetts coastal program, federal consistency review, and the application of coastal policy in other state regulatory programs.	Coastal areas	Effectiveness: Very Good Enforcement: MA Office of Coastal Zone Management	Continue to Enforce
<b>Guidelines for Barrier Beach Management in Massachusetts</b>				
	The Guidelines for Barrier Beach Management in Massachusetts provides guidance to aid in balancing competing uses and to protect the beneficial functions of barrier beaches.	Devereux Beach	Effectiveness: Very Good Enforcement: MA Office of Coastal Zone Management	Continue to Enforce

## **Section 4 Planned Mitigation Activities**

### **4.1 Introduction**

The protections currently employed by Marblehead, presented in Section 4, were discussed with the Hazard Mitigation Plan Implementation/Monitoring Team to determine any gaps in these existing protections. Goal statements aimed at resolving deficiencies in the existing protections were then developed.

The goal statements established through the Hazard Mitigation Plan Implementation/Monitoring Team process are as follows:

- Improve access to Marblehead Neck during large storm events to better ensure public health and safety for citizens of the Neck;
- Improve the protection of the community from coastal and interior flooding;
- Increase public awareness of natural Hazards, evacuation procedures, mitigation activities, and structures located within the floodplain;
- Enhance the protection of public utilities to ensure uninterrupted operation during significant storm events; and
- Protect the integrity and aesthetics of Marblehead's scenic shoreline.

### **4.2 Mitigation Activities**

In completing the risk and vulnerability analyses, the Hazard Mitigation Plan Implementation/Monitoring Team considered projects and actions that would reduce Marblehead's vulnerability to the identified hazards. The updated 2013 Risk Assessment Matrix presented in Table 4-1 is the basis for the mitigation actions presented in Section 4.3.

### **4.3 Mitigation Action Plan**

The Hazard Mitigation Plan Implementation/Monitoring Team considered the goals of this plan and prioritized the matrix and the associated actions based on historical damage, safety of the population, property protection and consistency with town-wide goals and objectives. Issues and objectives were aligned to public health risks, evacuation and mass care considerations, disruption of essential services and potential economic losses to the town.

The Hazard Mitigation Plan Implementation/Monitoring Team determined that the identified objectives could be met by considering actions aligned to the following Mitigation Categories:

- Planning and Prevention
- Property Protection
- Natural Resource Protection
- Structural Projects
- Emergency Services
- Public Education and Awareness

The Hazard Mitigation Plan Implementation/Monitoring Team has worked to set goals and objectives that are bounded by a time frame and are compatible and consistent with



state hazard mitigation goals. Upon submittal of this plan to MEMA, the State Hazard Mitigation Committee (SHMC) is expected to review and approve these goals and objectives to ensure consistency with the statewide goals and objectives. The time frames used for this strategy are as follows:

- Short Term = 0 to 6 Months
- Medium Term = 6 to 18 Months
- Long Term = 18 Months to 5 Years

The following actions use the Risk Assessment Matrix (Table 4-1) to identify areas at risk, offer mitigation strategies and consider benefits. Each action offers a discussion of the project and if applicable, includes the options considered. Multiple actions associated with a vulnerable area reflect town priorities and are simply prioritized high, medium or low. If known, the actions include cost estimations and assign responsible parties to lead the efforts to complete the action. Other relevant departments/agencies that can offer support to the project are also listed. Finally, possible finance options are offered.

Table 4-1  
2013 Risk Assessment Matrix, Marblehead, Massachusetts

<i>Mitigation Category</i>	<i>Location</i>	<i>Ownership</i>	<i>Natural Hazard</i>	<i>Primary Problem/Effect</i>	<i>Mitigation Objective</i>	<i>Risk H-Historical P- Potential</i>	<i>2013 Mitigation Measure</i>
<b>Planning and Prevention</b>							
Action #1	Town-wide	Public and Private	All	Public and Private property damage	Protection of life/property	H and P	Volunteer Disaster Resistance Program (16)
Action #2	Town-wide	Public	All	Additional level of community resources	Accelerated recovery period	H and P	Volunteer Disaster Assistance Officer (16)
Action #3	Town-wide	Public	All	Interrupted municipal services	Continuity of municipal services	H and P	Continuity of Operations Plan (17)
Action #4	Town-wide	Public and Private	All	Access to information	Protection of life/property	H and P	Public Information, Outreach and Incentive Program (20)
Action #5	Town-wide	Public	All	Access to information	Enhanced public safety/access to info., flexibility in response	H and P	GIS Integration Town-wide (9)
Action #6	Town-wide	Public	All	Access to information	Enhanced public safety/access to info., flexibility in response	H and P	GIS Software/Program Upgrades (9)
Action #7	Town-wide	Public and Private	All	Repetitive vulnerability	Protection of life/property	H and P	Recovery and Reconstruction Bylaw (1)
Action #8	Town-wide	Public and Private	Flooding	Decreased stormwater capacity/flooding	Improved stormwater capacity, protection of natural resources	H and P	Low-Impact Development (19)
Action #9	Town-wide	Public and Private	All	Delayed response and recovery period	Accelerated recovery period	H and P	Debris Management Plan (16)
Action #10	Coastal areas	Public and Private	Coastal storm surge/Sea level rise, Hurricanes	Repetitive vulnerability	Accelerated recovery period, Protection of life/property	H and P	Shoreline Management Plan (7)
Action #11	Coastal areas	Public and Private	Coastal storm surge/Sea level rise,	Potential contamination of materials	Protection of resources, maintenance of evacuation routes	H and P	Overwash/Sand/Rubble Removal Plan (13)
<b>Property Protection</b>							
Action #12	Flood hazard areas	Public and Private	Flooding	Damage to property	Decreased economic losses	H and P	Enroll in the Community Rating System (15)
Action #13	Flood hazard areas	Public and Private	Flooding	Damage to property	Decreased economic losses	H and P	Open space acquisition (8)
Action #14	Town-wide	Public and Private	Flooding	Damage to property	Decreased economic losses	H and P	Non-Residential structures in the floodplain (8)

Table 4-1  
2013 Risk Assessment Matrix, Marblehead, Massachusetts

<i>Mitigation Category</i>	<i>Location</i>	<i>Ownership</i>	<i>Natural Hazard</i>	<i>Primary Problem/Effect</i>	<i>Mitigation Objective</i>	<i>Risk H- Historical P- Potential</i>	<i>2013 Mitigation Measure</i>
<b>Property Protection (continued)</b>							
Action #15	Flood hazard area	Public and Private	Flooding	Damage to property	Decreased economic losses	H and P	Retrofit (Dry/Wet Floodproof, Elevation) Program (8)
Action #16	Town-wide	Public and Private	All	Damage to property	Decreased economic losses	H and P	Building Code Compliance Enforcement (21)
Action #17	Town-wide	Private	All	Interrupted clean up/recovery, loss of revenue	Accelerated recovery period	P	Business Continuation (12)
Action #18	Town-wide	Public and Private	All	Damage to property	Preservation of history/culture of Town	H and P	Historic Structures (13)
Action #19	Town-wide	Public and Private	All	Interrupted clean up/recovery	Protection of life/property	P	School Vulnerability (13)
Action #20	Town-wide	Public	All	Loss of life/property	Protection of life/property	P	Ensuring the Safety of Elderly Housing and Public Housing (16)
Action #21	Town-wide	Public and Private	All	Loss of life/property	Protection of life/property, predictable evacuation process	P	Elderly and Special Needs Residents (16)
<b>Natural Resource Protection</b>							
Action #22	Town-wide	Private	All	Risk to public health	Protection of public health	P	Contain Hazardous Materials (20)
Action #23	Town-wide	Public	Flooding	Risk to public health, disruption of essential services	Protection of infrastructure/lifelines, protection of public health and safety	P	Preservation of water supply reservoirs and their watersheds (15)
Action #24	Town-wide	Public	Flooding	Disruption of essential services		P	Uninterrupted municipal water supply (15)
Action #25	Town-wide	Public	Flooding	Disruption of essential services		P	Uninterrupted municipal wastewater collection (15)
<b>Structural Projects</b>							
Action #26	the Causeway	Public and Private	Coastal storm surge/Sea level rise, Hurricanes, Flooding	Loss of life/property, Repetitive vulnerability	Minimization of future impacts, improved evacuation	H and P	Install warning lights at the Causeway (4)
Action #27	Coastal areas	Public and Private	Coastal storm surge/Sea level rise, Hurricanes, Flooding	Loss of life/property, Repetitive vulnerability	Minimization of future impacts	P	Investigate breakwater (-6)

Table 4-1  
2013 Risk Assessment Matrix, Marblehead, Massachusetts

<i>Mitigation Measure</i>	<i>Location</i>	<i>Ownership</i>	<i>Natural Hazard</i>	<i>Primary Problem/Effect</i>	<i>Mitigation Objective</i>	<i>Risk H-Historical P- Potential</i>	<i>2013 Status</i>
<b>Structural Projects (continued)</b>							
Action #28	Devereux Beach area	Public and Private	Coastal storm surge/Sea level rise, Hurricanes, Flooding	Loss of life/property, Repetitive vulnerability	Minimization of future impacts	H and P	Investigate shoreline protection measures at Devereux Beach (14)
Action #29	Pleasant Street area	Public and Private	Coastal storm surge/Sea level rise, Hurricanes, Flooding	Loss of life/property, Repetitive vulnerability	Minimization of future impacts	H and P	Pleasant Street area drainage improvements (19)
Action #30	Beacon/Norman St., Fort Sewall Lane/Fort Beach Lane, Goldthwait Rd./Phillips St., Front St./State St./Glover St., Water St./Dock Ledge Way, Harbor Ave./Flint St./Foster St./Sean Way, Ocean Ave./Flint St./Sargent Rd.	Public and Private	Coastal storm surge/Sea level rise, Hurricanes, Flooding	Loss of life/property, Repetitive vulnerability	Minimization of future impacts	H and P	Localized flooding of roadways (14)
Action #31	Barnegat Landing and surrounding area	Public and Private	Coastal storm surge/Sea level rise, Hurricanes, Flooding	Loss of life/property, Repetitive vulnerability	Minimization of future impacts, improved evacuation/managed pull-out process	P	Barnegat Landing (9)
Action #32	Philip Clark Wharf and surrounding area	Public and Private	Coastal storm surge/Sea level rise, Hurricanes, Flooding	Loss of life/property, Repetitive vulnerability	Minimization of future impacts, improved evacuation/managed pull-out process	P	Philip Clark Wharf (12)



Table 4-1  
2013 Risk Assessment Matrix, Marblehead, Massachusetts

<i>Mitigation Measure</i>	<i>Location</i>	<i>Ownership</i>	<i>Natural Hazard</i>	<i>Primary Problem/Effect</i>	<i>Mitigation Objective</i>	<i>Risk H- Historical P- Potential</i>	<i>2013 Status</i>
<b>Structural Projects (continued)</b>							
Action #33	Commercial Street Landing and surrounding area	Public and Private	Coastal storm surge/Sea level rise, Hurricanes, Flooding	Loss of life/property, Repetitive vulnerability	Minimization of future impacts, improved evacuation/managed pull-out process	P	Commercial Street landing (12)
Action #34	Cliff Street Boatyard and surrounding area	Public and Private	Coastal storm surge/Sea level rise, Hurricanes, Flooding	Loss of life/property, Repetitive vulnerability	Minimization of future impacts, improved evacuation/managed pull-out process	P	Cliff Street Boatyard (11)
Action #35	Parker's Boatyard and surrounding area	Public and Private	Coastal storm surge/Sea level rise, Hurricanes, Flooding	Loss of life/property, Repetitive vulnerability	Minimization of future impacts, improved evacuation/managed pull-out process	P	Parkers Boatyard (10)
Action #36	Grace Oliver's Beach area	Public and Private	Coastal storm surge/Sea level rise, Hurricanes, Flooding	Damage to property, Repetitive vulnerability	Minimization of future impacts	H and P	Fort Beach Sea Wall (9)
Action #37	Grace Oliver's Beach area	Public and Private	Coastal storm surge/Sea level rise, Hurricanes, Flooding	Damage to property, Repetitive vulnerability	Minimization of future impacts	H and P	Grace Oliver's Beach Sea Wall (8)
<b>Emergency Services</b>							
Action #38	All new Town Personnel (as applicable)	Public	Hurricanes	Loss of life/property	Protection of life and property	P	Complete the Community Hurricane Preparedness Course (21)
Action #39	Town-wide	Public and Private	All	Loss of life/property	Coordinated/ accelerated evacuation	P	Maintain viable evacuation routes (16)
Action #40	Town-wide	Public and Private	All	Loss of life/property	Coordinated/ accelerated evacuation	P	Publish evacuation routes (20)
Action #41	Region-wide	Public and Private	All	Loss of life/property	Protection of life, Coordinated/ accelerated evacuation	P	Coordinate evacuation plans with neighboring municipalities (16)

Table 4-1  
2013 Risk Assessment Matrix, Marblehead, Massachusetts

<i>Mitigation Measure</i>	<i>Location</i>	<i>Ownership</i>	<i>Natural Hazard</i>	<i>Primary Problem/Effect</i>	<i>Mitigation Objective</i>	<i>Risk H-Historical P- Potential</i>	<i>2013 Status</i>
<b>Public Education and Awareness</b>							
Action #42	Town-wide	Public and Private	All	Loss of life/property	Protection of life, Accelerated evacuation	P	Tourist evacuation and shelter (15)
Action #43	Floodplain areas	Private	Coastal storm surge/Sea level rise, Hurricanes, Flooding	Loss of life/property, Repetitive vulnerability	Increased public and institutional awareness/resilience	H and P	Advise homeowners in the floodplain (16)
Action #44	Town-wide	Public and Private	All	Loss of life/property	Protection of life/property, Increased public and institutional awareness/resilience	H and P	Official Town of Marblehead website(14)

**Evaluation/Selection of Mitigation Actions** - After reviewing the Town's identified risks and vulnerabilities to natural hazards, the input/feedback from the public workshop and recommendations from the Town, and the local Capability Assessment, the Hazard Mitigation Plan Implementation/Monitoring Team selected mitigation actions to incorporate into the 2013 Update.

**Prioritization of Actions** - Due to budgetary constraints and other limitations, it is often impossible to implement all mitigation actions. The Hazard Mitigation Plan Implementation/Monitoring Team needed to select the most cost-effective actions for implementation first to use resources efficiently and develop a realistic approach toward mitigation risks. The Disaster Mitigation Act 2000 (DMA) supports this principle of cost-effectiveness by requiring action plans to follow a prioritization process that emphasizes benefits over costs. DMA 2000 states:

*"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."*

#### *Part 1: Review Benefits and Costs*

As part of the planning process, the Hazard Mitigation Plan Implementation/Monitoring Team utilized Review Tools 1, 2, and 3 associated with each action identified.

#### *Part 2 Prioritize Actions – Qualitative Method, Relative Score*

The Hazard Mitigation Plan Implementation/Monitoring Team utilized Method B: Prioritization using STAPLEE and Relative Scores (see Appendix B – March 12, 2013 Hazard Mitigation Plan Implementation Monitoring Team Meeting).

#### STAPLEE Criteria

1. **Social:** Is the action compatible with present and future local community needs and values?
2. **Technical:** Is the action feasible with available local resources (or as supplement by outside resources as necessary)?
3. **Administrative:** Does the community have the administrative capacity to implement the action?
4. **Political:** Is there strong public support to implement and maintain the action?
5. **Legal:** Does the community have the legal authority to implement the action?
6. **Economic:** Is the action cost-effective?
7. **Environmental:** Does the action impact environmental resources, and is the impact positive, negative, or neutral?

#### *Part 3 Documentation of the Process*

The Worksheets have been included in the Update, see Appendix C, to emphasize that a Benefit-Cost Review was employed when prioritizing actions.

Each of the mitigation actions were scored against each of the STAPLEE criteria outlined above with a numerical score. These numbers were then totaled and developed into an overall priority score. The ranking of the Priority Score is a guideline for when the Town should begin acting on the identified strategies, or actions.

The STAPLEE Method includes a cost-benefit review as part of the Mitigation Actions prioritization process. A more detailed cost-benefit analysis will be done, at the time of application, for those proposed Mitigation Actions that the Town applies for funding under the Pre-Disaster Grant Program and Hazard Mitigation Grant Program.

## PLANNING AND PREVENTION

### Volunteer Disaster Assistance Program

Work with Federal/State agencies, partner organizations, and the Town to educate municipal officials, residents and businesses about projected sea level rise/climate change impacts and potential management solutions.

- Priority Score - 16
- Lead – Marblehead EMA
- Supporting – MEMA, FEMA, CZM
- Financing Options – Town budget, grants
- Cost – Staff time or dependent upon level of training
- Time Frame – Short to medium term
- Benefit – Reduced vulnerability to impacts

### Volunteer Disaster Assistance Officer

Volunteers working at the community level, or even at the neighborhood level, can be a tremendous asset to hazard mitigation efforts before, during, and after a natural hazard event. A community member acting as a Volunteer Disaster Assistance Officer (under the Civilian Emergency Response Team (CERT) could coordinate community mitigation activities, act as a local hazard information resource, and offer assistance to residents not able to help themselves. In preparation for an impending disaster, volunteers can help residents prepare their homes and facilitate evacuations if necessary. After a disaster, qualified volunteers could provide an initial damage report to Town officials and aid resident clean-up efforts. These volunteers could be associated with neighborhood watch groups, or neighborhood preservation groups.

The Town will consider providing the framework under which this position (s) would be created, limited funding, and a weekend-long training session consistent with the existing emergency management operations within the Town. The training session should include discussion of liability issues, hazard mitigation techniques that homeowners can perform, a description of how the Town would operate during and after an emergency, and other information deemed necessary.

- Priority Score - 16
- Lead – Marblehead EMA
- Supporting – MEMA, FEMA
- Financing Options – Town budget, grants
- Cost – Staff time



- Time Frame – Short term
- Benefit – Accelerated, more predictable recovery period

#### Continuity of Operations Plan

Develop a Continuity of Operations Plan (COOP) to ensure the Town's operational capability in the wake of an emergency that affects a substantial segment of municipal staff.

- Priority Score - 17
- Lead – Marblehead EMA
- Supporting – MEMA, FEMA
- Financing Options – N/A
- Cost – Staff time
- Time Frame – Short term
- Benefit – Continuity of municipal services

#### Public Information, Outreach and Incentive Program

The Town will provide information to contractors and homeowners on risks of building in hazard-prone areas and inform builders and homeowners of the benefits of building and renovating structures to current standards. The Town will use FEMA's *Home Builder's Guide to Coastal Construction* (Publication #499), FEMA's *Coastal Construction Manual* (Publication #55CD Third Edition), *No Adverse Impact (NAI) Coastal Land Management Guidelines* developed by the Association of State Floodplain Managers, and other FEMA publications, as applicable.

- Priority Score - 20
- Lead – Building Commissioner
- Supporting – MEMA
- Financing Options – Private land owners
- Cost – Staff time
- Time Frame – Short term (following a disaster)
- Benefit – Protection of property and increased safety for residents

#### GIS Integration Town-wide

Update and integrate GIS capabilities throughout Town departments for use in emergency situations, as well as for daily use by municipal personnel. Accurate GIS data can assist various Town departments with response actions such as street closings, re-routing of traffic, water main breaks, sewer system backups, flooding, etc.

- Priority Score - 9
- Lead – Water/Sewer Superintendent
- Supporting – MEMA
- Financing Options – MEMA, FEMA, Town Budget
- Cost – Staff time
- Time Frame – Medium term
- Benefit – Enhanced public safety; consistency/flexibility in response actions

#### GIS Software/Program Upgrades

To facilitate full GIS integration Town-wide, the Town should elevate to an ArcGIS Enterprise level. In addition, the Town is presently using ArcGIS Work Group standard. The Town's

ArcGIS Server is currently running ArcGIS 9.3 and is migrating to ArcGIS 10.0. An ArcGIS suite of software upgrades and additional seats of Arcview, both desktop and runtime licenses, ArcInfo and ArcEditor, would facilitate a greater interdepartmental use, mobile deployment and periodic update and maintenance of the Town's GIS data.

- Priority Score - 9
- Lead – Water/Sewer Superintendent
- Supporting – MEMA
- Financing Options – MEMA, FEMA, Town Budget
- Cost – \_\_\_\_\_
- Time Frame – Medium term
- Benefit – Elevating to an ArcGIS Enterprise level will greatly enhance the Town's capabilities and will provide a more comprehensive platform for delivering GIS applications that are centrally managed and support multiple users throughout the various departments within town government. Some of the applications on the ArcGIS server will pertain to mapping and maintaining data for emergency management, utility maintenance, parcels, stormwater outfalls, etc. Upgrades to the existing software will help the Town to stay with the current software release and take advantage of new mapping applications and the functionality in the software.

#### Recovery and Reconstruction Bylaw

The Town should utilize the opportunity of a disaster to improve its' disaster resilience. Once critical life and safety issues and vital public services have been addressed and re-established, emphasis should be placed on the long-term recovery of the community, balancing the need to rebuild rapidly and return to normal against the objective of building back better and stronger.

Collaboration on a Regional Recovery and Reconstruction Bylaw could identify/facilitate resource and cost-sharing opportunities, as well as higher utilization of municipal services to those areas within the region most in need.

- Priority Score - 1
- Lead – Planning Department
- Supporting – Building Commissioner
- Financing Options – Town budget, grants
- Cost – Staff time/\$20,000 consultant fees
- Time Frame – Short to medium term
- Benefit – Minimization to future impacts

#### Low-Impact Development

Continue to encourage the incorporation of Low-Impact Development (LID) techniques, as identified in the Town's *Stormwater Management and Erosion Control Regulations*, into local subdivision and site/neighborhood development plans.

- Priority Score - 19
- Lead – Planning Department
- Supporting – Building Commissioner
- Financing Options – N/A
- Cost – Staff time

- Time Frame – Short to medium term
- Benefit – Improved CSO capacity; protection of water supply

#### Debris Management Plan

The Town will develop a plan update for collecting and disposing of debris after a storm event. Locations where debris can be collected will be determined with different locations for potentially hazardous debris, such as propane tanks, made separate. A list of hazardous material handlers regulated by the EPA can be found at <http://www.epa.gov/enviro/html/em/index/html>. The Town should actively seek an agreement with one or more such vendors in order to ensure a timely response at a reasonable price.

Collaboration on a Regional Debris Management Plan could identify/facilitate resource and cost-sharing opportunities, as well as higher utilization of municipal services to those areas within the region most in need.

- Priority Score - 16
- Lead – Marblehead EMA
- Supporting – Marblehead Police/Fire/DPW
- Financing Options – Town budget, grants
- Cost – Staff time
- Time Frame – Short to medium term
- Benefit – Accelerated, more predictable recovery period

#### Develop Shoreline Management Plan

Develop a management plan for Marblehead's coastal areas that includes the following objectives improves understanding of coastal processes; predicts the likely future evolution of the coast; identifies all the assets within the area covered by the plan likely to be affected by coastal change; identifies the need for regional or site specific research and investigations; and, identifies the various policies/procedures for hazard mitigation remediation projects.

Collaboration on a Regional Shoreline Management Plan could identify/facilitate resource and cost-sharing opportunities, as well as higher utilization of municipal services to those areas within the region most in need.

- Priority Score - 7
- Lead – Planning Department
- Supporting – CZM, MADCR, regional planning agency
- Financing Options – Town budget, grants, private homeowner's associations
- Cost – Staff time/\$50,000 consultant fees
- Time Frame – Medium term
- Benefit – Accelerated response, more predictable recovery period

#### Develop Overwash/Sand/Rubble Removal Plan

Remove only that overwash that is necessary to allow for entrance/access and use of houses/structures. Sand/rubble that has been deemed necessary to remove should be stored in a protected place for debris removal, evaluation and later deposition.

- Priority Score - 13
- Lead – Highway Department/DPW

- Supporting – CZM, MADCR, MassDOT/Highway, Marblehead EMA
- Financing Options – Town budget, grants
- Cost – Staff time/man hours per event
- Time Frame – Short term
- Benefit – Minimized contamination of materials

## PROPERTY PROTECTION

### Enroll in the Community Rating System (CRS)

Fulfill the requirements of the National Flood Insurance Program (NFIP) to join the CRS. In addition to assisting in developing future mitigation activities, this could allow the Town and residents to qualify for discounts on flood insurance rate premiums.

- Priority Score - 15
- Lead – Engineering/Planning Department
- Supporting – Building Commissioner
- Financing Options – Town budget, grants
- Cost – Staff time/varies dependent upon property acquisition
- Time Frame – Medium to long term
- Benefit – Minimization of economic losses

### Open Space Acquisition

Maintaining and securing land as open space in flood zones is one way to keep the number of people and homes vulnerable to severe storms and flooding from expanding. The Town will continue to take steps to protect land in flood zones maintaining a priority list of properties targeted for open space acquisition. Attention will also be given to providing public access and habitat protection.

- Priority Score - 8
- Lead – Planning Department
- Supporting – Building Commissioner
- Financing Options – Town budget, grants, FEMA, MADCR
- Cost – Staff time/varies dependent upon property acquisition
- Time Frame – Long term
- Benefit – Minimization of impacts from flooding

### Non-Residential Structures in the Floodplain

Flood proof existing structures in the floodplain. As required by NFIP standards, after flooding or storm surge damage or a major renovation that is more than 50 percent of a structure's market value, it is necessary to bring the structure up to current code.

- Priority Score - 8
- Lead – Planning Department
- Supporting – Building Commissioner
- Financing Options – private land owners, MEMA, FEMA
- Cost – Dependent upon approach
- Time Frame – Short term (following a disaster)

- Benefit – Protection of property and increased safety for facility residents. Future economic disruptions are minimized if business is not affected by facility damage.

#### Develop Retrofit (Dry/Wet Floodproof, Elevation) Program

Promote and support enforcement of the latest policy revisions relative to climate change and sea level rise within Massachusetts.

Structures in the floodplain should be elevated to the 100-year base flood elevation, as well as incorporating an additional 3 to 5 foot freeboard, to accommodate projected sea level rise impacts. The Town will make available the following FEMA manuals that reference coastal construction practices for homeowners and contractors: *Home Builder's Guide to Coastal Construction* (Publication #499) and *Coastal Construction Manual* (Publication #55CD Third Edition).

Consider developing public/private partnership incentives to implement mitigation measures in coordination with local, state, and federal funding opportunities. Incentives could include tax incentives, cost sharing, and regulatory streamlining or acceleration of the permit process for those who implement mitigation activities.

- Priority Score - 8
- Lead – Building Commissioner
- Supporting – MEMA
- Financing Options – Private land owners, MEMA, FEMA, MADCR
- Cost – Dependent upon approach
- Time Frame – Short term (following a disaster)
- Benefit – Protection of property and increased safety for residents. Future economic disruptions are minimized if business is not affected by damage.

#### Building Code Compliance Enforcement

The Building Commissioner will continue to enforce regulations regarding wind resistance, flood mitigation, and earthquake resistance. Information regarding natural hazard vulnerability will be provided to potential homeowners and considered as building permits are reviewed.

- Priority Score - 21
- Lead – Building Commissioner
- Supporting – MEMA
- Financing Options – Private land owners, FEMA, MADCR
- Cost – Staff time
- Time Frame – Short term (following a disaster)
- Benefit – Protection of property and increased safety for residents. Future economic disruptions are minimized if business is not affected by damage.

#### Business Continuation

The Police Department in coordination with the Chamber of Commerce will develop strategies to help local businesses in flood prone areas recover from the effects of a natural disaster. These strategies will include organizing business owners for collective clean-up of their properties after a disaster and the creation of a list of businesses and the people connected with those businesses that are authorized to enter the businesses in the period of time immediately following a disaster. This list would be used by the Police Dept. in their role of guarding



properties after a disaster. The Police Dept. will develop criteria for determining when safety considerations outweigh the rights of a given business owner to access their property.

- Priority Score - 12
- Lead – Marblehead Police Department
- Supporting – Chamber of Commerce, Marblehead EMA
- Financing Options – N/A
- Cost – Staff time
- Time Frame – Short term
- Benefit – Accelerated, more predictable recovery period.

#### Historic Structures

Periodically inspect and evaluate historic structures for code compliance. Consider developing a GIS 'Historic Resources' data layer which maps existing resources.

- Priority Score - 13
- Lead – Planning Department
- Supporting – Historical Commission
- Financing Options – MEMA, MA Historic District Commission, FEMA
- Cost – Staff time
- Time Frame – Short term
- Benefit – Preservation of the history and culture of Marblehead.

#### School Vulnerability

Periodically inspect and evaluate school buildings for code compliance as well as their vulnerability to damage from natural hazard events. Important school records will be stored in a manner to protect them from damage.

- Priority Score - 13
- Lead – Building Commissioner
- Supporting – Marblehead School Department
- Financing Options – Marblehead School Department budget, CIP
- Cost – Staff time
- Time Frame – Medium to long term
- Benefit – Ensure the safety of students, teachers, and school employees. Protection of facilities and assets. Ensure the availability of mass care/evacuation facilities.

#### Ensuring the Safety of Elderly Housing and Public Housing

Natural hazards occurring on a town-wide basis are a threat to all elderly housing and public housing facilities in the Town. The Building Commissioner will provide assistance towards self-assessment of these structures as to their vulnerability to hazards affecting the community. Retrofitting will be recommended and/or conducted as necessary.

- Priority Score - 16
- Lead – Council on Aging
- Supporting – Building Commissioner
- Financing Options – Grants
- Cost – varies, dependent upon remediation measure
- Time Frame – Short to medium term

- Benefit – Reduce/eliminate damage costs associated with flooding or high winds. Reduce fire risks. Ensure the safety of housing residents.

#### Elderly and Special Needs Residents

The Council on Aging will continue to update/maintain a list of elderly and special needs residents living independently in the Town, and coordinate with the Police Department. The list will be divided by evacuation area and susceptibility to hazards, in the event an evacuation is necessary.

- Priority Score - 16
- Lead – Council on Aging
- Supporting – Building Commissioner
- Financing Options – N/A
- Cost – Staff time
- Time Frame – Short term
- Benefit – Predictable, safe evacuation process.

### **NATURAL RESOURCE PROTECTION**

#### Contain Hazardous Materials

Property owners will be contacted and these businesses will be requested to develop plans that ensure the containment of hazardous materials in the event of a severe storm or hurricane. Special attention will be paid to underground storage tanks that could float or rupture in the event of flooding.

- Priority Score - 20
- Lead – Marblehead Fire Department
- Supporting – Marblehead EMA
- Financing Options – N/A
- Cost – Staff time
- Time Frame – Short to medium term
- Benefit – Minimized contamination from hazardous materials

#### Preservation of Water Supply Reservoirs and their Watersheds

The Office of Watershed Management within the Division of Water Supply Protection of the Department of Conservation and Recreation, is charged with protection of the Quabbin Reservoir, Ware River, Wachusett Reservoir, and Sudbury Reservoir watersheds, more specifically, “to construct, maintain and operate a system of watersheds, reservoirs, water rights and rights in source of water supply [to] supply thereby a sufficient supply of pure water to the Massachusetts Water Resources Authority, and [to] utilize and conserve said water and other natural resources to protect, preserve and enhance the environment of the Commonwealth and to assure the availability of pure water for future generations.”<sup>1</sup>

- Priority Score - 15
- Lead – MWRA
- Supporting – Water and Sewer Department
- Financing Options – Water and sewer revenue

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<sup>1</sup> Quabbin Reservoir Watershed System, Land Management Plan 2007-2017.

- Cost – varies, dependent upon property acquisition
- Time Frame – Long term
- Benefit – Protection of water supply/lifeline

#### Uninterrupted Municipal Water Supply

Marblehead is able to operate for a short duration with the supply held in 2 water tanks. Hard pipe connections exist between Lynn and Swampscott, and existing underwritten agreements between these fellow MWRA Communities, already provide for emergency water supply from these connections. The Water and Sewer Department should purchase an emergency pump to ensure water flow in the system from Beverly/Salem Water District to Marblehead, in the event of an emergency. At a minimum, the Water and Sewer Department should initiate a redundant emergency contract with a local supplier to ensure the availability of equipment as needed. MWRA has an unwritten agreement for the use of two portable pump units to member communities. Consideration of rejuvenating the existing wells could be studied. The Water and Sewer Department should evaluate the need for replacement of the Village Street Tank (riveted steel tank constructed in 1924), which would increase the life of tank storage availability and increase ability to maintain Town's minimum pressure, during times of interrupted service.

- Priority Score - 15
- Lead – Water and Sewer Department
- Supporting – MWRA
- Financing Options – Water and Sewer revenue
- Cost –
  - Emergency Pump: \$10,000
  - Emergency contract for pumping equipment: no up-front costs
  - Village St. tank replacement cost: \$2.9 million
  - Rejuvenation of existing wells study: \$300,000
- Time Frame – Long term
- Benefit – Maintenance of essential services

#### Uninterrupted Wastewater Collection

The Marblehead Sewer Department has an aggressive I / I program and has seen improvement in capacity management as a result of this program. During events, a station can struggle due to age and design capacity. Upgrades to the following pump stations ( Sargent , Clifton, Liberty) would address capacity management issues. Installation of new underground stations (Wilson, Edgemere, Nahant) should be included in future capital improvement plans. SCADA installation increases the consistency of management of remote sites during times of hazardous situations, and also provides data collection to insure future management decisions are accurate and beneficial.

- Priority Score - 15
- Lead – Water and Sewer Department
- Supporting – SESD
- Financing Options – Water and Sewer revenue
- Cost –
  - Pump Station rehabilitation:
    - Sargent Station (structure/pumps/generator/electrical/outfall): \$1 million
    - Clifton Station (structure/pumps/generator/electrical): \$550,000

- Liberty Station (structure/pumps/generator/electrical): \$550,000
  - Replacement of underground pump stations (Wilson, Edgemere and Nahant): \$400,000 per station
  - SCADA: \$1.6 million
- Time Frame – Long term
- Benefit – Maintenance of essential services

## STRUCTURAL PROJECTS

### Install Warning Lights at the Causeway

Install warning lights and/or signs on the Causeway to alert citizens of an impending storm, the need for evacuation of the Neck, or the closing of the Causeway.

- Priority Score - 4
- Lead – Marblehead EMA
- Supporting – Engineering Dept.
- Financing Options – Town budget
- Cost – \$8,000
- Time Frame – Medium to long term
- Benefit – Predictable, safe evacuation process

### Investigate Breakwater

Re-evaluate the potential for construction of a breakwater to be located in Marblehead Harbor from near the Marblehead Lighthouse on the Neck heading westward towards the mainland. Re-address the planning level cost estimated in a similar evaluation performed by the Army Corps of Engineers in the 1960's and 1970's. The breakwater is intended to break the waves from the open ocean that enter Marblehead Harbor. This is intended to protect the eastern shore of the mainland and western shore of the Neck around Marblehead Harbor. As of the 2004 Plan, it was anticipated that the breakwater could protect 55 percent (10 out of 18) of the Town's repetitive loss structures that are located around the Marblehead Harbor area.

- Priority Score – (-6)
- Lead – Board of Selectmen
- Supporting – Engineering Dept.
- Financing Options – Town budget
- Cost – \$50,000
- Time Frame – Long term
- Benefit – Minimization of future impacts

### Investigate Shoreline Protection Measures at Devereux Beach

Re-evaluate the effectiveness of various shoreline protection measures including, but not limited to, extending the existing seawall at the southwestern edge of the Causeway with a new sea wall to the existing natural barrier located along Devereux Beach. Issue is to be studied to determine the BMP (s) to mitigate flooding of the beach pavilion and parking area.

- Priority Score - 14
- Lead – Engineering Department
- Supporting – Recreation, Parks and Forestry Department
- Financing Options – Town budget

- Cost – \$12,000
- Time Frame – Medium to long term
- Benefit – Minimization of future impacts

#### Pleasant Street Area Drainage Improvements

Increase the inlet and conveyance capacity of the drainage system through the Pleasant Street area to reduce inland flooding of roadways, businesses, and homes. The Project includes the replacement of existing mains, rehabilitation of several underground culvert, and some sections of new storm sewer installation. The Project area includes Pleasant Street, Atlantic Avenue, Spring Street, Essex Street, Sewall Street, Evans Road, Washington Street and School Street.

- Priority Score - 19
- Lead – Water and Sewer Department
- Supporting – Engineering
- Financing Options – Town budget
- Cost – \$5 million
- Time Frame – Long term
- Benefit – Minimization of future impacts, maintenance of roadways as passable

#### Localized Flooding of Roadways

There are various areas in the Town that experience repetitive coastal flooding by storm surges on the exposed northern and eastern coastlines of both the Marblehead mainland and Marblehead Neck. An Engineering/Planning Study should be performed to include the identification of drainage improvements/coastal armoring (if any) could alleviate flooding/washout and maintain roadways as passable in the event of flooding.

<u>Flood Hazard Area</u>	<u>Flood Prone Section</u>
Beacon St./Norman St.	Intersection of Beacon St./Norman St.
Front St./Doaks Lane	Fort Sewall Lane (along Ft. Beach), Ft. Beach Lane
Devereux/Tucker's Beach	Goldthwait Rd./Phillips St., the Causeway
Front St./Ferry Lane	Ferry Lane terminus, Front St./State St./Glover St. intersections
Boston Yacht Club	Water St., Dock Ledge Way
The Causeway	The Causeway/Harbor Ave./Ocean Ave. intersections.
Harbor/Foster/Sean Way	The Causeway/Harbor Ave./Flint St. intersections, Harbor Ave./Foster St./Sean Way intersections
Sargent Rd./Ocean Ave.	Ocean Ave./Flint St./Sargent Rd intersections

- Priority Score - 14
- Lead – Highway Department
- Supporting – DPW
- Financing Options – Town budget
- Cost – varies dependent upon location/remediation measure
- Time Frame – Short to medium term
- Benefit – Minimization of future impacts, maintenance of roadways as passable

There are also other various areas in the Town that experience repetitive inland flooding and road washout caused by deficiencies in the community's storm water collection system. In 2000, by vote at Town Meeting, \$4.6 million was bonded to address areas of severe flooding



including installation of larger drain pipes and new outfalls, cleaning of existing drain lines, addition of increased inlet capacity, and redirection of flows to increase capacity, and should include the identification of drainage improvements to alleviate flooding/washout and maintain roadways passable in the event of flooding.

The Pleasant Street Drainage Project (approved at Town Meeting in June 2012) is in preliminary design and construction plans/specifications for Phase I are due out in early 2013, with a late spring 2013 construction start anticipated, and includes improvement projects/remediation measures for the following roadways:

- Green St.
- Evans Rd./Roosevelt St.
- School St.
- Sewall St.
- Pleasant St.
- Atlantic Avenue

#### Marblehead Harbor Public Infrastructure Projects

Presently, there is the anticipated heavy demand on public boat ramps/landings and other associated facilities in response to a projected hurricane or other severe event. Municipal costs for maintaining the Marblehead Harbor and Water facilities, floats, equipment, boats, staff and services are met through harbor-generated revenues, including permit fees and excise tax returns on private vessels. The Town's *Harbor Management Plan* has identified the following major issue (high priority) items recommended for improvement:

#### Barnegat Landing

Recommended repairs and improvements include the rehabilitation of the granite curb sea wall and reconstruction and possible widening of the concrete ramp.

- Priority Score - 9
- Lead – Harbormaster, Harbors and Waters Board
- Supporting – Recreation, Parks and Forestry Department
- Financing Options – permit fees, excise tax on private vessels
- Cost – \$800,000 (opinion of probable cost, 2009)
- Time Frame – Long Term
- Benefit – Minimization of future impacts, improved evacuation/managed pull-out process

#### Philip Clark Wharf (State Street South)

Recommended repairs and improvements include the rehabilitation of the timber pier and gangway, and rehabilitation of the stone sea wall.

- Priority Score - 12
- Lead – Harbormaster, Harbors and Waters Board
- Supporting – Recreation, Parks and Forestry Department
- Financing Options – permit fees, excise tax on private vessels
- Cost – \$270,000 (opinion of probable cost, 2009)
- Time Frame – Long Term
- Benefit – Minimization of future impacts, improved evacuation/managed pull-out process

#### *Commercial Street Landing (State Street North)*

Recommended repairs and improvements include the rehabilitation of the existing stone wall.

- Priority Score - 12
- Lead – Harbormaster, Harbors and Waters Board
- Supporting – Recreation, Parks and Forestry Department
- Financing Options – permit fees, excise tax on private vessels
- Cost – \$300,000 (opinion of probable cost, 2009)
- Time Frame – Long Term
- Benefit – Minimization of future impacts, improved evacuation/managed pull-out process

#### *Cliff Street Boatyard*

Recommended repairs and improvements include the rehabilitation of the existing stone wall and revetment under the Yacht Club.

- Priority Score - 11
- Lead – Harbormaster, Harbors and Waters Board
- Supporting – Recreation, Parks and Forestry Department
- Financing Options – permit fees, excise tax on private vessels
- Cost – \$800,000 (opinion of probable cost, 2009)
- Time Frame – Long Term
- Benefit – Minimization of future impacts, improved evacuation/managed pull-out process

#### *Parkers Boatyard*

Recommended repairs and improvements include the rehabilitation of the stone revetment and timber gangway. Future rehabilitation will include the rehabilitation of the existing stone walls.

- Priority score – 10
- Lead - Harbormaster, Harbors and Waters Board
- Supporting - Recreation, Parks and Forestry Department
- Financing options - permit fees, excise tax on private vessels
- Cost - \$500,000 (opinion of probable cost 2009)
- Time Frame – within 10 years
- Benefit – Minimization of future impacts, improve evacuation/managed pull-out process

#### *Fort Beach*

Recommended repairs include the rehabilitation of the stone wall, installation of toe protection, and the reconstruction of the toe revetment. Replacement of the handrail with a steel guardrail system should be considered.

- Priority score – 9
- Lead - Highway
- Supporting - Harbormaster, Harbors and Waters Board
- Financing options - permit fees, excise tax on private vessels
- Cost - \$790,000 (opinion of probable cost 2009)
- Time Frame – Long Term
- Benefit – Minimization of future impacts, improve evacuation/managed pull-out process

### Grace Oliver's Beach

Recommended repairs to the sea wall include filling of voids, repointing of the wall, and resetting the toe revetment.

- Priority score – 8
- Lead - Highway
- Supporting - Harbormaster, Harbors and Waters Board
- Financing options - permit fees, excise tax on private vessels
- Cost - \$100,000 (opinion of probable cost 2009)
- Time Frame – Long Term (within 10 years)
- Benefit – Minimization of future impacts, improve evacuation/managed pull-out process

## **EMERGENCY SERVICES**

### Complete the Community Hurricane Preparedness Course

Have the Marblehead Emergency Response Team and other associated personnel complete the web-based version of FEMA's Community Hurricane Preparedness Course.

- Priority Score - 21
- Lead – Marblehead EMA
- Supporting – Fire Department
- Financing Options – Town budget
- Cost – Staff Time
- Time Frame – applicable to new hires
- Benefit – Accelerated, more predictable recovery period

### Maintain Viable Evacuation Routes

As part of the Town's tree maintenance activities, priority will be placed on trimming and maintaining the health of trees identified as running along evacuation routes and roads offering a single point of access to flood prone neighborhoods.

- Priority Score - 16
- Lead – Tree Warden
- Supporting – Highway Department/DPW
- Financing Options – N/A
- Cost – staff time/municipal budget
- Time Frame – Short term
- Benefit – Maintenance of evacuation routes

### Publish Evacuation Routes

Contact the local phone company in regards to putting the Marblehead Evacuation Routes Map, including emergency shelter locations, in the Community Section of the local phone book.

- Priority Score - 20
- Lead – Police Department
- Supporting – Marblehead EMA
- Financing Options – N/A
- Cost – staff time



- Cost – staff time
- Time Frame – Short term
- Benefit – Predictable, safe evacuation process

#### Coordinate Evacuation Plans with Neighboring Municipalities

The Police Department will work with neighboring communities to coordinate evacuation plans.

- Priority Score -16
- Lead – Police Department
- Supporting – Marblehead EMA
- Financing Options – N/A
- Cost – staff time
- Time Frame – Short term
- Benefit – Predictable, coordinated, safe evacuation process

#### Tourist Evacuation and Shelter

Out of state tourists may not be familiar with local authorities, evacuation routes, locations of designated shelters, or know what to expect if police-enforced evacuation becomes necessary. The Police Department will distribute information on town evacuation routes and emergency shelters to hotels, Bed and Breakfasts, real estate agencies dealing with seasonal rentals, and other facilities and events hosting tourists.

- Priority Score - 15
- Lead – Police Department
- Supporting – Chamber of Commerce, Marblehead EMA
- Financing Options – N/A
- Cost – Staff time
- Time Frame – Short term
- Benefit – Predictable, safe evacuation process

## **PUBLIC EDUCATION AND AWARENESS**

#### Advise Homeowners in Floodplain

Install a small pamphlet in the tax bills of citizens whose homes lie within the 100-year floodplain and advise them to visit the official Town website to learn more about the risks and hazards they face, as well as mitigation actions they can perform.

- Priority Score - 16
- Lead – Engineering Department
- Supporting – Planning Department
- Financing Options – N/A
- Cost – Staff time
- Time Frame – Short term
- Benefit – Informed public

#### Official Town of Marblehead Website

Expand the official Town website ([www.marblehead.org](http://www.marblehead.org)) to increase public outreach with links to mitigation activities, evacuation procedures as described in the Comprehensive Emergency Management Plan, links to FEMA 100-year floodplain maps, and other natural disaster-related

links, such as hurricane preparation and FEMA's *Home Builder's Guide to Coastal Construction* (Publication #499), FEMA's *Coastal Construction Manual* (Publication #55CD Third Edition), *No Adverse Impact (NAI) Coastal Land Management Guidelines* developed by the Association of State Floodplain Managers, and other FEMA publications, as applicable.

- Priority Score - 14
- Lead – Engineering Department
- Supporting – Planning Department
- Financing Options – N/A
- Cost – Staff time
- Time Frame – Short term
- Benefit – Informed public

DRAFT

## Section 5 Plan Implementation and Maintenance

### 5.1 Implementation, Evaluation, and Revision of Plan

“The success of the hazard mitigation plan is measured by the degree to which actions are accomplished. Without the implementation and maintenance of the plan, the previous components have merely been an effort in research void of any practical application.” — Tennessee Emergency Management Agency

#### Implementation

The Marblehead Hazard Mitigation Plan Implementation/Monitoring Team realized that assigning a time frame to each recommended mitigation action is important so that activities can be coordinated with other important governmental functions, such as committee meetings and budget hearings. Assigned time frames also provide inputs to a project plan used for tracking the progress of all activities.

#### Evaluation

The Marblehead Hazard Mitigation Plan Implementation/Monitoring Team will meet annually to review the status of the mitigation actions. Within two months of this meeting, a status report will be given to the Planning Board and Board of Selectmen. Progress will be reviewed annually at advertised public hearings held by the Marblehead Planning Board. It is advantageous the annual review be conducted prior to the Town’s annual budget process/Town Meeting so any locally funded projects can be considered in the budget process.

#### Revision

As per 44 CFR S 201.6(d)(3), the Plan will be reviewed and revised to reflect progress in local mitigation efforts and changes in priorities, and resubmitted for approval within 5 years in order to continue to be eligible for mitigation project grant funding. In order to ensure that the Plan remains current, the Marblehead Hazard Mitigation Plan Implementation/Monitoring Team, which consisted of representatives from the Planning Department, EMA, Public Works, Zoning and Code Enforcement, Water/Sewer Department, Fire Department, and Police Department, will meet annually. The Plan will also be evaluated and updated after a disaster, or as funding opportunities arise for the actions and projects identified in the plan. Any updates will be reviewed and submitted to MEMA upon local approval to ensure that the state hazard mitigation strategy remains current.

The Town of Marblehead Natural Hazards Mitigation Plan will be incorporated into the Town’s Comprehensive Emergency management Plan (CEMP) as an appendix.

# References

## **Federal/National Resources**

Local Mitigation Plan Review Guide  
FEMA  
October 1, 2011

*Achieving Hazard-Resilient Coastal & Waterfront Smart Growth – Coastal and Waterfront Smart Growth and Hazard Mitigation Roundtable Report*  
National Oceanic and Atmospheric Administration's Coastal Services Center/National Sea Grant College Program/Office of Ocean and Coastal Resource Management and US Environmental Protection Agency's Office of Sustainable Communities  
August 2011

## **State Resources**

*Commonwealth of Massachusetts State Hazard Mitigation Plan 2010*  
Massachusetts Emergency Management Agency/Department of Conservation & Recreation  
October 2010

*Massachusetts Office of Coastal Zone Management Policy Guide*  
Massachusetts Office of Coastal Zone Management  
October 2011

*Massachusetts State Building Code – 8<sup>th</sup> Edition Base and Residential Volumes*  
Board of Building Regulations and Standards  
August 2011 and February 4, 2011, respectively.

*Guidelines for Barrier Beach Management in Massachusetts*  
Massachusetts Barrier Beach Task Force  
February 1994

*Massachusetts Department of Conservation and Recreation*  
Rich Zingarelli - State NFIP Coordinator

*Commonwealth of Massachusetts Emergency Management Agency*  
Marybeth Groff – Hazard Mitigation Planner

## **Local/Regional Resources**

*Town of Marblehead Comprehensive Emergency Management Plan*  
Marblehead Emergency Management Agency  
2002

*Zoning Bylaw, Chapter 194: Wetlands Protection*  
Town of Marblehead  
May 1, 1995 Amended



*Zoning Bylaw, Chapter 195: Stormwater Management and Erosion Control Regulations*  
Town of Marblehead  
May 5, 2007

*Zoning Bylaw, Chapter 200: Zoning*  
Town of Marblehead  
May 1, 1995 Amended

*2007-2017 Quabbin Land Management Plan*  
Department of Conservation and Recreation, Division of Water Supply Protection, Office of  
Watershed Management

*Pleasant Street Drainage Study*  
Water & Sewer Commission Power Point Presentation  
May 7, 2012

*Town of Swampscott Hazard Mitigation Plan 2013 Update*  
Metropolitan Area Planning Council  
November 21, 2012

*City of Salem Draft Hazard Mitigation Plan 2011 Update*  
Metropolitan Area Planning Council  
June 2011

*Town of Marblehead Board of Assessors*  
Michael A. Tumulty – Department Head

*2007 Manual for Marblehead Waters*  
Marblehead Harbormaster  
2007

*Town of Marblehead Harbor Management Plan*  
Pare Corporation  
2009

*Climate Change: Ready or Not – Climate Change Impacts, Vulnerability, Risk and Adaptation  
Strategies for the Salem Sound Area of Massachusetts*  
Tufts University and Salem Sound Coast Watch  
May 2008

# Appendix A

## Natural Hazards Figures

Critical Facilities Map

Flood Hazard Areas

Annual Snowfall

Coastal Erosion


Hurricane Tracks

Earthquakes





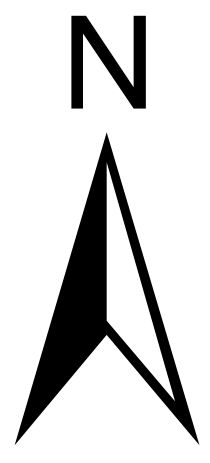
Critical Facilities			
MEMA Site ID	Facility Name	MEMA Site ID	Facility Name
1	Marblehead Children's Center	65	US Post Office
2	Farrell Court Elderly Housing	66	Electrical Substation
3	L.H. Coffin Elementary School	67	Generating Electrical Station
4	Marblehead Community Charter School	68	Marblehead Municipal Light Dept.
5	Elbridge Gerry Elementary School	69	Electrical Substation
6	Old North Nursery School	70	Gas Pumping Station
7	Powder House Court	71	Harold Breare Bridge
8	St. Michael's Day Care	72	Causeway Sea Wall
9	Marblehead Trading Company	73	Water Pumping Station
11	Abbot Hall	74	Gas Booster Station
12	Amy's Cozy Corner	75	Baptist Church
13	Roads Elderly Housing	76	Unitarian-Universalist Church
14	Amy's Play School	77	St. Michael's Episcopal Church
15	Gerry School	78	Old North Congregation Church
16	Marblehead Arts Festival July 4th	79	Christian Science
17	Omitted	80	Sta at the Sea Catholic Church
18	National Historic District	81	St. Andrew's Episcopal Church
19	Harbor Fireworks Display July 4th	82	Temple Sinai
20	Mary Alley Building	83	Lutheran Church
21	Marblehead Harbor	84	Temple Emanuel
22	Green Street Court Elderly Housing	85	Boston Yacht Club
23	Spirit of '76 Painting	86	Tucker's Wharf Sea Wall
24	Marblehead Police Dept.	87	Clark Landing
25	Marblehead High School	88	Sea Wall at Clark Landing
26	Marblehead Veteran's Middle School	89	Pleon Yacht Club
27	Seaside Nursery School	90	Eastern Yacht Club
28	Tower Elementary School	91	Corinthian Yacht Club
29	Lower Bell Elementary School	92	Dolphin Yacht Club
30	Omitted	93	Sea Wall at Parker's Boatyard
31	Verizon	94	Marblehead Yacht Club
32	Marblehead Fire Dept.	95	Sea Wall at Cliff Street Boatyard
33	Montessori School	96	Sea Wall at O'Brien's Landing
34	St. Stephens Day Care	97	Rocket Landing Pier
35	St. Andrews Co-op Nursery School	98	Cliff Street Boatyard
36	Lafayette Nursing Home	99	Parker's Boatyard
37	Marblehead COA/Park and Rec. Bldg	100	Sea Wall at Parker's Boatyard
38	Devereux Nursing Home	101	Tucker's Wharf
39	Omitted	102	O'Brien Landing
40	Devereux School	103	Sea Wall at Grace Oliver Beach
41	Glover Elementary School	104	Devereux Beach Heliport
42	Glover School Annex	105	Devereux Beach
43	Cohen Hill Academy	106	Heliport at Tucker's Beach
44	North Shore JCC Nursery School	107	Tucker's Beach
45	YMCA Day Care	108	Heliport at Catchell Playground
46	Dr. Samuel C. Eveleth Elementary School	109	Heliport at Goldthwaite Reservation
47	Green Street Court	110	Heliport at Reynolds Playground
48	Marblehead Trading Company	111	Grace Oliver Beach
49	Heliport at Seaside School	112	River Head Beach
50	EOC	113	Gas House Beach
51	Heliport at Seaside School	114	Fort Beach
52	Upper Bell Elementary School	115	Star of the Sea RC Cemetery
53	Sundance Day Care	116	Green Street Cemetery
54	St. Stephen's Church	117	Harbor View Cemetery
55	Hobbs Memorial	118	Waterside Cemetery
56	Cell Tower	119	Unitarian Cemetery
57	Stand Pipe	120	Old Burial Hill Cemetery
58	Stand Pipe	121	Abbot Public Library
59	Village Pharmacy	122	Franklin Fire House
60	CVS	123	Municipal Garages



### Town of Marblehead, MA

07501,5003,000

Feet



### Legend

100

Critical Facilities

PS

Pump Stations

Structures

Area of 100-year flood, shallow flooding

Area of 100-year flood (usually sheet flow on sloping terrain)

Area of 100-year coastal flood with velocity

500-year flood and 100-year flood with depths < 1ft., or drainage areas less than one square mile, or protected by a levee

Area of stormwater related flooding (Identified by Community Team)

Figure A-1  
Critical Facilities Map

April 10, 2013  
Source: MassGIS, Marblehead municipal database

### Horsley Witten Group

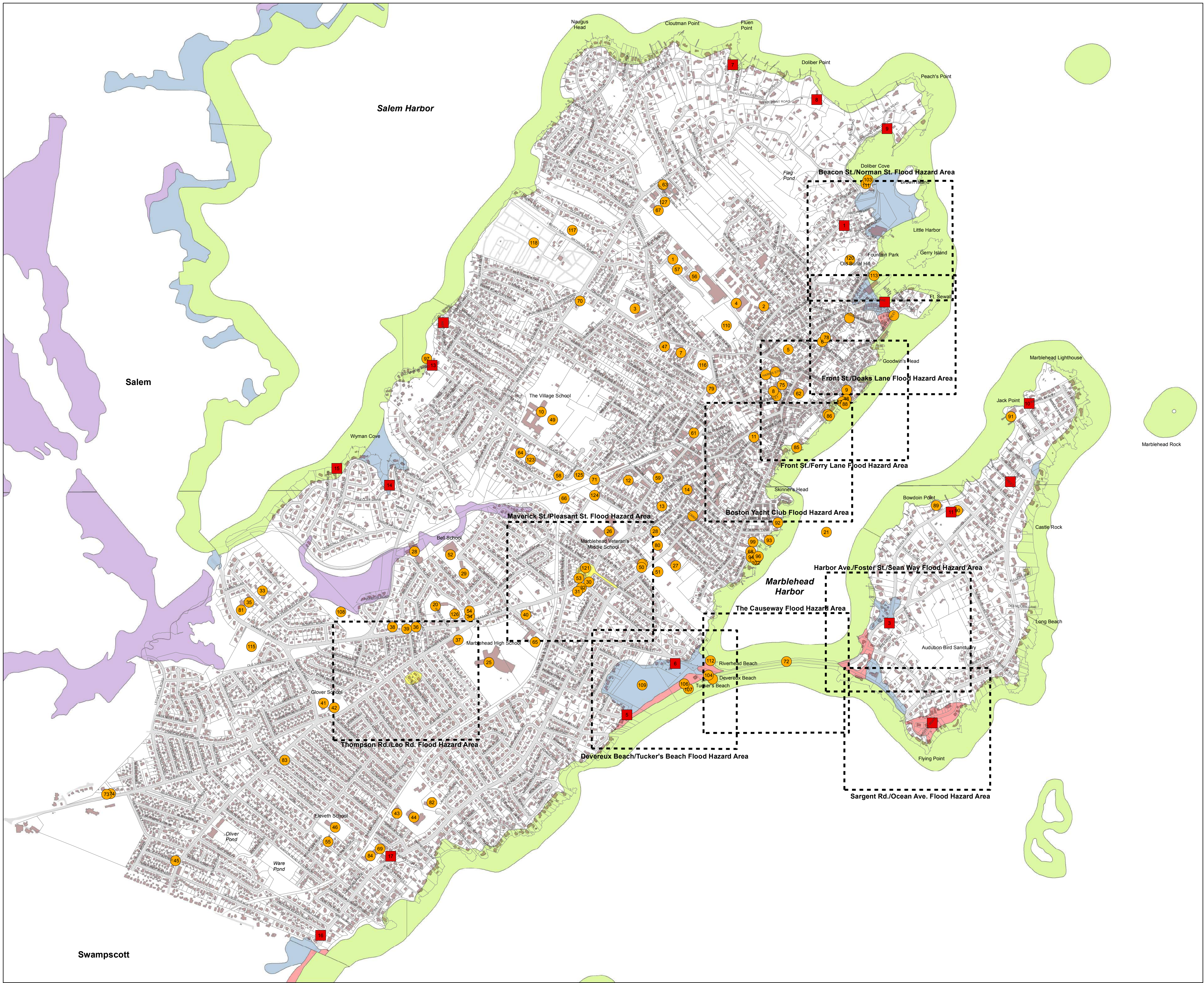
Sustainable Environmental Solutions

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Phone - 401-272-1717 • Fax - 401-437-8368 • [www.horsleywitten.com](http://www.horsleywitten.com)

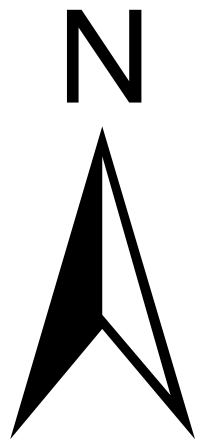
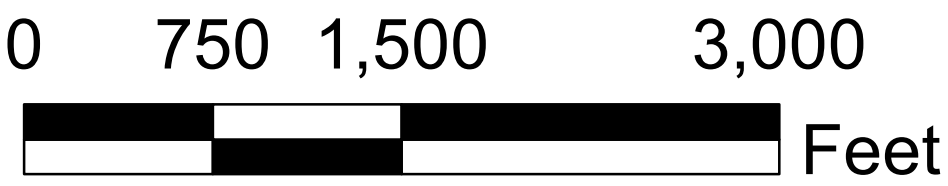


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**Town of Marblehead, MA**



**Legend**

- Critical Facilities
- Pump Stations
- Structures
- Area of 100-year flood, shallow flooding
- Area of 100-year flood (usually sheet flow on sloping terrain)
- Area of 100-year coastal flood with velocity
- 500-year flood and 100-year flood with depths < 1ft., or drainage areas less than one square mile, or protected by a levee
- Area of stormwater related flooding (Identified by Community Team)

**Figure A-2  
Flood Hazard Areas Map**

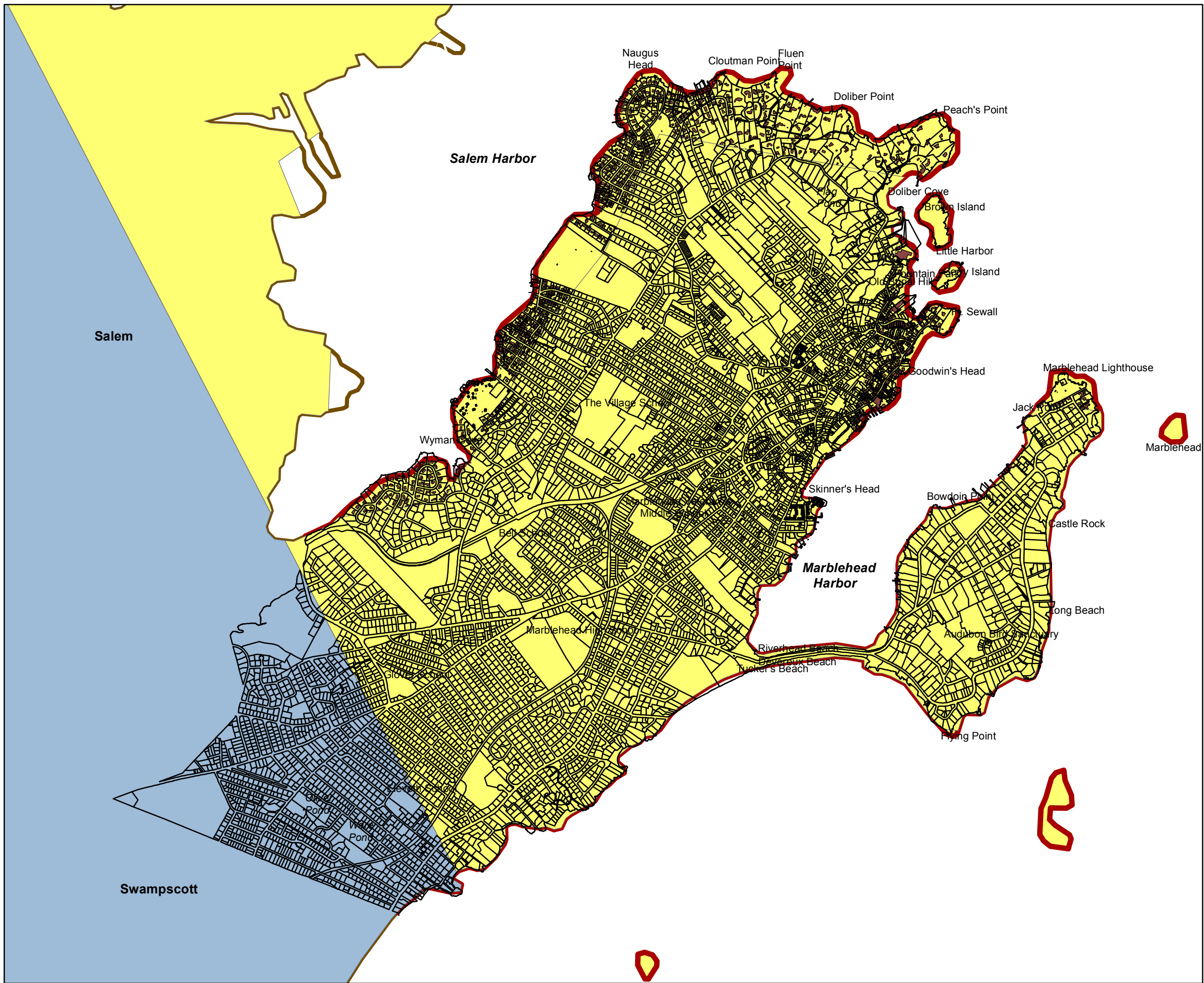
April 10, 2013  
Source: MassGIS, Marblehead municipal database

**Horsley Witten Group**  
*Sustainable Environmental Solutions*  
370 Ives Street • Providence, RI • 02906  
Phone - 401-272-1717 • Fax - 401-437-8368 • [www.horsleywitten.com](http://www.horsleywitten.com)

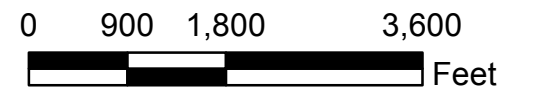


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## Town of Marblehead, MA



### Legend

(Inches)	
<span style="display:inline-block; width:20px; height:10px; background-color:yellow; border:1px solid black;"></span>	36.1 - 48.0
<span style="display:inline-block; width:20px; height:10px; background-color:blue; border:1px solid black;"></span>	48.1 - 72.0
<span style="display:inline-block; width:20px; height:10px; background-color:darkred; border:1px solid black;"></span>	Structure
<span style="display:inline-block; width:20px; height:10px; background-color:yellow; border:2px solid red;"></span>	Town Boundary

**Figure A-3**  
**Annual Snowfall**

April 10, 2013 CSP  
Source: MAPC 12/11/03

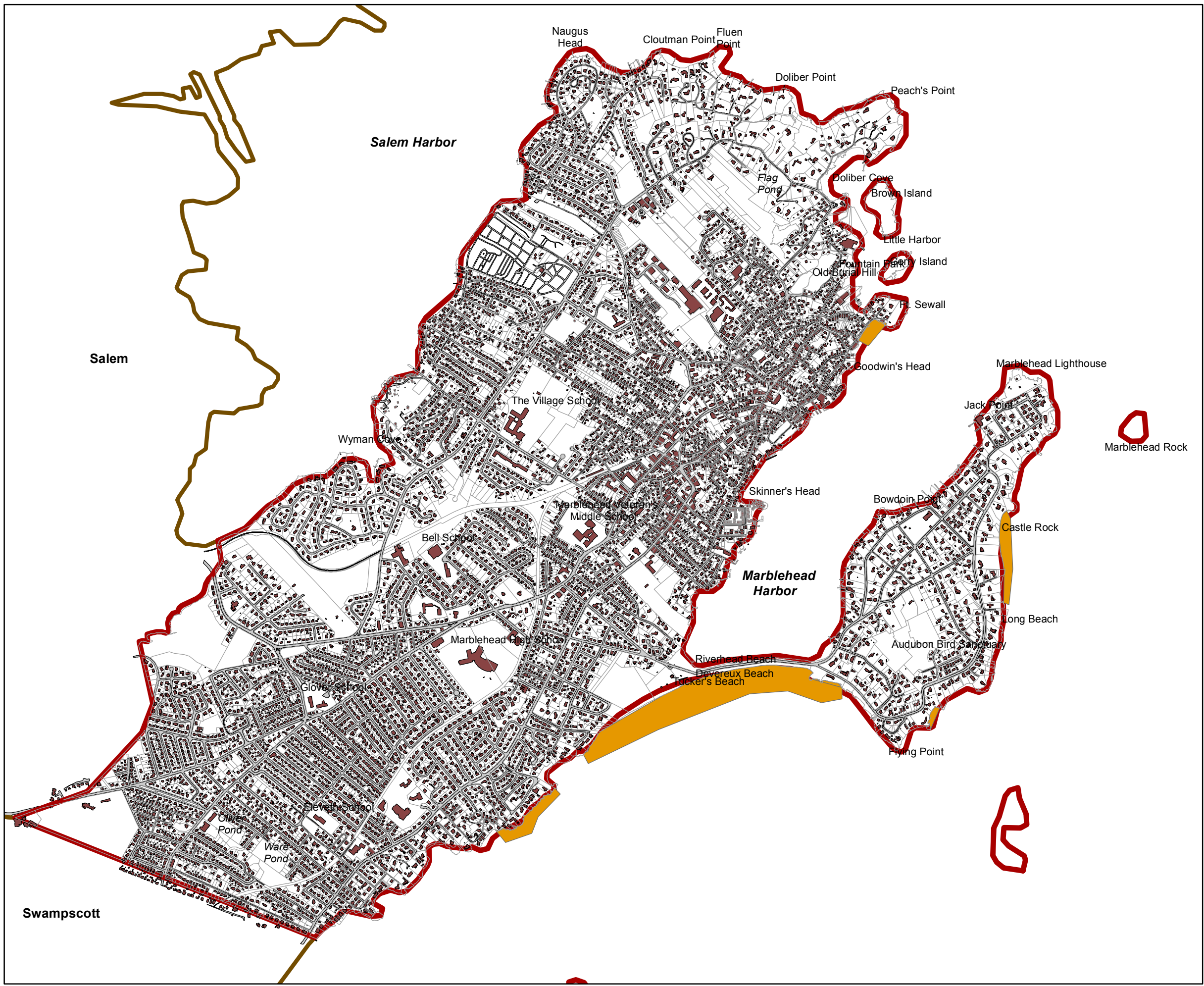
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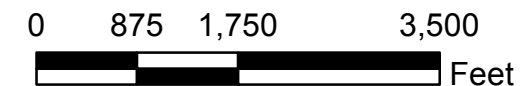


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## Town of Marblehead, MA



### Legend

- Erosional Areas of 6 - 18 inches per year
- Structure
- Town Boundary

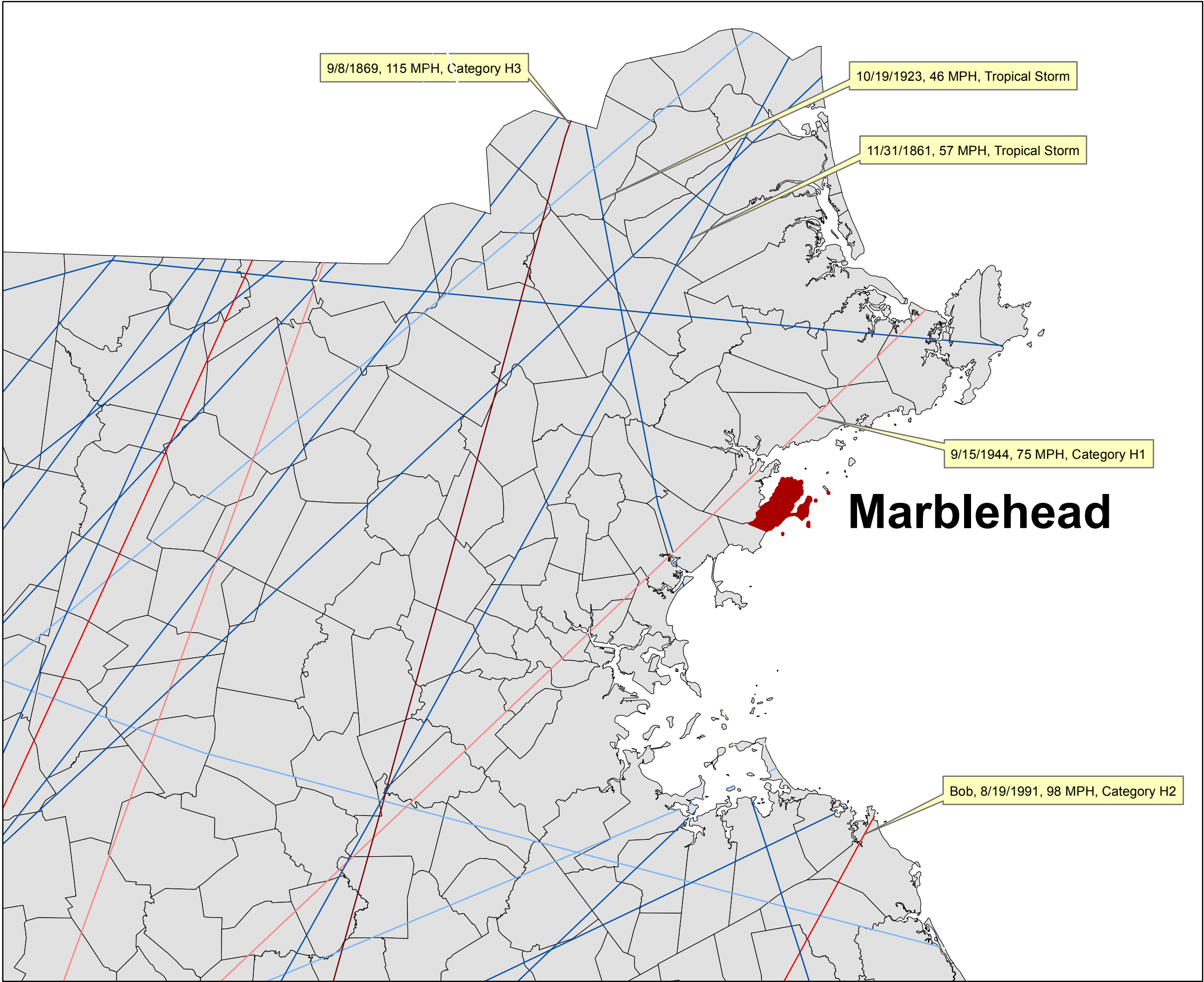
**Figure A-4  
Coastal Erosion**

April 10, 2013 CSP  
Source: MAPC 12/11/03

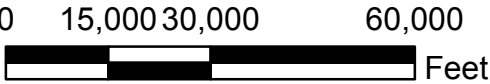
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**Town of Marblehead, MA**



**Legend**

Hurricane Tracks

Category

- Tropical Depression
- Tropical Storm
- Level 1 Hurricane
- Level 2 Hurricane
- Level 3 Hurricane

**Figure A-5**  
**Hurricane Tracks**

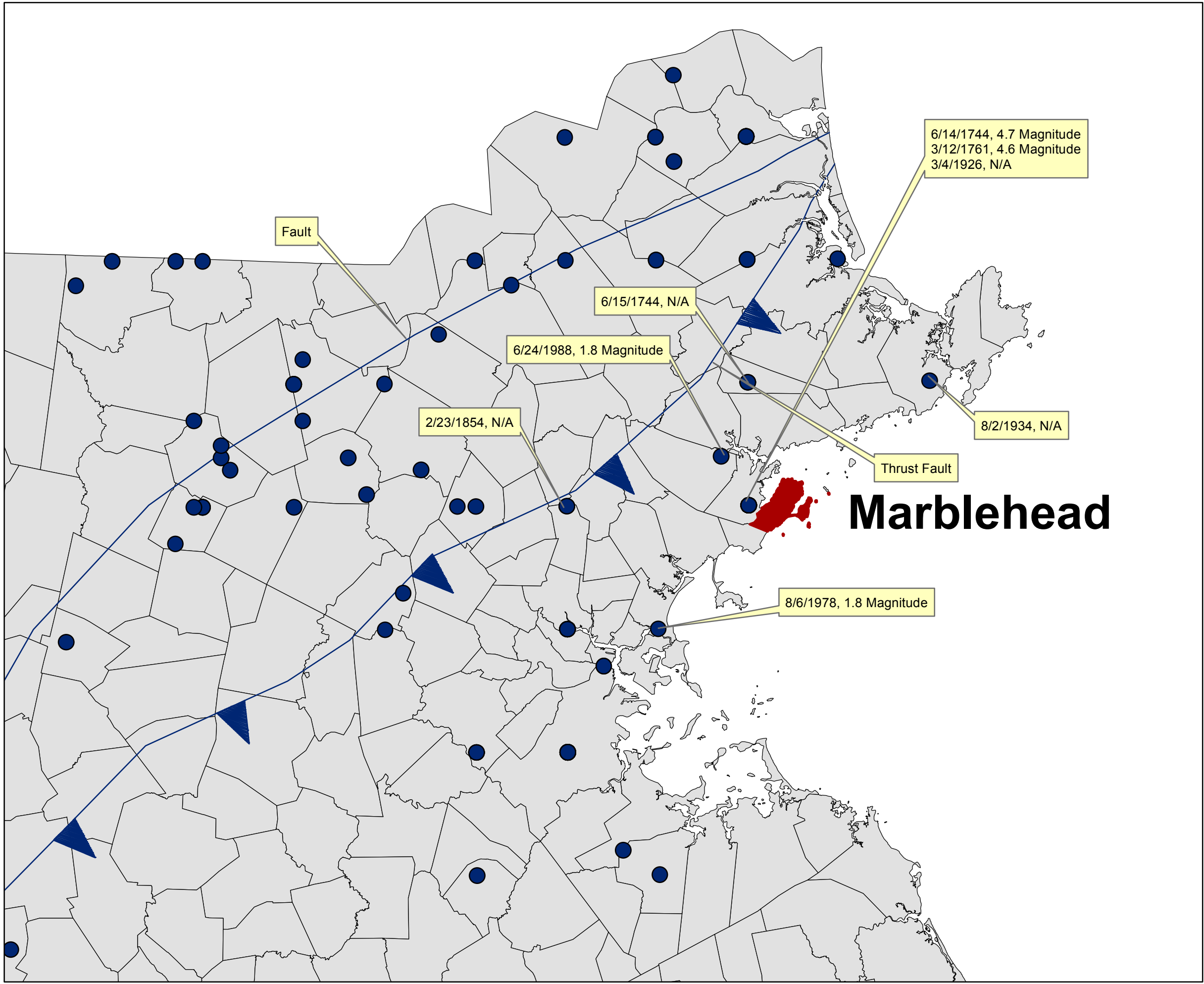
April 10, 2013 CSP  
Source: MAPC 12/11/03

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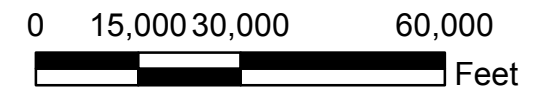


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## Town of Marblehead, MA



**Legend**

- Earthquakes
- Fault Lines

**Figure A-6  
Earthquakes**

April 10, 2013 CSP  
Source: MAPC 12/11/03

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Sustainable Environmental Solutions

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## Appendix B

### Planning Process/Public Meeting Documentation

#### Hazard Mitigation Plan Implementation and Monitoring Team Meeting – July 26, 2012

*Agenda*  
*Project Web Page*  
*Sign-In Sheet*  
*Memorandum of Meeting*

#### Municipal Interviews – October 12, 2012

*Memorandum of Meetings*

#### Municipal Interviews – October 18, 2012

*Memorandum of Meetings*

#### Public Workshop – October 29, 2012 (original date, cancelled due to Hurricane Sandy)

*Workshop Invitation (Boards, Commissions, Interested Parties)*  
*Wicked Local Marblehead Meeting Listing*  
*Town Website Announcement*

#### Public Workshop – December 5, 2012

*Workshop Invitation (Boards, Commissions, Interested Parties)*  
*Town Website Announcement*  
*Agenda*  
*PowerPoint Presentation*  
*Sign-In Sheet*  
*Memorandum of Meeting*

#### Hazard Mitigation Plan Implementation and Monitoring Team Meeting – January 15, 2013

*Agenda*  
*Mitigation Actions for Discussion*  
*Sign-In Sheet*  
*Memorandum of Meeting*

#### Hazard Mitigation Plan Implementation and Monitoring Team Meeting – March 12, 2013

*Agenda*  
*Draft Mitigation Actions*  
*Prioritization Ranking*  
*Sign-In Sheet*

# Marblehead Hazard Mitigation Plan Update

## **Hazard Mitigation Plan Implementation/Monitoring Team Meeting**

Abbott Hall – Selectmen’s Meeting Room  
188 Washington Street

July 26, 2012 – 10:00 AM

### **Agenda**

1. Introductions
2. Overview of Scope and Revised Schedule
3. Project Coordination
  - a. Data Collection
  - b. Municipal Coordination
  - c. Public Outreach
    - i. Project Webpage
    - ii. ‘Notify Me’ email subscription service
4. Agenda/Logistics for Public Workshop





*Photos courtesy of Marblehead Patch.*

FEMA defines hazard mitigation as:

*A series of actions and policies designed to reduce and/or eliminate the impacts of naturally occurring disasters on people and property.*

## **About the Natural Hazards Mitigation Plan Update**

A hazard mitigation plan should be considered a living document that must grow and adapt, keeping pace with a community's growth and change. The Disaster Mitigation Act of 2000 (DMA) places high priority on the continuation of the planning process after the initial submittal, requiring communities to seek and receive re-approval from FEMA in order to remain eligible for assistance. The evaluation, revision and update process is also a means to create an increased institutional awareness and involvement in hazard mitigation as part of daily activities.

This Plan Update will replace the existing December 2004 Natural Hazards Mitigation Plan as a standalone document. The approach for this Update is premised on four primary methods, all geared towards meeting the requirements of the DMA 2000 Public Law 106-390, October 10, 2000:

- Planning Process—Outreach and Stakeholder Coordination
- Risk Assessment—Identifying Hazards and Estimating Losses
- Mitigation Strategy— Identifying Mitigation Actions and Implementation Strategies
- Plan Maintenance—Implementation, Evaluation and Revision/Update

**Stay tuned for more information on how to get involved!**

## **Contacts**

Rebecca L. Curran—Town Planner  
Abbott Hall  
188 Washington Street  
Marblehead, MA 01945  
[curranr@marblehead.org](mailto:curranr@marblehead.org)  
Phone: (781) 631-0000

# Marblehead Hazard Mitigation Plan Update

## Sign in Sheet

Abbott Hall - Selectmen's Meeting Room

188 Washington Street

July 26, 2012 - 10:00 AM

<u>Name</u>	<u>Email Address</u>	<u>Phone</u>
CRAN PIERRENA	HORSLEY WITTEN GROUP	401.272.1717
Amy McHugh	mchugh@marblehead.org	978-998-1024
Charles R. McCollum	Water & Sewer	781-953 1214 cell
" "	" "	781-631-0102 office
WILLY LANPHEAR	LANPHEARW@MARBLEHEAD.COM	781-631-1529
REBECCA CURRAN	curran@marblehead.org	781 631 0000
Chuck McC	mccollumc@marblehead.org	



# Memorandum of Meeting

**To:** Becky Curran, Hazard Mitigation Plan Implementation/Monitoring Team  
**CC:** Carl Simons  
**From:** Craig Pereira  
**Date:** 8/30/2012  
**Re:** Hazard Mitigation Plan Implementation/Monitoring Team Meeting No. 1

---

A meeting was held on July 26, 2012 at Marblehead Town Hall to review the project scope and revised schedule, discuss project coordination (data collection, municipal coordination and public outreach) and coordinate the agenda and logistics for the first Public Workshop. Attendance/Sign-in sheet is attached. The following items were discussed:

- Craig Pereira reviewed the Scope and Revised Schedule. No changes were suggested.
- Mr. Pereira discussed development of a project webpage to be hosted on the Town's website. The webpage would serve as a repository for project information (upcoming meetings, past presentations, drafts for public review/comment). Mr. Pereira also requested more information on the Town's 'Notify Me' email subscription service as a way for interested persons to get involved and stay in touch as the project evolves. Mr. Pereira will develop a draft webpage layout and coordinate with Becky Curran/Town's IT Department.
- Mr. Pereira reviewed *Section 5 – Planned Mitigation Activities* of the existing 2004 Plan, specifically the Priority and Secondary Measures. Review of this section will inform the implementation status or 'Report Card' of the 2004 Plan and serve as the baseline for developing an updated plan. Several items were tabled for later discussion with municipal personnel, while several completed reports were identified for further review/data collection.
- Mr. Pereira discussed adding 'Climate Change' as a hazard the Town is vulnerable to, in addition to the reformatting/expansion of *Section 5 – Planned Mitigation Activities* to include the following categories:
  - Planning and Prevention
  - Property Protection
  - Natural Resource Protection
  - Structural Projects
  - Emergency Services
  - Public Education and Awareness
- The agenda/logistics were discussed for the first Public Workshop to include the project announcement, 2004 Plan Report Card and to receive comments from the general public. Ms. Curran suggested waiting until after the Labor Day holiday, when most municipal personnel and residents are settled back into their normal routines.

Follow-up Action Items:



- Mr. Pereira will develop a draft webpage layout and coordinate with Becky Curran/Town's IT Department regarding setup. Ms. Curran will also look into the 'Notify Me' email subscription service as a means for residents to get/stay involved in the project.
- Ms. Curran will coordinate with municipal departments/personnel to identify and schedule a date for in-person interviews by HW to receive comments on the update of the Plan. Telephone/email interviews will serve as a secondary means of coordination.
- Ms. Curran/identified personnel will provide the information for the Town's accomplishments (date completed, responsible party, and funding stream/costs) relative to the Primary and Secondary Measures to be included in the Plan Update and Public Workshop.
- Ms. Curran will identify a date and location for the first Public Workshop.
- Mr. Pereira to obtain copies of the identified, available reports:
  - Harbor Management Plan
  - Devereux Beach Shoreline Protection Measures
  - Storm Water Master Plan



# Memorandum of Meetings

**To:** Becky Curran, Hazard Mitigation Plan Implementation/Monitoring Team  
**CC:** Carl Simons  
**From:** Craig Pereira  
**Date:** 10/16/2012  
**Re:** Municipal Interviews regarding the Hazard Mitigation Plan Update

---

The Horsley Witten Group conducted interviews with Municipal Officials/Department Chairs on Friday October 12, 2012 in the Selectmen's Meeting Room at Abbot Hall to review the project scope and revised schedule, and to discuss project coordination (data collection, municipal coordination and report card for the 2004 plan). The following is a summary of the interviews with follow-up/action items for municipal personnel in preparation of the Public Workshop scheduled for Monday October 29, 2012.

**Superintendent/Assistant Superintendent Water/Sewer Dept. (Chuck McCollum and Amy McHugh)**

- The Stormwater Master Plan is expected to be completed this year (\$4.9 million appropriated at Town Meeting)
- Commented on a new effort to fully integrate the Town's GIS system/functionality across municipal departments/personnel
- 5 pump stations are SCADA (Supervisory Control and Data Acquisition) with the ability to monitor, control and alarm plant or regional operating systems from a central location
- 6 pump stations have generators, while three others (smaller sites) have battery backups. Dept. also has 3 backup generators
- Dept.'s Five-Year Plan includes rebuilt pump stations, however, 5-year plan for drains is very small
- Dept. does have a catch basin maintenance plan and MOU's for emergency supplies/contractors
- Dept. has 2 in-house crews that do all their work and oversees the Drain Dept.
- Mentioned the Phillips St. pump station is no longer within the 100-yr flood zone (not correctly depicted on the mapping)

*Follow-up/Action Items*

- Provide written details of what the Stormwater Master Plan will include
- Provide details of what the municipal GIS system should include from department's perspective
- Provide a list of recent (since 2004) accomplishments including project type/completion date/funding mechanism/responsible party
  - Install watertight hatches at wastewater pump stations
  - Develop a Stormwater Master Plan

**Town Administrator (Jeff Chelgren)**

- 'Sharing' of information is problematic, Town needs better system in place for central database access/information management and distribution

- Town is currently working on a regional grant project (with Salem and Swampscott) through 'SharePoint'

*Follow-up/Action Items*

- Provide details of what the municipal GIS system should include from Town's perspective
- Provide a list of recent (since 2004) accomplishments including project type/completion date/funding mechanism/responsible party

**Police Chief (Bob Picariello)**

- Recognized SOP's in place for emergencies, but also spoke to 'local knowledge' relative to emergency response and that this should also be codified
- Dept. does have a three-year plan (currently 1 year in)
- Code Red Reverse 911 currently used
- Coordination with local utilities could be improved (there is a large gas line off the coast...what if scenarios should be explored)
- Recommended coordinating with Pat Roberts (Council on Aging) for listing of elderly populations at risk living independently in the community (most vulnerable population)

*Follow-up/Action Items*

- Provide details of what the municipal GIS system should include from department's perspective
- Provide a list of recent (since 2004) accomplishments including project type/completion date/funding mechanism/responsible party

**Engineering/Conservation (Willy Lanphear)**

- Not aware of where the Town is at regarding enrollment in the Community Rating System (CRS)
- Has been receiving multiple calls from residents regarding new FEMA flood maps. Agrees the Town's website could be developed/expanded to include links to mitigation activities/homeowner information/resources etc.
- Identified the pavilion at Devereux Beach at risk to periodic flooding
- Protocol for new subdivision applications could include parameters for how information is submitted to improve periodic update of GIS parcel dataset

*Follow-up/Action Items*

- Provide details of what the municipal GIS system should include from department's perspective
- Provide a list of recent (since 2004) accomplishments including project type/completion date/funding mechanism/responsible party
  - Construct a new seawall at the causeway
  - Advise homeowners in the floodplain
  - Devereux Beach Shoreline Protection Measures report

**Fire Chief and Emergency Management Director (Jason Gilliland and Chuck Cerrutti)**

- Town's Comprehensive Emergency Management Plan (CEMP) needs updating
- Town does not have a Continuity of Operations Plan (COOP)
- Recommended coordinating with former Town Engineer, Doug Saal
- Recognized the need for GIS (particularly in vehicles), but referenced inability to access when in the station
- Recommended coordinating with Andrew Petty, Director of Public Health
- Installation of warning lights at the causeway mitigation measure should be carried forward in the updated plan



- American Red Cross has completed their survey/review of emergency shelters in town
- Back-up generator purchase for the Middle School should be carried forward in the updated plan. Village School has a new generator, and Glover School will soon have a new generator
- Pet shelters identification not complete and should be discussed prior to carrying over into updated plan...action conflicts with recommendations of the Board of Health
- Community Hurricane Preparedness Course has been completed by emergency personnel, but should be carried forward for new hires

*Follow-up/Action Items*

- Provide details of what the municipal GIS system should include from department's perspective
- Provide a list of recent (since 2004) accomplishments including project type/completion date/funding mechanism/responsible party

**Tax Assessor (Mike Tumulty)**

- MassGIS will be updating the Town's Parcel data set by the spring 2013, possibly earlier

*Follow-up/Action Items*

- Provide details of what the municipal GIS system should include from department's perspective



# Memorandum of Meetings

**To:** Becky Curran, Hazard Mitigation Plan Implementation/Monitoring Team  
**CC:** Carl Simons  
**From:** Craig Pereira  
**Date:** 4/30/2013  
**Re:** Municipal Interviews regarding the Hazard Mitigation Plan Update

---

The Horsley Witten Group conducted interviews with Municipal Officials/Department Chairs on Thursday October 18, 2012 in the Selectmen's Meeting Room at Abbot Hall to review the project scope and revised schedule, and to discuss project coordination (data collection, municipal coordination and report card for the 2004 plan). The following is a summary of the interviews with follow-up/action items for municipal personnel in preparation of the Public Workshop scheduled for Monday October 29, 2012.

## **Harbormaster (Webb Russell)**

- SOP's for storm duties exists in the CEMP (managed pull-outs for pending storm surge/hurricanes).
- Aware of gas line off the coast, SOP likely in CEMP.
- GIS could be useful and utilized in this role.

### *Follow-up/Action Items*

- Provide copy of the Marblehead Harbor Management Plan
- Provide details of what the municipal GIS system should include from department's perspective
- Provide a list of actions to be considered for inclusion in the update (public access to the water, etc.)

## **Building Commissioner (Bob Ives)**

- Assisted with the development of GIS files/maps for the 2004 plan.
- On-line Assessors is outdated.
- Responsible for municipal buildings (Library, Mary Alley Municipal Building).

### *Follow-up/Action Items*

- Provide details of what the municipal GIS system should include from department's perspective
- Provide a list of recent (since 2004) accomplishments including project type/completion date/funding mechanism/responsible party
- Provide a list of actions to be considered for inclusion in the update (protection of public buildings/library floods)

## **Tree Warden (Doug Gordon)**

- No codified 'Tree Maintenance/Trimming Program' in Town, conducted on an as-needed basis.
- Has a 4-man crew that does the work themselves.

*April 30, 2013*

- Responds to calls that come in...during extreme events, can pull manpower from DPW if necessary.
- Debris Management Plan? No, utilizes the municipal dump/transfer station to dispose of waste, which is undergoing a transition (future capacity unknown).
- Would be ideal to have an MOU in place for crane /logging truck services.



TO: Boards, Commissions and Interested Citizens  
FROM: Marblehead Hazard Mitigation Committee  
DATE: October 16, 2012  
RE: Invitation to Hazard Mitigation Plan Update Workshop

---

As you may know, the Town of Marblehead has recently retained the consultants the Horsley Witten Group to assist the town in the update of the town's Hazard Mitigation Plan. This project is funded through a matching grant from the Massachusetts Emergency Management Agency.

The term "Hazard Mitigation" describes actions that can help reduce or eliminate long-term risks caused by natural hazards, or disaster, such as floods, hurricanes, tornadoes and earthquakes. After disasters, repairs and reconstruction are often completed in such a way as to simply restore damaged property to pre-disaster conditions. These efforts may expedite a return to normalcy, but the replication of pre-disaster conditions often results in a repetitive cycle of damage, reconstruction, and repeated damage. Hazard mitigation is needed to break this repetitive cycle by producing less vulnerable conditions through post-disaster repairs and reconstruction. The implementation of such hazard mitigation actions now means building stronger, safer and smarter communities that will be able to reduce future injuries and future damage.

A hazard mitigation plan is considered a "living" document that should adapt, keeping pace with a community's growth and change. This Plan Update will replace the town's existing December 2004 Natural Hazards Mitigation Plan as a standalone document. The town is required to update the plan in order to remain eligible for federal assistance from FEMA.

The evaluation, revision and update process is also a means to create an increased institutional awareness and involvement in hazard mitigation as part of daily activities. Public input at this stage of the project is helpful. This planning process involves outreach and stakeholder coordination and this workshop is intended to gain valuable information from the community. The workshop will also include a project overview and a summary of the 2004 Plan's goals from the consultant, as well as a rough outline of anticipated next steps.

The committee will be holding a public workshop on Monday, October 29 at 7 PM at the Council on Aging Dining Room in the Marblehead Community Center 10 Humphrey Street. We are writing to invite you to this workshop, and to encourage your attendance.

If you have any questions, please contact Town Planner Becky Curran at 781-631-0000 or [curranr@marblehead.org](mailto:curranr@marblehead.org);

We hope you will be able to attend the meeting on October 29<sup>th</sup>.  
Thank you.





## Public input sought for update of Marblehead hazard plan

By Staff reports  
**Marblehead Reporter**

Posted Oct 19, 2012 @ 07:28 PM

### Business News

- **Democratic, GOP Anxiety Over Retirement Looks Different**
- **The Digital Skeptic: Facebook Isn't Much More Exciting Than Email**
- **6 Halloween Candy Stocks to Watch This Holiday Season**

Marblehead — The Marblehead Hazard Mitigation Committee will be holding a public workshop on Monday, Oct. 29 at 7 p.m. at the Council on Aging Dining Room in the Marblehead Community Center, 10 Humphrey St.

The town of Marblehead recently retained consultants the Horsley Witten Group to assist the town with updating its Hazard Mitigation Plan, funded through a matching grant from the

Massachusetts Emergency Management Agency.

The term “hazard mitigation” describes actions that can help reduce or eliminate long-term risks caused by natural hazards, or disaster, such as floods, hurricanes, tornadoes and earthquakes. After disasters, repairs and reconstruction are often designed simply to restore damaged property to pre-disaster conditions. These efforts may expedite a return to normalcy, town officials note, but the replication of pre-disaster conditions often results in a repetitive cycle of damage, reconstruction and repeated damage.

According to MEMA, hazard mitigation is needed to break this repetitive cycle by producing less vulnerable conditions through post-disaster repairs and reconstruction. The implementation of such hazard-mitigation actions now means building stronger, safer and smarter communities that will be able to reduce future injuries and future damage, MEMA said.

A hazard-mitigation plan is considered a “living” document that should adapt, keeping pace with a community’s growth and change, according to MEMA. This updated plan will replace the town’s existing December 2004 Natural Hazards Mitigation Plan as a standalone document. The town is required to update the plan in order to remain eligible for federal assistance from FEMA.

The evaluation, revision and update process is also a means to create an increased institutional awareness and involvement in hazard mitigation as part of daily activities, according to MEMA, which notes that public input at this stage of the project is helpful. The workshop is intended to obtain valuable information from the community. The workshop will also include a project overview and a summary of the 2004 plan’s goals from the consultant, as well as a rough outline of anticipated next steps.

If you have any questions, contact Town Planner Becky Curran at 781-631-0000 or [curranr@marblehead.org](mailto:curranr@marblehead.org).

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TO: Boards, Commissions and Interested Citizens  
FROM: Marblehead Hazard Mitigation Committee  
DATE: November 27, 2012  
RE: Invitation to Hazard Mitigation Plan Update Workshop

---

As you may know, the Town of Marblehead has recently retained the consultants the Horsley Witten Group to assist the town in the update of the town's Hazard Mitigation Plan. This project is funded through a matching grant from the Massachusetts Emergency Management Agency.

The term "Hazard Mitigation" describes actions that can help reduce or eliminate long-term risks caused by natural hazards, or disaster, such as floods, hurricanes, tornadoes and earthquakes. After disasters, repairs and reconstruction are often completed in such a way as to simply restore damaged property to pre-disaster conditions. These efforts may expedite a return to normalcy, but the replication of pre-disaster conditions often results in a repetitive cycle of damage, reconstruction, and repeated damage. Hazard mitigation is needed to break this repetitive cycle by producing less vulnerable conditions through post-disaster repairs and reconstruction. The implementation of such hazard mitigation actions now means building stronger, safer and smarter communities that will be able to reduce future injuries and future damage.

A hazard mitigation plan is considered a "living" document that should adapt, keeping pace with a community's growth and change. This Plan Update will replace the town's existing December 2004 Natural Hazards Mitigation Plan as a standalone document. The town is required to update the plan in order to remain eligible for federal assistance from FEMA.

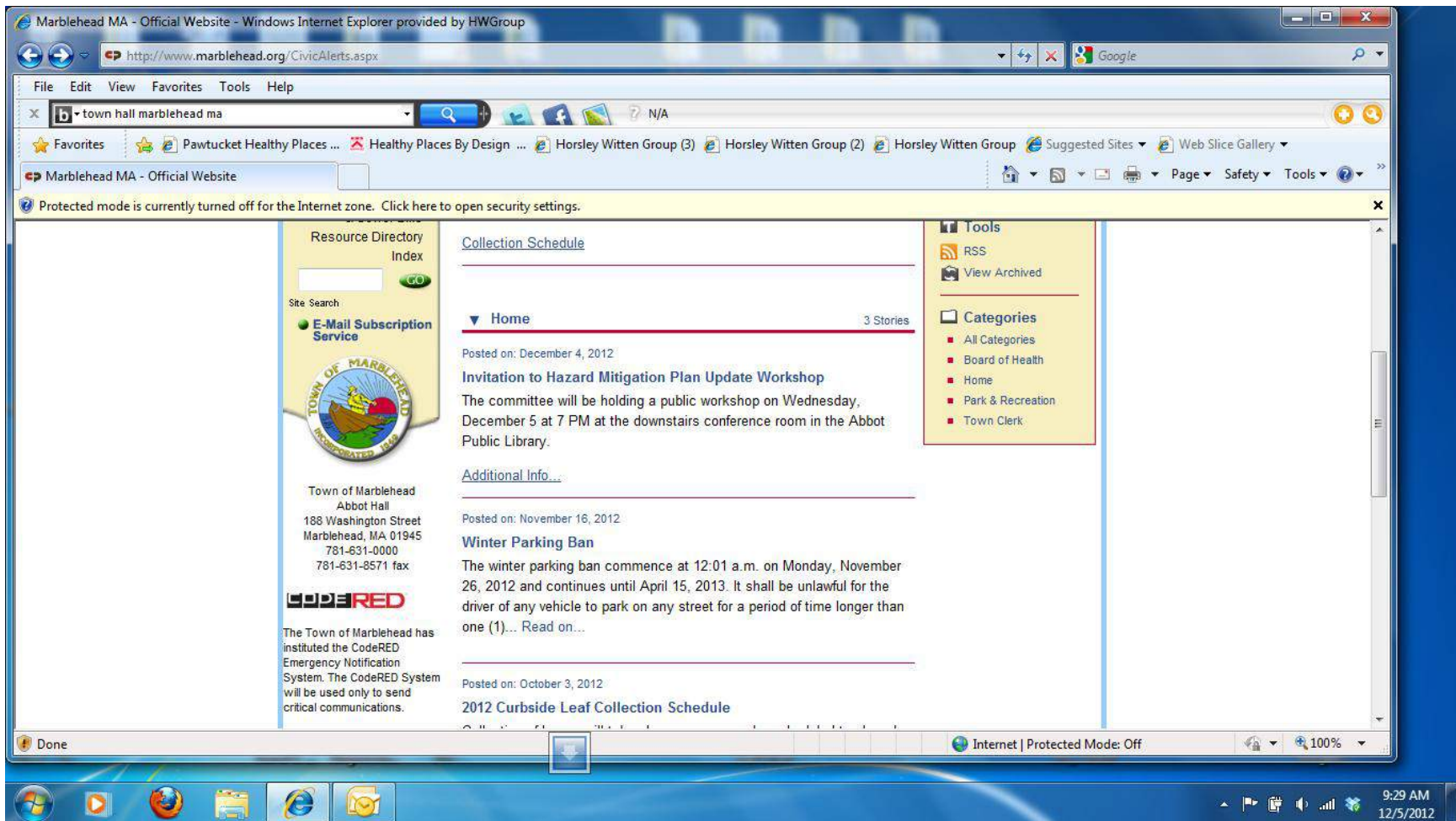
The evaluation, revision and update process is also a means to create an increased institutional awareness and involvement in hazard mitigation as part of daily activities. Public input at this stage of the project is helpful. This planning process involves outreach and stakeholder coordination and this workshop is intended to gain valuable information from the community. The workshop will also include a project overview and a summary of the 2004 Plan's goals from the consultant, as well as a rough outline of anticipated next steps.

The committee will be holding a public workshop on **Wednesday, December 5 at 7 PM at the downstairs conference room in the Abbot Public Library 235 Pleasant Street**. We are writing to invite you to this workshop, and to encourage your attendance.

If you have any questions, please contact Town Planner Becky Curran at 781-631-0000 or [curranr@marblehead.org](mailto:curranr@marblehead.org);

We hope you will be able to attend the meeting on December 5, 2012.  
Thank you.





# Marblehead Hazard Mitigation Plan Update

## **Public Workshop**

Abbot Public Library  
235 Pleasant Street

December 5, 2012 – 7:00 PM

## **Agenda**

1. Hazard Mitigation Planning Overview
2. 2004 Plan
  - a. Risk and Vulnerability Assessment
  - b. Hazard Index
  - c. Mitigation Measures
  - d. Report Card
3. Next Steps
4. Public Comments



## Town of Marblehead Natural Hazards Mitigation Plan December 2004 - Update

Public Workshop  
December 5, 2012  
7:00 pm  
Abbot Public Library



## Why Hazard Mitigation Planning?

Disaster Mitigation Act of 2000, Interim Final Rule, 44 CFR Parts 201 and 206 states, "All communities must have an approved Multiple Hazards Mitigation Plan in order to qualify for future federal disaster mitigation grants".

Reduction or elimination of long-term risk to life, property, and the environment.



## Marblehead Hazard Mitigation Plan Implementation/Monitoring Team

- Rebecca Curran, Town Planner
- Jeff Chelgren, Town Administrator
- Chuck Cerrutti, Emergency Management Director
- Jason Gilliland, Fire Chief
- Bob Picariello, Police Chief
- Chuck McCollum, Superintendent Water/Sewer Dept.
- Amy McHugh, Assistant Superintendent Water/Sewer Dept.
- Willy Lanphear, Town Engineer/Conservation Commission
- William Conly, Historic Commission
- Bob Ives, Building Commissioner
- Craig Pereira, Consultant – Horsley Witten Group



## Mitigation Process

- **Assess Risks**
- Establish Goals
- Identify Projects/Actions
- Update/Maintain Plan



## Assess Risks... Risk and Vulnerability Assessment

### *Natural Hazard:*

"Any event or physical condition that has the potential to cause fatalities, injuries, property damage, infrastructure damage, and agricultural loss, damage to the environment, interruption of business, or other types of harm and/or loss".



## Hazards Affecting Marblehead (2004 Plan)

- Flood-Related
  - Coastal Storms/Nor'easters/Thunderstorms/Winter Storms
  - Erosion
  - Hurricanes
  - Interior Flooding from Storm Run-off
- Wind-Related
  - Hurricanes
  - Coastal Storms/Winter Storms
- Fire-Related
  - Urban Fires
- Geologic
  - Earthquakes

\* Hazards affecting Marblehead will be updated to include climate change and sea level rise



## Hazards Affecting Marblehead (2004 Plan)

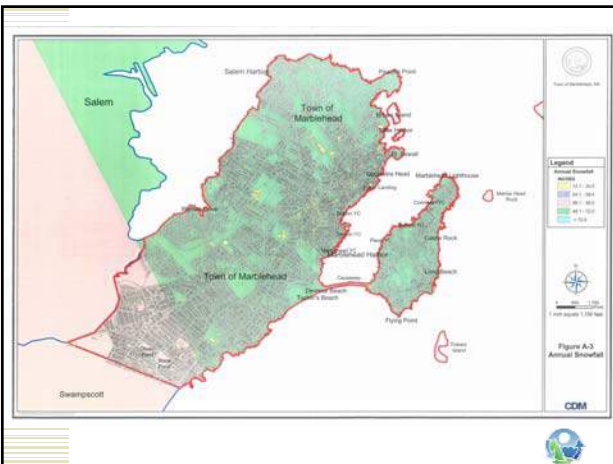
### • Flooding

- Coastal Flood Hazards...where the 100-year flood zone encroaches inland from the ocean. The Flood Insurance Rate Map (FIRM) is the standard used to determine the vulnerability of structures to flood hazards. Marblehead experiences significant coastal flooding several times per year due to storm surges.
- Interior Flooding from Storm Run-off...Several interior locations experience flooding due to inadequate drainage during significant storm events.

### • Winter Storms

- Marblehead receives between 36 inches to 72 inches of snow per year. Most dangerous hazard associated with winter storms for Marblehead, is the possibility of citizens being stranded on the Neck – due to closure of the Causeway.

\* Geographic flood hazard areas will be updated with new FEMA FIRM mapping (effective July 1, 2012).



## Hazards Affecting Marblehead (2004 Plan)

### • Erosion

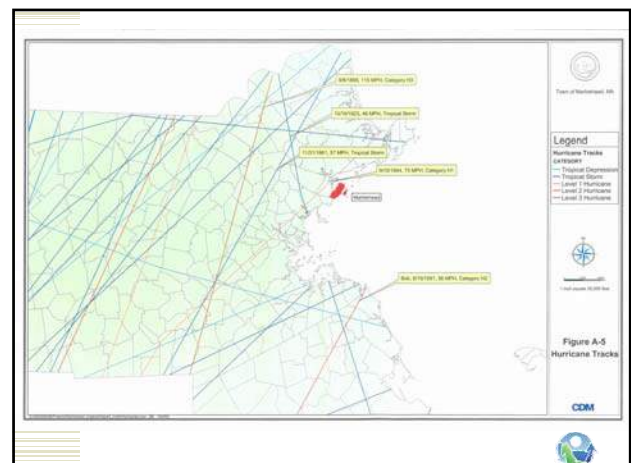
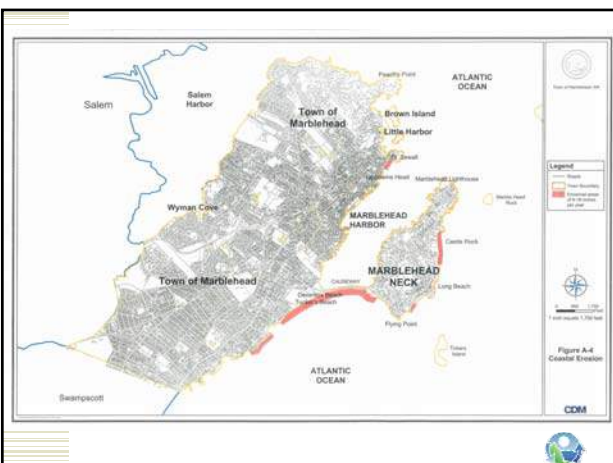
- Erosion is another hazard that occurs during large coastal events and through nature's natural processes. There are segments of coastline along the Neck and Marblehead's mainland that undergo between 6 inches and 18 inches of erosion per year.

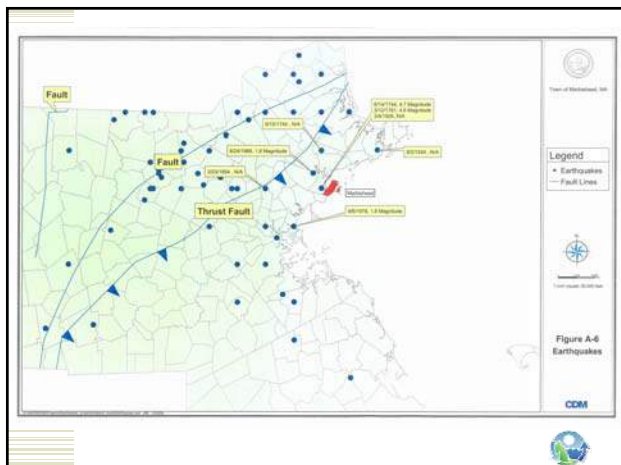
### • Hurricanes

- Hurricanes are multi-hazard storms that can potentially wreak havoc on a coastal community. Marblehead has not experienced the brunt of a hurricane since Hurricane Bob in August, 1991, but has experienced high winds and heavy rains associated with past hurricanes.

### • Earthquakes

- New England is not considered to be a hot spot for earthquakes, however, Marblehead is located in one of the highest risk zones in Massachusetts, and do occur from time to time.





## Hazard Index (2004 Plan)

The Hazard Mitigation Plan Implementation/Monitoring Team evaluated each of the hazards affecting Marblehead in order to establish the following **Hazard Index**:

➤ Coastal flooding from coastal storms/nor'easters	10
➤ Interior flooding from storm run-off	9
➤ Wind-related hazards from coastal/winter storms	8/7
➤ Erosion	6
➤ Thunderstorms	6
➤ Hurricanes	6
➤ Urban Fires	6

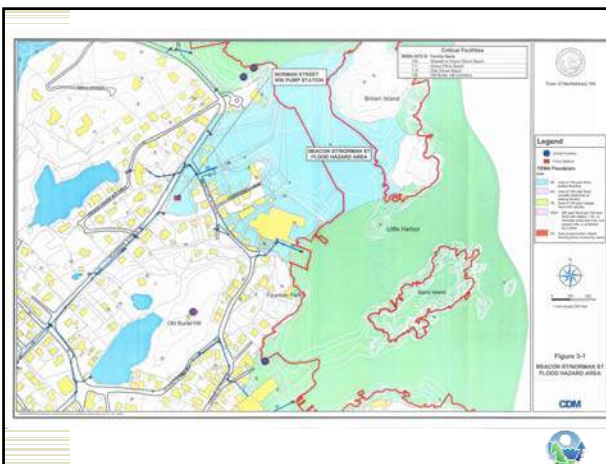
Horsley Witten Group

## High Hazard Areas (2004 Plan)

Flood related hazards (coastal due to storm surge and inland due to stormwater collection deficiencies) are the major issues of natural hazard risk to the Town of Marblehead, resulting in the identification of the following coastal-hazard area profiles:

- Beacon Street/Norman Street
- Front Street/Doaks Lane
- Devereux Beach/Tucker's Beach
- Front Street/Ferry Lane
- Boston Yacht Club
- The Causeway
- Foster Street/Sean Way
- Sargent Road/Ocean Avenue

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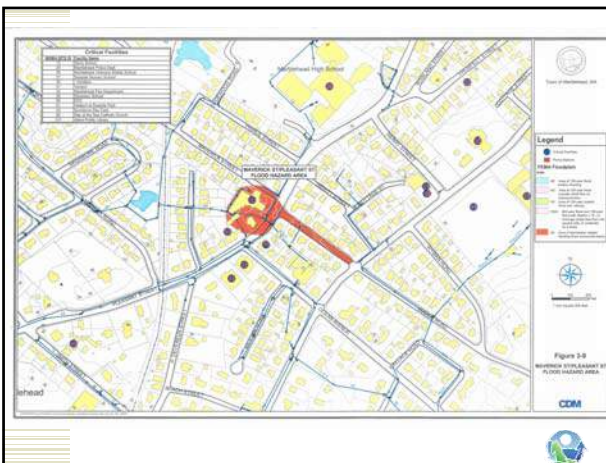


## High Hazard Areas (2004 Plan)

Second only to coastal flooding, interior flooding caused by deficiencies in the Town's storm water collection system resulted in the development and approval (June 2012) of the *Pleasant Street Drainage Project* to remedy some of the remaining interior flooding issues associated with multiple residential and commercial structures, public utilities, and municipally-owned properties.

Other previously identified interior flooding issues have been reduced or eliminated through the installation of larger drain pipes, and new outfalls, cleaning of existing drain lines, replacement of defective pipes, adding additional inlet capacity and redirecting flow to other areas and/or outfalls.

Horsley Witten Group





## Assess Risks... Risk and Vulnerability Assessment Identification of Assets

- **Economic Assets**
  - Businesses/major employers
  - Tourist destinations
- **Social Assets**
  - Vulnerable populations
  - Cultural locations
- **Natural Resources**
  - Lifeline and utility systems
  - Wetlands
  - Conservation and recreation lands



## Assess Risks... Risk and Vulnerability Assessment Identification of Assets

- **Essential Buildings and Critical Facilities**
  - Municipal buildings
  - Hazardous facilities
  - Roadways

One hundred and twenty seven (127) critical facilities have been identified by the Massachusetts Emergency Management Agency (MEMA, 2004) and Town officials, with only a portion located in high hazard areas.



## Assess Risks... Risk and Vulnerability Assessment Identification of Assets

There are an estimated (2004) 280 residents living in 70 properties within the main coastal flood hazard area in Marblehead, and approximately 23 commercial properties and 10 wastewater pump stations located within these flood hazard profile areas. A detailed listing of the structures considered vulnerable to coastal flooding is estimated at \$112.5 million.

FEMA reports a total of 18 structures that have had at least two flood insurance claims (Repetitive Loss Structures).

\* Approximate loss estimates will be updated with new FEMA FIRM mapping (effective July 1, 2012).



## Mitigation Process

- Assess Risks
- Establish Goals
- Identify Projects/Actions
- Update/Maintain Plan



## Establish Goals... Mitigation Strategy

### Review Existing Hazard Mitigation Activities:

- Marblehead Emergency Response Team
- Comprehensive Emergency Operations Plan
- Wetland By-Law
- Massachusetts State Building Codes
- Marblehead Harbor By-Law



## Establish Goals... Mitigation Goal

*“Reduce the loss of or damage to life, property, infrastructure, and natural, cultural, and economic resources from natural disasters”*



## Establish Goals... Mitigation Measures

- Planning and Prevention
- Property Protection
- Natural Resource Protection
- Structural Projects
- Emergency Services, and
- Public Education and Awareness

\* Proposed approach to reconfigure the format/layout of the updated plan.



## Mitigation Process

- Assess Risks
- Establish Goals
- **Identify Projects/Actions**
- Update/Maintain Plan



## Identify Projects/Actions... Identification of Mitigation Actions

Mitigation actions to be developed based on review of the Town's identified risks and vulnerabilities to natural hazards.

Each action incorporates a brief description of the intended action, who the responsible parties are, a proposed time frame for completion and potential funding sources.



## Identify Projects/Actions... Prioritization of Actions

- Social
- Technical
- Administrative
- Political
- Legal
- Economic
- Environmental



## Identify Projects/Actions... Action Plan (example)

### EMERGENCY SERVICES

#### Essential Public Services

Action 12 – Purchase a 150 KW emergency power source for the Department of Public Works. Public Works has no back up power to keep up with necessary services in the event of a power outage. The community's Emergency Operations Center is located in this facility.

- Action Type - Emergency Services
- Priority - High
- Lead - Municipal EMA
- Supporting - DPW
- Financing Options - MEMA, FEMA, Town Capital Budget
- Cost - \$50,000
- Time Frame - Short Term
- Benefit - Public safety is enhanced



## Identify Projects/Actions... Implementation

- Town Capability
- Plan Adoption/Incorporation into Existing Plans



## Mitigation Process

- Assess Risks
- Establish Goals
- Identify Projects/Actions
- **Update/Maintain Plan**



## Update/Maintain Plan...

- Maintain periodically, recommended annually
- Update every 5 years per DMA 2000



## 2004 Plan Report Card

### Priority Measures

#### *Enroll in the Community Rating System (CRS)*

Fulfill the requirements of the National Flood Insurance Program (NFIP) to join CRS. In addition to assistance in developing future mitigation activities, this could allow the Town and residents to qualify for discounts on flood insurance rate premiums...**Not Completed – Carry Forward**

#### *Official Town of Marblehead Website*

Develop an official town website ([www.marblehead.org](http://www.marblehead.org)), and increase public outreach with links to mitigation activities, evacuation procedures as described in the Comprehensive Emergency Management Plan, links to FEMA 100-year floodplain maps, and other natural-disaster related links, such as hurricane preparedness...**Completed – Expand and Carry Forward**



## 2004 Plan Report Card

### Priority Measures

#### *Construct a New Seawall at the Causeway*

Rebuild the seawall on the southern side of the Causeway that is directly exposed to the ocean. The new seawall will be constructed with a concave face to the ocean to direct ocean waves away from the roadway and prevent the over-wash of cobbles onto the traveled way...**Completed**

#### *Install Warning Lights at the Causeway*

Install warning lights and/or signs on the Causeway to alert citizens of an impending storm, the need for evacuation of the Neck, or the closing of the Causeway...**Not Completed – Carry Forward**

#### *Install Watertight Hatches at Wastewater Pump Stations*

Plan, engineer and construct new watertight entrance hatches at each of nine underground wastewater pump stations that are located within the 100-year flood plain...**Completed**



## 2004 Plan Report Card

### Secondary Measures

#### *Advise Homeowners in the Floodplain*

Insert a small pamphlet in the tax bills of citizens whose homes lie within the 100-year floodplain and advise them to visit the official town website to learn more about the risks and hazards they face, as well as mitigation actions they can perform. Also inform them of their right to receive a discount on their flood insurance premiums based on the Town's score in the Community Rating System...**Completed – Carry Forward**

#### *Provide Backup Generator*

Purchase and install a backup electrical generator at the Middle School of Village Street...**Not Completed – Carry Forward**



## 2004 Plan Report Card

### Secondary Measures

#### *Pet Shelters*

Locate and establish pet shelters to house displaced pets during disaster ... **Not Completed – Requires Discussion Prior to Carrying Forward**

#### *Investigate Breakwater*

Re-evaluate the potential for construction of a breakwater to be located in Marblehead Harbor from near the Marblehead Lighthouse on the Neck heading westward towards the mainland. Re-address the planning level costs estimated in a similar evaluation performed by the Army Corps of Engineers in the 1960's and 1970's. The breakwater is intended to break the waves from the open ocean that enter Marblehead Harbor. This is intended to protect the eastern shore of the mainland and western shore of the Neck around Marblehead Harbor. It is anticipated that the breakwater could protect 55-percent (10 out of 18) of the Town's repetitive flood loss structures that are located around the Marblehead Harbor area...**Not Completed – Carry Forward**





## 2004 Plan Report Card

### Secondary Measures

#### *Develop a Storm Water Master Plan*

Develop and implement a town-wide Storm Water Master Plan including a storm water collection system evaluation to solve interior flood related problems. Plan and engineer the storm water collection system improvements and see the projects through the construction process. Currently there is a 5-year rolling plan effect...**Completed – Due for release in early winter**

#### *Investigate Shoreline Protection Measures at Devereux Beach*

Evaluate the effectiveness of various shoreline protection measures including but not limited to extending the existing seawall at the south western edge of the Causeway with a new 'knee wall' to the existing natural barrier located along Devereux Beach. Issue is to be studied to determine the best approach to mitigate flooding in this area...**Completed**

Horsley Witten Group



## 2004 Plan Report Card

### Secondary Measures

#### *Install Sand Fences*

Install sand fences in areas where coastal erosion exceeds 6-inches annually...**Completed**

#### *Complete the Community Hurricane Preparedness Course*

Have the Marblehead Emergency Response Team and other associated personnel complete the web-based version of FEMA's Community Hurricane Preparedness course...**Completed – Carry Forward for new municipal employees**

Horsley Witten Group



## Contact Us...

If you have general questions and/or comments about the Hazard Mitigation Plan Update, please contact:

Rebecca Curran – Town Planner  
Abbot Hall  
188 Washington Street  
Marblehead, MA 01945  
[curranr@marblehead.org](mailto:curranr@marblehead.org)  
Phone: (781) 631-0000

Thank You!

# Marblehead Hazard Mitigation Plan Update Public Workshop

## Sign in Sheet

Abbot Public Library  
235 Pleasant Street

December 5, 2012 - 7:00 PM

Name	Email Address	Phone
JAN SMITH	janpsmith@gmail.com	781-631-2651
DAVE DONAHUE	DONAHUE.D@MARBLEHEAD.ORG	781-760-0988
PAT ROBERTS	robertsp@marblehead.org	781-631-6737
Doug Gordon	gordond@marblehead.org	781-631-2721
BILL CONLY	WECONLY@COMCAST.NET	781-631-1025
Charles Cerruti	Cerruti.C@Marblehead.org	781-316-6134
WALTER O. ATTALIO	WALTERO@COMCAST.NET	781-858-7292
ART GRAVES		781-631-1750
Kathy Lunden	KLunden@comcast.net	631-1999
WILLY LANPHEAR	LANPHEAR.W@MARBLEHEAD.ORG	631-1529
Amy McHugh	McHugh.A@marblehead.org	631-0107
Margbeth Groff	margbeth.groff@massmail.state.ma.us	508-820-1435
Rebecca Curran	curranr@marblehead.org	781-631-0000
Deborah Seepel	debseep@verizon.net	
Shirley Himmelfarb	s.himmelfarb@comcast.net	
Andrew Petty	pettya@marblehead.org	781-990-3690
Don Tuttle		781-631-0196
Fred Sullivan	none	781-631-0647
Robert Vrs	rvrsb@marblehead.org	781-631-2220
Kyle Wiley	wileyk@marblehead.org	631-0000



# Memorandum of Meeting

**To:** Becky Curran, Hazard Mitigation Plan Implementation/Monitoring Team  
**CC:** Carl Simons  
**From:** Craig Pereira  
**Date:** 12/19/2012  
**Re:** Public Workshop regarding the Hazard Mitigation Plan Update

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The Horsley Witten Group conducted a Public Workshop on Wednesday December 5, 2012 in the Abbot Public Library to introduce/announce the project to the general public, provide an overview of hazard mitigation planning, discuss the existing 2004 Plan (Risk and Vulnerability Assessment, Hazard Index, Mitigation Measures, and Report Card), and to solicit comments from the general public. Approximately 20 members of the community were in attendance, including a mix of municipal officials and residents. An attendance/sign-in sheet and PowerPoint Presentation are attached. The following is a summary of the Public Workshop presentation and comments received:

- Craig Pereira (Consultant – Horsley Witten Group) opened the workshop with introductions and the Town's need for continued hazard mitigation planning. Mr. Pereira also recognized Ms. Marybeth Groff, CFM Hazard Mitigation Planner – Massachusetts Emergency Management Agency (MEMA) attendance at the meeting.
- Mr. Pereira followed with an overview of the plan update process, followed by a review of the status of the 2004 Plan action items, then concluded with recent accomplishments above and beyond what was included in the 2004 Plan by municipal department interviews conducted in late Fall.
- The following questions were received from the public following the completion of the presentation:
  - Is there a significant change in the new FEMA Flood Plain Mapping?
  - Will the plan take into consideration what the schools (shelters) need?
  - Are you aware that in addition to the closure of the Causeway (isolating residents on the Neck), that Fort Sewall also gets cut off occasionally?
  - Will you be mapping coastal shoreline erosion changes that have happened over time?
  - The Town is too complacent because they haven't experienced an event large/strong enough to really impact the community.
- Following the Q&A session, participants were provided the opportunity to mark up town-wide maps identifying specific problem areas. The following comments were included on the mapping:
  - Erosion at Fort Sewall
  - Acquisition of property of Gerry's Island
  - Sea wall along the coast at the terminus of Gingerbread Hill Road
  - Wall and fence at coast along Front Street (Franklin Street terminus)
  - Brick pavers and sea wall at Clark's Landing experiences sinkholes every year



*December 19, 2012*

- Pleasant St. and Curtis St. drainage project approved at Town Meeting 5/12
- Address small area of Causeway sea wall that still overtops in storms
- Potential for flood damage at Devereux Beach
- Tower School experiences flooding
- Recent waterfront acquisition north of Wyman Woods Conservation Area
- Wave issues along the coast east of Bass Rock

# Marblehead Hazard Mitigation Plan Update

## **Hazard Mitigation Plan Implementation/Monitoring Team Meeting**

Abbott Hall – Selectmen's Meeting Room  
188 Washington Street

January 15, 2013 – 2:00 PM

### **Agenda**

1. Overview of Public Workshop
2. Discussion – Mitigation Actions for Consideration
3. Next Steps
  - a. GIS Mapping Update
  - b. Risk Assessment/Loss Estimation
4. Next Hazard Mitigation Plan Implementation/Monitoring Meeting?
  - a. Cost/Benefit Review and Prioritization

## **Mitigation Actions for Consideration...January 15, 2013**

### **2004 Plan Status of Mitigation Actions**

#### **Priority Measures**

- Enroll in the Community Rating System – Not Completed, Carry Forward
- Develop official Town website – Completed, expand and Carry Forward
- Construct New Sea Wall at the Causeway - Completed
- Install Warning Lights at the Causeway – Carry Forward
- Install Watertight Hatches at Wastewater Pump Stations – Completed

#### **Secondary Measures**

- Advise Homeowners in the Floodplain – Completed, expand and Carry Forward
- Provide Backup Generator at Middle School – Not Completed, Carry Forward
- Locate/establish Pet Shelters – Discussion: **Town has a facility but it is not large enough. Craig Pereira to coordinate with Betsy Tufts – Animal Control Officer**
- Investigate Breakwater – Completed, Carry Forward
- Develop Stormwater Master Plan – Completed
- Investigate Shoreline Protection Measures at Devereux Beach - Completed, Carry Forward
- Install Sand Fences to remediate coastal erosion – Remove
- Complete the Hurricane Preparedness Course – Completed, Carry Forward (for new hires)

### **2004 Plan Status of Mitigation Actions**

#### **Beacon Street/Norman Street**

The Marblehead Hazard Mitigation Plan Implementation/Monitoring Team indicates that the neighborhood located on the northeast corner of the mainland and adjacent to Grace Oliver Beach has experienced significant flooding in recent memory. There is also a larger portion of this area that experiences shallow flooding during a 100-year flood in accordance with FEMA FIRMs. Flooding of structures, yards, beaches and streets occur in several locations throughout this area especially at the intersection of Norman and Beacon Streets.

#### **Front Street/Doaks Lane**

The area in the northeast coast of the mainland around Fort Sewall, including Gas House Beach and Fort Beach experiences flooding from velocity wave action, shallow flooding and/or sheet flow flooding approximately three times a year. Flooding of structures, yards, beaches and streets occur in various locations throughout this area on a yearly basis. Approximately 300 linear feet of coastline extending southward from the Fort Sewall peninsula experiences an estimated coastal erosion of 6 inches to 17 inches annually.

#### **Devereux Beach/Tucker's Beach**



Approximately 2,000 linear feet of beach, residences, and saltwater marshland extending south from the southwestern shore of the Causeway westerly to Goldthwait Road experiences “semi-frequent” flooding from velocity wave action, shallow flooding, and/or sheet flow. Flooding of structures, yards, beaches and streets of the surrounding neighborhood have occurred on many occasions. Coastal erosion estimated at 6 inches to 10 inches annually remains a concern along the Devereux Beach area. Faulty tide gates remain the recognized potential source for the inland flooding problems in this area. Past proposals for replacing the existing tide gates have been denied due to environmental concerns with the saltwater marsh and its ecosystem. It is also understood that flooding in Tucker’s beach area is exacerbated by water entering through the Marblehead harbor side through Riverhead Beach.

#### Front Street/Ferry Lane

Various public boat landings, restaurants, and commercial properties characterize this area of Marblehead’s eastern coastline located adjacent to Marblehead Harbor. The boundaries of the 100-year floodplain indicates the potential to experience significant flooding during periods of heavy storm surge and high velocity wave action. This hazard area contains public and municipal sites such as Clark Landing and Tucker’s Wharf.

#### Boston Yacht Club

The Boston Yacht Club, surrounding commercial area, and portions of Crocker Park experience significant flooding roughly once every two years from coastal storm surges with velocity wave action.

#### The Causeway

The Causeway frequently experiences significant storm surges with velocity wave action that overtops the existing seawall located at the southern shore of the roadway (ocean side), both engulfing the roadway and over-washing cobbles, requiring the roadway to be closed. Coastal erosion is also of concern on the ocean side of the Causeway in which 9 inches to 10 inches of shoreline is eroded annually – encroaching on the existing seawall, designated as a critical facility. Houses located on Marblehead Neck near the southeastern shore of the Causeway experience frequent flooding. These homes experience flooding from sheet flow as well as shallow flooding during large storm events. Flood waters have been known to flow over Ocean Avenue and into backyards of homes in this area. Coastal water also floods Flint Street and the yards of homes on Harbor Avenue.

#### Foster Street/Sean Way

This neighborhood located on the south western shore of the Neck experiences infrequent shallow flooding. Flooding of structures, yards, beaches and streets infrequently occurs in various locations throughout this area.

#### Sargent Road/Ocean Avenue

The southernmost tip of Marblehead Neck experiences flooding from velocity wave action and sheet flow flooding approximately once every ten years. The Marblehead Hazard Mitigation Plan Implementation/Monitoring Team indicates significant flooding in this area has occurred three to four times since 1972. Flooding of residential structures, yards and streets is

experienced over a large area on Ocean Street and to the south of Ocean Street. Typically, water entering this area from the ocean surge collects in the low lying area near Sargent Road. Coastal erosion estimated at 10 inches of coastline annually is also a concern.

## **Municipal Interviews**

### Water/Sewer Dept.

- Town-wide GIS integration

### Town Administrator

- Town-wide GIS integration

### Police Dept.

- SOP's in place, but local knowledge trumps...should be written
- Utility coordination could be improved...gas lines off the coast – what if situations?  
**Police/Fire recently attended a seminar with Natural Gas provider...Craig Pereira to contact Police/fire.**

### Engineering/Conservation

- Expand Town's website with new FEMA flood map information
  - FEMA's Home Builder's Guide to Coastal Construction (FEMA Pub. #499)
  - FEMA's Coastal Construction Manual (FEMA Pub. #55CD, 3<sup>rd</sup> edition)
  - Association of State Floodplain Managers No Adverse Impact – Coastal Land Management Guidelines
- Devereux Beach parking/pavilion subject to flooding
- Protocol for new subdivision applications to include parameters to improve periodic update of GIS parcel dataset

### Fire/Emergency Management

- CEMP needs updating
- COOP should be developed
- Carry forward 'Installation of Warning Lights at the Causeway' priority mitigation measure
- Carry forward 'Purchase/install backup generator at Middle School' secondary mitigation measure
- Discussion... 'Locate/establish pet shelters to house displaced pets during disaster' secondary mitigation measure
- Carry forward 'Community Hurricane Preparedness Course' for new hires, secondary mitigation measure
- Town-wide GIS integration

### Tax Assessor

- Town-wide GIS integration

### Harbormaster

- SOP's for gas lines off the coast
- Town-wide GIS integration

### Building Commissioner

- Town-wide GIS integration

### Tree Warden

- No codified 'tree maintenance/trimming program'...as needed, should follow evacuation routes as priority
- Debris Management Plan could be useful
- MOU's in place for crane/logging truck could be useful

## **Public Workshop**

### Beacon St/Norman St. High Hazard Area

- Acquisition of Gerry Island? **Talk that it is being developed, also in high hazard area.**

### Front St./Doaks Lane

- Erosion at Fort Sewall
- Wall and fence Front St. (between Franklin St. and Doaks Lane) **Barnacle to Fort Sewall, there are better ways to protect.**
- Brick pavers/Sea wall/Sink holes at Clarks Landing

### Devereux Beach/Tucker's Beach

- Potential flood damage Devereux Beach
- Small area of Causeway still overtops

### Other

- Recent waterfront acquisition north of Wyman Woods Conservation Area? **Lead Mills, recent open space acquisition.**
- Wave issues along the coast east of Bass Rock **coast is hard-armored here, sea wall is in disrepair, with 2 major failures. 9-foot concrete wall recently repaired.**
- Tower School experiences flooding **water table is rising**

**Harbor Management Plan** **discussed that these should be folded into the Hazard Mitigation Plan, identified as high priority/public infrastructure.**



### Barnegat Landing

The Barnegat Landing facility is a public launching ramp, with two adjacent sea walls. The sea wall to the south is comprised of a mortared stone wall built from granite curbing and measures 55 feet long (observed to be in fair condition, with missing mortar and dislodged cap stones). A small park is located behind this sea wall. The sea wall to the north is 70 feet long and is comprised of a cast in place concrete wall. Parking is provided behind this wall. The concrete ramp is approximately 13 feet wide and extends seaward to a depth of 1.5 feet at mean low water (observed to have eroded, worn surface with cracks in the approach). Recommended repairs and improvements include the rehabilitation of the granite curb sea wall and reconstruction and possible widening of the concrete ramp.

Opinion of probable cost estimate: \$800,000

### Philip Clark Wharf (State Street South)

The State Street South facility is comprised of a 90 foot long stone sea wall and a 25 foot by 22 foot timber pier (observed to be in overall good to fair condition, with subsidence behind the wall and reported to be troublesome during periods of extreme high tide). The facility is provided with a 16 foot wide by 44 foot long timber float, accessible via a 40 foot long timber gangway (observed to be in overall fair to poor condition, with deterioration of the timber decking, stringers, and pile caps, corrosion of the fasteners, and loss of pile section). The float is anchored with chains connected to 5 concrete moorings. Recommended repairs and improvements include the rehabilitation of the timber pier and gangway, and rehabilitation of the stone sea wall.

Opinion of probable cost estimate: \$270,000

### Commercial Street Landing (State Street North)

The Commercial Street Landing facility is comprised of a 70 foot long granite block sea wall with mortar in the upper joints (observed to be in fair condition, with apparent stone movement and loss of chinking stones). The facility is provided with year round concrete floats measuring approximately 16 by 40 feet and 8 by 40 feet (observed to be in fair to good condition with obvious signs of wear). The floats are anchored with concrete mooring blocks and chains and are accessed via a newer 40 foot long aluminum gangway, with an associated steel A-frame for retrieval. The facility is currently used by commercial fishermen. Recommended repairs and improvements include the rehabilitation of the existing stone wall and the replacement of the concrete floats.

Opinion of probable cost estimate: \$300,000

### Cliff Street Boatyard

The Cliff Street Boatyard facility is comprised of an approximately 305 foot long granite stone filled pier structure presently leased by the Town to the Marblehead Trading Company. The granite block wall is a dry lain structure with a granite block cap (observed to be in fair condition,

with sinkholes and subsidence behind the wall and open joints at the east end). A 40 foot long rip rap revetment is located beneath the timber of the Marblehead Yacht Club (observed to be in fair condition, with subsidence behind the revetment). An adjacent 95 foot long dry set rubble stone wall and stone revetment is located north of the Yacht Club. Recommended repairs and improvements include the rehabilitation of the existing stone wall and revetment under the Yacht Club.

Opinion of probable cost estimate: \$800,000

## Telephone Conversations

### Bill Conley

- Carry forward 'Investigate Breakwater' mitigation secondary measure
- Devereux Beach - extend sea wall (shorter cap wall land side) to the parking area to remediate parking lot and pavilion flooding

## Additional Considerations

- Planning and Prevention
- Property Protection
- Natural Resource Protection
- Structural Projects
- Emergency Services
- Public Education and Awareness

## PLANNING AND PREVENTION

### Volunteer Disaster Resistance Program

Work with Federal/State agencies, partner organizations, and the Town to educate municipal officials, residents and businesses about projected sea level rise/climate change impacts and potential management solutions.

### Volunteer Disaster Assistance Officer

Volunteers working at the community level, or even at the neighborhood level, can be a tremendous asset to hazard mitigation efforts before, during, and after a natural hazard event. A community member acting as a Volunteer Disaster Assistance Officer (under the Civilian Emergency Response Team (CERT) could coordinate community mitigation activities, act as a local hazard information resource, and offer assistance to residents not able to help themselves. In preparation for an impending disaster, volunteers can help residents prepare their homes and facilitate evacuations if necessary. After a disaster, qualified volunteers could provide an initial damage report to Town officials and aid resident clean-up efforts. These volunteers could be associated with neighborhood watch groups, or neighborhood preservation groups.

The Town will consider providing the framework under which this position (s) would be created, limited funding, and a weekend-long training session consistent with the existing emergency management operations within the Town. The training session should include discussion of liability issues, hazard mitigation techniques that homeowners can perform, a description of how

the Town would operate during and after an emergency, and other information deemed necessary.

#### Public Information, Outreach and Incentive Program

The Town will provide information to contractors and homeowners on risks of building in hazard-prone areas and inform builders and homeowners of the benefits of building and renovating structures to current standards. The Town will use FEMA's *Home Builder's Guide to Coastal Construction* (Publication #499), FEMA's *Coastal Construction Manual* (Publication #55CD Third Edition), *No Adverse Impact (NAI) Coastal Land Management Guidelines* developed by the Association of State Floodplain Managers, and other FEMA publications, as applicable.

#### GIS Integration Citywide

Update and integrate GIS capabilities throughout Town departments for use in emergency situations. Accurate GIS data can assist various Town departments with response actions such as street closings, rerouting of traffic, water main breaks, sewer system backups, flooding, etc.

#### GIS Software/Program Upgrades

#### Recovery and Reconstruction Ordinance

The Town should utilize the opportunity of a disaster to improve its' disaster resilience. Once critical life and safety issues and vital public services have been addressed and re-established, emphasis should be placed on the long-term recovery of the community, balancing the need to rebuild rapidly and return to normal against the objective of building back better and stronger.

Collaboration on a Regional Recovery and Reconstruction Ordinance could identify/facilitate resource and cost-sharing opportunities, as well as higher utilization of municipal services to those areas within the region most in need.

#### Low-Impact Development identified in the new stormwater regulations

Encourage the incorporation of Low-Impact Development (LID) techniques in local subdivision regulations and site/neighborhood development plans.

#### Debris Management Plan

The Town will develop a plan for collecting and disposing of debris after a storm event. Locations where debris can be collected will be determined with different locations for potentially hazardous debris, such as propane tanks, made separate. A list of hazardous material handlers regulated by the EPA can be found at <http://www.epa.gov/enviro/html/em/index/html>. The Town should actively seek an agreement with one or more such vendors in order to ensure a timely response at a reasonable price.

#### Develop Shoreline Management Plan

#### Develop Overwash/Sand/Rubble Removal Plan

### **PROPERTY PROTECTION**

#### Open Space Acquisition

Maintaining and securing land as open space in flood zones is one way to keep the number of people and homes vulnerable to severe storms and flooding from expanding. The Town will continue to take steps to protect land in flood zones. As a priority list of properties targeted for



open space acquisition will be developed, hazard mitigation of flood-prone areas, will be an important part of the prioritization process. Attention will also be given to providing public access and habitat protection.

#### Industries in the Floodplain

Flood proof existing structures in the floodplain. As required by NFIP standards, after flooding or storm surge damage or a major renovation that is more than 50 percent of a structure's market value, it is necessary to bring the structure up to current code.

#### Develop Retrofit (Dry/Wet Floodproof, Elevation) Program

#### Building Code Compliance Enforcement

The Building Commissioner/Zoning Compliance Officer will continue to enforce regulations regarding wind resistance, flood mitigation, and earthquake resistance. Information regarding natural hazard vulnerability will be provided to potential homeowners and considered as building permits are reviewed.

#### Business Continuation

The Police Department in coordination with the Chamber of Commerce will develop strategies to help local businesses in flood prone areas recover from the effects of a natural disaster. These strategies will include organizing business owners for collective clean-up of their properties after a disaster and the creation of a list of businesses and the people connected with those businesses that are authorized to enter the businesses in the period of time immediately following a disaster. This list would be used by the Police Dept. in their role of guarding properties after a disaster. The Police Dept. will develop criteria for determining when safety considerations outweigh the rights of a given business owner to access their property.

#### Historic Structures

Periodically inspect and evaluate historic structures for code compliance. Consider developing a GIS 'Historic Resources' data layer which maps existing resources.

#### School Vulnerability

Periodically inspect and evaluate school buildings for code compliance as well as their vulnerability to damage from natural hazard events. Important school records will be stored in a manner to protect them from damage.

#### Ensuring the Safety of Elderly Housing and Public Housing

Natural hazards occurring on a town wide basis are a threat to all elderly housing and public housing facilities in the Town. The Building Official will provide assistance towards self-assessment of these structures as to their vulnerability to hazards affecting the community. Retrofitting will be recommended and/or conducted as necessary.

#### Elderly and Special Needs Residents

The Housing Authority will continue to update/maintain a list of elderly and special needs residents living independently in the Town, and coordinate with the Police Department. The list will be divided by evacuation area and susceptibility to hazards, in the event an evacuation is necessary.

### **NATURAL RESOURCE PROTECTION**

#### Contain Hazardous Materials

Property owners will be contacted and these businesses will be requested to develop plans that ensure the containment of hazardous materials in the event of a severe storm or hurricane. Special attention will be paid to underground storage tanks that could float or rupture in the event of flooding.

#### Preservation of Water Supply Reservoirs and their Watersheds

#### Uninterrupted Municipal Water Supply

### **STRUCTURAL PROJECTS**

#### Localized Flooding of Roadways

There are various areas in the Town that experience repetitive flooding and road washout during heavy rains. A preliminary town wide inventory of streets subject to repetitive flooding and washout should be developed and an Engineering/Planning Study should be performed to catalog all the streets subject to flooding/washout town wide, and should include the identification of drainage improvements to alleviate flooding/washout and maintain roadways passable in the event of flooding.

#### Bridge Inspection Town **doTown owns Village Street Bridge...talk to Chuck Cerruti**

All Town bridges will be inspected for structural integrity to determine their individual vulnerability to damage in the event of flood or earthquake. Bridges will be retrofitted as needed. A schedule of inspection will be developed to ensure that all bridges are maintained at a high level of safety.

#### Emergency Procedure for Gas/Electrical Lines Running on Bridges **don't have any**

Secure gas pipes and electric wiring with collars along low-lying bridges.

#### Emergency Procedure for Water Lines Running on Bridges **don't have any**

#### Elevate Low-Lying Bridges/Culverts **don't have any**

In addition to protecting utility infrastructure, elevating low-lying bridges/culverts ensures that evacuation routes are preserved during serious flooding caused by a hurricane or other storm event.

### **EMERGENCY SERVICES**

#### Maintain Viable Evacuation Routes

As part of the Town's tree maintenance program, priority will be placed on trimming and maintaining the health of trees identified as running along evacuation routes and roads offering a single point of access to flood prone neighborhoods.

#### Publish Evacuation Routes

Contact the local phone company in regards to putting the Marblehead Evacuation Routes Map, including emergency shelter locations, in the Community Section of the local phone book.

#### Coordinate Evacuation Plans with Neighboring Municipalities

The Police Department will work with neighboring communities to coordinate evacuation plans.

#### Mass Care Facility Equipment

Make sure emergency shelters have a source of emergency power (portable generators).

#### Tourist Evacuation and Shelter

Out of state tourists may not be familiar with local authorities, evacuation routes, locations of designated shelters, or know what to expect if police-enforced evacuation becomes necessary. The Police Department will distribute information on town evacuation routes and emergency shelters to hotels, Bed and breakfasts, real estate agencies dealing with seasonal rentals, and other facilities and events hosting tourists.

### **PUBLIC EDUCATION AND AWARENESS**

#### Information Brochure

Property owners will be informed of their natural hazard vulnerabilities: this information will be passed on to renters as well. In addition, these brochures will encourage residents and businesses in vulnerable areas to develop emergency action plans and to assess the ability of their structure to withstand flooding, high winds, and earthquakes. Instructions for self-assessment of structure vulnerabilities will be included. Techniques homeowners can utilize on their properties for long-term hazard mitigation and for protection from impending storms will be compiled and distributed to properties located in vulnerable areas, and will include a detail of town evacuation routes and shelters. The brochure will also be distributed to area builders and contractors.



## Sign in Sheet

January 15, 2013 - 2:00 PM

Phone

631-0000

781-631-0000

781-631-0102

781-631-0102

781-631-1529

781 316 6134



# Memorandum of Meeting

**To:** Becky Curran, Hazard Mitigation Plan Implementation/Monitoring Team  
**CC:** Carl Simons  
**From:** Craig Pereira  
**Date:** 2/7/2013  
**Re:** Hazard Mitigation Plan Implementation/Monitoring Team Meeting No. 2

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**In attendance:**

Rebecca Curran  
Jeff Chelgren  
Amy McHugh  
Charles McCollum  
Willy Lanphear  
Chuck Cerruti  
Craig Pereira

A meeting was held on January 15, 2013 at Marblehead Town Hall to review the December 5, 2012 Public Workshop, mitigation actions for consideration, and next steps. A copy of the Mitigation Actions for Consideration is attached. The following items were discussed:

- Craig Pereira reviewed the meeting minutes from the December 5, 2012 Public Workshop. Team members clarified some of the comments received, including:
  - Acquisition of Gerry's Island – this is a high hazard area and there is talk of it being developed
  - Wall and fence at coast along Front St. (Franklin St. terminus) – Barnacle to Fort Sewall
  - Recent waterfront acquisition north of Wyman Woods Conservation Area – Lead Mills, recent open space acquisition
  - Wave issues along the coast east of Bass Rock – coast is hard-armored here, sea wall is in disrepair, with 2 major failures. 9-foot concrete wall recently repaired.
- Mr. Pereira discussed the Mitigation Measures for Consideration developed from the 2004 Plan, municipal interviews, Public Workshop, exiting plans/studies/reports (Harbor Management Plan), Telephone conversations, and additional considerations to create a comprehensive listing as part of the newly-organized Mitigation Categories (Planning and Prevention, Property Protection, Natural Resource Protection, Structural Projects, Emergency Services, and Public Education and Awareness). See separate attachment for discussion points under each section.
- Mr. Pereira discussed the next steps which include GIS mapping update and completion of the Risk Assessment and Loss Estimation. Becky Curran provided CD of hazard mitigation files/GIS shapefiles/project files.

# Marblehead Hazard Mitigation Plan Update

## **Hazard Mitigation Plan Implementation/Monitoring Team Meeting**

Abbott Hall – Selectmen’s Meeting Room  
188 Washington Street

March 12, 2013 – 3:00 PM

### **Agenda**

1. Overview of Mitigation Actions
2. Discussion – Draft Mitigation Actions
3. Prioritization Ranking
4. Next Steps
  - a. Finish GIS Mapping
  - b. Coordinate with remaining outstanding municipal personnel
  - c. Wrap up draft Update (anticipate month of May for public comment period)
5. Conduct individual discussions with members regarding outstanding information needs



## Mitigation Action Plan

- Planning and Prevention
- Property Protection
- Natural Resource Protection
- Structural Projects
- Emergency Services
- Public Education and Awareness

The time frames used for this strategy are as follows:

- Short Term = 0 to 6 Months
- Medium Term = 6 to 18 Months
- Long Term = 18 Months to 5 Years

### STAPLEE Criteria

1. **Social:** Is the action compatible with present and future local community needs and values?
2. **Technical:** Is the action feasible with available local resources (or as supplement by outside resources as necessary)?
3. **Administrative:** Does the community have the administrative capacity to implement the action?
4. **Political:** Is there strong public support to implement and maintain the action?
5. **Legal:** Does the community have the legal authority to implement the action?
6. **Economic:** Is the action cost-effective?
7. **Environmental:** Does the action impact environmental resources, and is the impact positive, negative, or neutral?

## PLANNING AND PREVENTION

### Volunteer Disaster Resistance Program

Work with Federal/State agencies, partner organizations, and the Town to educate municipal officials, residents and businesses about projected sea level rise/climate change impacts and potential management solutions.

- Priority Score -
- Lead – Marblehead EMA
- Supporting – MEMA, FEMA, CZM
- Financing Options – Town budget, grants
- Cost – Staff time or dependent upon level of training
- Time Frame – Short to medium term
- Benefit – Reduced vulnerability to impacts

### Volunteer Disaster Assistance Officer

Volunteers working at the community level, or even at the neighborhood level, can be a tremendous asset to hazard mitigation efforts before, during, and after a natural hazard event. A community member acting as a Volunteer Disaster Assistance Officer (under the Civilian

Emergency Response Team (CERT) could coordinate community mitigation activities, act as a local hazard information resource, and offer assistance to residents not able to help themselves. In preparation for an impending disaster, volunteers can help residents prepare their homes and facilitate evacuations if necessary. After a disaster, qualified volunteers could provide an initial damage report to Town officials and aid resident clean-up efforts. These volunteers could be associated with neighborhood watch groups, or neighborhood preservation groups.

The Town will consider providing the framework under which this position (s) would be created, limited funding, and a weekend-long training session consistent with the existing emergency management operations within the Town. The training session should include discussion of liability issues, hazard mitigation techniques that homeowners can perform, a description of how the Town would operate during and after an emergency, and other information deemed necessary.

- Priority Score -
- Lead – Marblehead EMA
- Supporting – MEMA, FEMA
- Financing Options – Town budget, grants
- Cost – Staff time
- Time Frame – Short term
- Benefit – Accelerated, more predictable recovery period

#### Continuity of Operations Plan

Develop a Continuity of Operations Plan (COOP) to ensure the Town's operational capability in the wake of an emergency that affects a substantial segment of municipal staff.

- Priority Score -
- Lead – Marblehead EMA
- Supporting – MEMA, FEMA
- Financing Options – N/A
- Cost – Staff time
- Time Frame – Short term
- Benefit – Continuity of municipal services

#### Public Information, Outreach and Incentive Program

The Town will provide information to contractors and homeowners on risks of building in hazard-prone areas and inform builders and homeowners of the benefits of building and renovating structures to current standards. The Town will use FEMA's *Home Builder's Guide to Coastal Construction* (Publication #499), FEMA's *Coastal Construction Manual* (Publication #55CD Third Edition), *No Adverse Impact (NAI) Coastal Land Management Guidelines* developed by the Association of State Floodplain Managers, and other FEMA publications, as applicable.

- Priority Score -
- Lead – Building Commissioner
- Supporting – MEMA
- Financing Options – Private land owners
- Cost – Staff time
- Time Frame – Short term (following a disaster)
- Benefit – Protection of property and increased safety for residents

### GIS Integration Town-wide

Update and integrate GIS capabilities throughout Town departments for use in emergency situations, as well as for daily use by municipal personnel. Accurate GIS data can assist various Town departments with response actions such as street closings, re-routing of traffic, water main breaks, sewer system backups, flooding, etc.

- Priority Score -
- Lead – Water/Sewer Superintendent
- Supporting – MEMA
- Financing Options – MEMA, FEMA, Town Budget
- Cost – Staff time
- Time Frame – Medium term
- Benefit – Enhanced public safety; consistency/flexibility in response actions

### GIS Software/Program Upgrades

To facilitate full GIS integration Town-wide, the Town should elevate to an ArcGIS Enterprise level. In addition, the Town is presently using ArcGIS Work Group standard. The Town's ArcGIS Server is currently running ArcGIS 9.3 and is migrating to ArcGIS 10.0. An ArcGIS suite of software upgrades and additional seats of Arcview, both desktop and runtime licenses, ArcInfo and ArcEditor, would facilitate a greater interdepartmental use, mobile deployment and periodic update and maintenance of the Town's GIS data.

- Priority Score - Lead – Water/Sewer Superintendent
- Supporting – MEMA
- Financing Options – MEMA, FEMA, Town Budget
- Cost – \_\_\_\_\_
- Time Frame – Medium term
- Benefit – Elevating to an ArcGIS Enterprise level will greatly enhance the Town's capabilities and will provide a more comprehensive platform for delivering GIS applications that are centrally managed and support multiple users throughout the various departments within town government. Some of the applications on the ArcGIS server will pertain to mapping and maintaining data for emergency management, utility maintenance, parcels, stormwater outfalls, etc. Upgrades to the existing software will help the Town to stay with the current software release and take advantage of new mapping applications and the functionality in the software.

### Recovery and Reconstruction Bylaw

The Town should utilize the opportunity of a disaster to improve its' disaster resilience. Once critical life and safety issues and vital public services have been addressed and re-established, emphasis should be placed on the long-term recovery of the community, balancing the need to rebuild rapidly and return to normal against the objective of building back better and stronger.

Collaboration on a Regional Recovery and Reconstruction Bylaw could identify/facilitate resource and cost-sharing opportunities, as well as higher utilization of municipal services to those areas within the region most in need.

- Priority Score -
- Lead – Planning Department



- Supporting – Building Commissioner
- Financing Options – Town budget, grants
- Cost – Staff time/\$20,000 consultant fees
- Time Frame – Short to medium term
- Benefit – Minimization to future impacts

#### Low-Impact Development

Continue to encourage the incorporation of Low-Impact Development (LID) techniques, as identified in the Town's *Stormwater Management and Erosion Control Regulations*, into local subdivision and site/neighborhood development plans.

- Priority Score -
- Lead – Planning Department
- Supporting – Building Commissioner
- Financing Options – N/A
- Cost – Staff time
- Time Frame – Short to medium term
- Benefit – Improved CSO capacity; protection of water supply

#### Debris Management Plan

The Town will develop a plan update for collecting and disposing of debris after a storm event. Locations where debris can be collected will be determined with different locations for potentially hazardous debris, such as propane tanks, made separate. A list of hazardous material handlers regulated by the EPA can be found at <http://www.epa.gov/enviro/html/em/index/html>. The Town should actively seek an agreement with one or more such vendors in order to ensure a timely response at a reasonable price.

Collaboration on a Regional Debris Management Plan could identify/facilitate resource and cost-sharing opportunities, as well as higher utilization of municipal services to those areas within the region most in need.

- Priority Score -
- Lead – Marblehead EMA
- Supporting – Marblehead Police/Fire/DPW
- Financing Options – Town budget, grants
- Cost – Staff time
- Time Frame – Short to medium term
- Benefit – Accelerated, more predictable recovery period

#### Develop Shoreline Management Plan

Develop a management plan for Marblehead's coastal areas that includes the following objectives improves understanding of coastal processes; predicts the likely future evolution of the coast; identifies all the assets within the area covered by the plan likely to be affected by coastal change; identifies the need for regional or site specific research and investigations; and, identifies the various policies/procedures for hazard mitigation remediation projects.

Collaboration on a Regional Shoreline Management Plan could identify/facilitate resource and cost-sharing opportunities, as well as higher utilization of municipal services to those areas within the region most in need.

- Priority Score -
- Lead – Planning Department
- Supporting – CZM, MADCR, regional planning agency
- Financing Options – Town budget, grants, private homeowner's associations
- Cost – Staff time/\$50,000 consultant fees
- Time Frame – Medium term
- Benefit – Accelerated response, more predictable recovery period

#### Develop Overwash/Sand/Rubble Removal Plan

Remove only that overwash that is necessary to allow for entrance/access and use of houses/structures. Sand/rubble that has been deemed necessary to remove should be stored in a protected place for debris removal, evaluation and later deposition.

- Priority Score -
- Lead – Highway Department/DPW
- Supporting – CZM, MADCR, MassDOT/Highway, Marblehead EMA
- Financing Options – Town budget, grants
- Cost – Staff time/man hours per event
- Time Frame – Short term
- Benefit – Minimized contamination of materials

## **PROPERTY PROTECTION**

#### Enroll in the Community Rating System (CRS)

Fulfill the requirements of the National Flood Insurance Program (NFIP) to join the CRS. In addition to assisting in developing future mitigation activities, this could allow the Town and residents to qualify for discounts on flood insurance rate premiums.

- Priority Score -
- Lead – Engineering/Planning Department
- Supporting – Building Commissioner
- Financing Options – Town budget, grants
- Cost – Staff time/varies dependent upon property acquisition
- Time Frame – Medium to long term
- Benefit – Minimization of economic losses

#### Open Space Acquisition

Maintaining and securing land as open space in flood zones is one way to keep the number of people and homes vulnerable to severe storms and flooding from expanding. The Town will continue to take steps to protect land in flood zones maintaining a priority list of properties targeted for open space acquisition. Attention will also be given to providing public access and habitat protection.

- Priority Score -
- Lead – Planning Department
- Supporting – Building Commissioner
- Financing Options – Town budget, grants, FEMA, MADCR

- Cost – Staff time/varies dependent upon property acquisition
- Time Frame – Long term
- Benefit – Minimization of impacts from flooding

#### Non-residential structures in the Floodplain

Flood proof existing structures in the floodplain. As required by NFIP standards, after flooding or storm surge damage or a major renovation that is more than 50 percent of a structure's market value, it is necessary to bring the structure up to current code.

- Priority Score -
- Lead – Planning Department
- Supporting – Building Commissioner
- Financing Options – private land owners, MEMA, FEMA
- Cost – Dependent upon approach
- Time Frame – Short term (following a disaster)
- Benefit – Protection of property and increased safety for facility residents. Future economic disruptions are minimized if business is not affected by facility damage.

#### Develop Retrofit (Dry/Wet Floodproof, Elevation) Program

Promote and support enforcement of the latest policy revisions relative to climate change and sea level rise within Massachusetts.

Structures in the floodplain should be elevated to the 100-year base flood elevation, as well as incorporating an additional 3 to 5 foot freeboard, to accommodate projected sea level rise impacts. The Town will make available the following FEMA manuals that reference coastal construction practices for homeowners and contractors: *Home Builder's Guide to Coastal Construction* (Publication #499) and *Coastal Construction Manual* (Publication #55CD Third Edition).

Consider developing public/private partnership incentives to implement mitigation measures in coordination with local, state, and federal funding opportunities. Incentives could include tax incentives, cost sharing, and regulatory streamlining or acceleration of the permit process for those who implement mitigation activities.

- Priority Score -
- Lead – Building Commissioner
- Supporting – MEMA
- Financing Options – Private land owners, MEMA, FEMA, MADCR
- Cost – Dependent upon approach
- Time Frame – Short term (following a disaster)
- Benefit – Protection of property and increased safety for residents. Future economic disruptions are minimized if business is not affected by damage.

#### Building Code Compliance Enforcement

The Building Commissioner will continue to enforce regulations regarding wind resistance, flood mitigation, and earthquake resistance. Information regarding natural hazard vulnerability will be provided to potential homeowners and considered as building permits are reviewed.

- Priority Score -
- Lead – Building Commissioner



- Supporting – MEMA
- Financing Options – Private land owners, FEMA, MADCR
- Cost – Staff time
- Time Frame – Short term (following a disaster)
- Benefit – Protection of property and increased safety for residents. Future economic disruptions are minimized if business is not affected by damage.

#### Business Continuation

The Police Department in coordination with the Chamber of Commerce will develop strategies to help local businesses in flood prone areas recover from the effects of a natural disaster. These strategies will include organizing business owners for collective clean-up of their properties after a disaster and the creation of a list of businesses and the people connected with those businesses that are authorized to enter the businesses in the period of time immediately following a disaster. This list would be used by the Police Dept. in their role of guarding properties after a disaster. The Police Dept. will develop criteria for determining when safety considerations outweigh the rights of a given business owner to access their property.

- Priority Score -
- Lead – Marblehead Police Department
- Supporting – Chamber of Commerce, Marblehead EMA
- Financing Options – N/A
- Cost – Staff time
- Time Frame – Short term
- Benefit – Accelerated, more predictable recovery period.

#### Historic Structures

Periodically inspect and evaluate historic structures for code compliance. Consider developing a GIS 'Historic Resources' data layer which maps existing resources.

- Priority Score -
- Lead – Planning Department
- Supporting – Historical Commission
- Financing Options – MEMA, MA Historic District Commission, FEMA
- Cost – Staff time
- Time Frame – Short term
- Benefit – Preservation of the history and culture of Marblehead.

#### School Vulnerability

Periodically inspect and evaluate school buildings for code compliance as well as their vulnerability to damage from natural hazard events. Important school records will be stored in a manner to protect them from damage.

- Priority Score -
- Lead – Building Commissioner
- Supporting – Marblehead School Department
- Financing Options – Marblehead School Department budget, CIP
- Cost – Staff time
- Time Frame – Medium to long term

- Benefit – Ensure the safety of students, teachers, and school employees. Protection of facilities and assets. Ensure the availability of mass care/evacuation facilities.

#### Ensuring the Safety of Elderly Housing and Public Housing

Natural hazards occurring on a town-wide basis are a threat to all elderly housing and public housing facilities in the Town. The Building Commissioner will provide assistance towards self-assessment of these structures as to their vulnerability to hazards affecting the community. Retrofitting will be recommended and/or conducted as necessary.

- Priority Score -
- Lead – Council on Aging
- Supporting – Building Commissioner
- Financing Options – Grants
- Cost – varies, dependent upon remediation measure
- Time Frame – Short to medium term
- Benefit – Reduce/eliminate damage costs associated with flooding or high winds. Reduce fire risks. Ensure the safety of housing residents.

#### Elderly and Special Needs Residents

The Council on Aging will continue to update/maintain a list of elderly and special needs residents living independently in the Town, and coordinate with the Police Department. The list will be divided by evacuation area and susceptibility to hazards, in the event an evacuation is necessary.

- Priority Score -
- Lead – Council on Aging
- Supporting – Building Commissioner
- Financing Options – N/A
- Cost – Staff time
- Time Frame – Short term
- Benefit – Predictable, safe evacuation process.

### **NATURAL RESOURCE PROTECTION**

#### Contain Hazardous Materials

Property owners will be contacted and these businesses will be requested to develop plans that ensure the containment of hazardous materials in the event of a severe storm or hurricane. Special attention will be paid to underground storage tanks that could float or rupture in the event of flooding.

- Priority Score -
- Lead – Marblehead Fire Department
- Supporting – Marblehead EMA
- Financing Options – N/A
- Cost – Staff time
- Time Frame – Short to medium term
- Benefit – Minimized contamination from hazardous materials

#### Preservation of Water Supply Reservoirs and their Watersheds

The Office of Watershed Management within the Division of Water Supply Protection of the Department of Conservation and Recreation, is charged with protection of the Quabbin Reservoir, Ware River, Wachusett Reservoir, and Sudbury Reservoir watersheds, more specifically, “to construct, maintain and operate a system of watersheds, reservoirs, water rights and rights in source of water supply [to] supply thereby a sufficient supply of pure water to the Massachusetts Water Resources Authority, and [to] utilize and conserve said water and other natural resources to protect, preserve and enhance the environment of the Commonwealth and to assure the availability of pure water for future generations.”<sup>1</sup>

- Priority Score -
- Lead – MWRA
- Supporting – Water and Sewer Department
- Financing Options – Water and sewer revenue
- Cost – varies, dependent upon property acquisition
- Time Frame – Long term
- Benefit – Protection of water supply/lifeline

#### Uninterrupted Municipal Water Supply

Marblehead is able to operate for a short duration with the supply held in 2 water tanks. Hard pipe connections exist between Lynn and Swampscott, and existing underwritten agreements between these fellow MWRA Communities, already provide for emergency water supply from these connections. The Water and Sewer Department should purchase an emergency pump to ensure water flow in the system from Beverly/Salem Water District to Marblehead, in the event of an emergency. At a minimum, the Water and Sewer Department should initiate a redundant emergency contract with a local supplier to ensure the availability of equipment as needed. MWRA has an unwritten agreement for the use of two portable pump units to member communities. Consideration of rejuvenating the existing wells could be studied. The Water and Sewer Department should evaluate the need for replacement of the Village Street Tank (riveted steel tank constructed in 1924), which would increase the life of tank storage availability and increase ability to maintain Town’s minimum pressure, during times of interrupted service.

- Priority Score -
- Lead – Water and Sewer Department
- Supporting – MWRA
- Financing Options – Water and Sewer revenue
- Cost –
  - Emergency Pump: \$10,000
  - Emergency contract for pumping equipment: no up- front costs
  - Village St. tank replacement cost: \$2.9 million
  - Rejuvenation of existing wells study: \$300,000
- Time Frame – Long term
- Benefit – Maintenance of essential services

#### Uninterrupted Wastewater Collection

The Marblehead Sewer Department has an aggressive I / I program and has seen improvement in capacity management as a result of this program. During events, a station can struggle due to age and design capacity. Upgrades to the following pump stations ( Sargent , Clifton,

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<sup>1</sup> Quabbin Reservoir Watershed System, Land Management Plan 2007-2017.



Liberty) would address capacity management issues. Installation of new underground stations (Wilson, Edgemere, Nahant) should be included in future capital improvement plans. SCADA installation increases the consistency of management of remote sites during times of hazardous situations, and also provides data collection to insure future management decisions are accurate and beneficial.

- Priority Score -
- Lead – Water and Sewer Department
- Supporting – SESD
- Financing Options – Water and Sewer revenue
- Cost –
  - Pump Station rehabilitation:
    - Sargent Station (structure/pumps/generator/electrical/outfall): \$1 million
    - Clifton Station (structure/pumps/generator/electrical): \$550,000
    - Liberty Station (structure/pumps/generator/electrical): \$550,000
  - Replacement of underground pump stations (Wilson, Edgemere and Nahant): \$400,000 per station
  - SCADA: \$1.6 million
- Time Frame – Long term
- Benefit – Maintenance of essential services

## **STRUCTURAL PROJECTS**

### *Install Warning Lights at the Causeway*

Install warning lights and/or signs on the Causeway to alert citizens of an impending storm, the need for evacuation of the Neck, or the closing of the Causeway.

- Priority Score -
- Lead – Marblehead EMA
- Supporting – Engineering Dept.
- Financing Options – Town budget
- Cost –
- Time Frame – Medium to long term
- Benefit – Predictable, safe evacuation process

### *Investigate Breakwater*

Re-evaluate the potential for construction of a breakwater to be located in Marblehead Harbor from near the Marblehead Lighthouse on the Neck heading westward towards the mainland. Re-address the planning level cost estimated in a similar evaluation performed by the Army Corps of Engineers in the 1960's and 1970's. The breakwater is intended to break the waves from the open ocean that enter Marblehead Harbor. This is intended to protect the eastern shore of the mainland and western shore of the Neck around Marblehead Harbor. As of the 2004 Plan, it was anticipated that the breakwater could protect 55 percent (10 out of 18) of the Town's repetitive loss structures that are located around the Marblehead Harbor area.

- Priority Score –
- Lead – Board of Selectmen
- Supporting – Engineering Dept.
- Financing Options – Town budget

- Cost –
- Time Frame – Long term
- Benefit – Minimization of future impacts

#### Investigate Shoreline Protection Measures at Devereux Beach

Re-evaluate the effectiveness of various shoreline protection measures including, but not limited to, extending the existing seawall at the southwestern edge of the Causeway with a new sea wall to the existing natural barrier located along Devereux Beach. Issue is to be studied to determine the BMP (s) to mitigate flooding of the beach pavilion and parking area.

- Priority Score -
- Lead – Engineering Department
- Supporting – Recreation, Parks and Forestry Department
- Financing Options – Town budget
- Cost –
- Time Frame – Medium to long term
- Benefit – Minimization of future impacts

#### Pleasant Street Area Drainage Improvements

Increase the inlet and conveyance capacity of the drainage system through the Pleasant Street area to reduce inland flooding of roadways, businesses, and homes. The Project includes the replacement of existing mains, rehabilitation of several underground culvert, and some sections of new storm sewer installation. The Project area includes Pleasant Street, Atlantic Avenue, Spring Street, Essex Street, Sewall Street, Evans Road, Washington Street and School Street.

- Priority Score -
- Lead – Water and Sewer Department
- Supporting – Engineering
- Financing Options – Town budget
- Cost – \$5 million
- Time Frame – Long term
- Benefit – Minimization of future impacts, maintenance of roadways as passable

#### Localized Flooding of Roadways

There are various areas in the Town that experience repetitive coastal flooding by storm surges on the exposed northern and eastern coastlines of both the Marblehead mainland and Marblehead Neck. An Engineering/Planning Study should be performed to include the identification of drainage improvements/coastal armoring (if any) could alleviate flooding/washout and maintain roadways as passable in the event of flooding

<u>Flood Hazard Area</u>	<u>Flood Prone Section</u>
Beacon St./Norman St.	Intersection of Beacon St./Norman St.
Front St./Doaks Lane	Fort Sewall Lane (along Ft. Beach), Ft. Beach Lane
Devereux/Tucker's Beach	Goldthwait Rd./Phillips St., the Causeway
Front St./Ferry Lane	Ferry Lane terminus, Front St./State St./Glover St. intersections
Boston Yacht Club	Water St., Dock Ledge Way
The Causeway	The Causeway/Harbor Ave./Ocean Ave. intersections.
Harbor/Foster/Sean Way	The Causeway/Harbor Ave./Flint St. intersections, Harbor Ave./Foster St./Sean Way intersections

Sargent Rd./Ocean Ave.      Ocean Ave./Flint St./Sargent Rd intersections

- Priority Score -
- Lead – Highway Department
- Supporting – DPW
- Financing Options – Town budget
- Cost – varies dependent upon location/remediation measure
- Time Frame – Short to medium term
- Benefit – Minimization of future impacts, maintenance of roadways as passable

There are also other various areas in the Town that experience repetitive inland flooding and road washout caused by deficiencies in the community's storm water collection system. In 2000, by vote at Town Meeting, \$4.6 million was bonded to address areas of severe flooding including installation of larger drain pipes and new outfalls, cleaning of existing drain lines, addition of increased inlet capacity, and redirection of flows to increase capacity, and should include the identification of drainage improvements to alleviate flooding/washout and maintain roadways passable in the event of flooding.

The Pleasant Street Drainage Project (approved at Town Meeting in June 2012) is in preliminary design and construction plans/specifications for Phase I are due out in early 2013, with a late spring 2013 construction start anticipated, and includes improvement projects/remediation measures for the following roadways:

- Green St.
- Evans Rd./Roosevelt St.
- School St.
- Sewall St.
- Pleasant St.
- Atlantic Avenue

#### Marblehead Harbor Public Infrastructure Projects

Presently, there is the anticipated heavy demand on public boat ramps/landings and other associated facilities in response to a projected hurricane or other severe event. Municipal costs for maintaining the Marblehead Harbor and Water facilities, floats, equipment, boats, staff and services are met through harbor-generated revenues, including permit fees and excise tax returns on private vessels. The Town's *Harbor Management Plan* has identified the following major issue (high priority) items recommended for improvement:

#### *Barnegat Landing*

Recommended repairs and improvements include the rehabilitation of the granite curb sea wall and reconstruction and possible widening of the concrete ramp.

- Priority Score -
- Lead – Harbormaster, Harbors and Waters Board
- Supporting – Recreation, Parks and Forestry Department
- Financing Options – permit fees, excise tax on private vessels
- Cost – \$800,000 (opinion of probable cost, 2009)
- Time Frame – Long Term
- Benefit – Minimization of future impacts, improved evacuation/managed pull-out process



#### *Philip Clark Wharf (State Street South)*

Recommended repairs and improvements include the rehabilitation of the timber pier and gangway, and rehabilitation of the stone sea wall.

- Priority Score -
- Lead – Harbormaster, Harbors and Waters Board
- Supporting – Recreation, Parks and Forestry Department
- Financing Options – permit fees, excise tax on private vessels
- Cost – \$270,000 (opinion of probable cost, 2009)
- Time Frame – Long Term
- Benefit – Minimization of future impacts, improved evacuation/managed pull-out process

#### *Commercial Street Landing (State Street North)*

Recommended repairs and improvements include the rehabilitation of the existing stone wall and the replacement of the concrete floats.

- Priority Score -
- Lead – Harbormaster, Harbors and Waters Board
- Supporting – Recreation, Parks and Forestry Department
- Financing Options – permit fees, excise tax on private vessels
- Cost – \$300,000 (opinion of probable cost, 2009)
- Time Frame – Long Term
- Benefit – Minimization of future impacts, improved evacuation/managed pull-out process

#### *Cliff Street Boatyard*

Recommended repairs and improvements include the rehabilitation of the existing stone wall and revetment under the Yacht Club.

- Priority Score -
- Lead – Harbormaster, Harbors and Waters Board
- Supporting – Recreation, Parks and Forestry Department
- Financing Options – permit fees, excise tax on private vessels
- Cost – \$800,000 (opinion of probable cost, 2009)
- Time Frame – Long Term
- Benefit – Minimization of future impacts, improved evacuation/managed pull-out process

#### *Parkers Boatyard*

Recommended repairs and improvements include the rehabilitation of the stone revetment and timber gangway. Future rehabilitation will include the rehabilitation of the existing stone walls.

- Priority score –
- Lead - Harbormaster, Harbors and Waters Board
- Supporting - Recreation, Parks and Forestry Department
- Financing options - permit fees, excise tax on private vessels
- Cost - \$500,000 (opinion of probable cost 2009)
- Time Frame – within 10 years
- Benefit – Minimization of future impacts, improve evacuation/managed pull-out process

### *Fort Beach*

Recommended repairs include the rehabilitation of the stone wall, installation of toe protection, and the reconstruction of the toe revetment. Replacement of the handrail with a steel guardrail system should be considered.

- Priority score –
- Lead - Harbormaster, Harbors and Waters Board
- Supporting - Recreation, Parks and Forestry Department
- Financing options - permit fees, excise tax on private vessels
- Cost - \$790,000 (opinion of probable cost 2009)
- Time Frame – Long Term
- Benefit – Minimization of future impacts, improve evacuation/managed pull-out process

### *Grace Oliver's Beach*

Recommended repairs to the sea wall include filling of voids, repointing of the wall, and resetting the toe revetment.

- Priority score –
- Lead - Harbormaster, Harbors and Waters Board
- Supporting - Recreation, Parks and Forestry Department
- Financing options - permit fees, excise tax on private vessels
- Cost - \$100,000 (opinion of probable cost 2009)
- Time Frame – Long Term (within 10 years)
- Benefit – Minimization of future impacts, improve evacuation/managed pull-out process

## **EMERGENCY SERVICES**

### Complete the Community Hurricane Preparedness Course

Have the Marblehead Emergency Response Team and other associated personnel complete the web-based version of FEMA's Community Hurricane Preparedness Course.

- Priority Score -
- Lead – Marblehead EMA
- Supporting – Fire Department
- Financing Options – Town budget
- Cost – Staff Time
- Time Frame – applicable to new hires
- Benefit – Accelerated, more predictable recovery period

### Maintain Viable Evacuation Routes

As part of the Town's tree maintenance activities, priority will be placed on trimming and maintaining the health of trees identified as running along evacuation routes and roads offering a single point of access to flood prone neighborhoods.

- Priority Score -
- Lead – Tree Warden
- Supporting – Highway Department/DPW
- Financing Options – N/A

- Cost – staff time/municipal budget
- Time Frame – Short term
- Benefit – Maintenance of evacuation routes

#### *Publish Evacuation Routes*

Contact the local phone company in regards to putting the Marblehead Evacuation Routes Map, including emergency shelter locations, in the Community Section of the local phone book.

- Priority Score -
- Lead – Police Department
- Supporting – Marblehead EMA
- Financing Options – N/A
- Cost – staff time
- Time Frame – Short term
- Benefit – Predictable, safe evacuation process

#### *Coordinate Evacuation Plans with Neighboring Municipalities*

The Police Department will work with neighboring communities to coordinate evacuation plans.

- Priority Score -
- Lead – Police Department
- Supporting – Marblehead EMA
- Financing Options – N/A
- Cost – staff time
- Time Frame – Short term
- Benefit – Predictable, coordinated, safe evacuation process

#### *Tourist Evacuation and Shelter*

Out of state tourists may not be familiar with local authorities, evacuation routes, locations of designated shelters, or know what to expect if police-enforced evacuation becomes necessary. The Police Department will distribute information on town evacuation routes and emergency shelters to hotels, Bed and Breakfasts, real estate agencies dealing with seasonal rentals, and other facilities and events hosting tourists.

- Priority Score -
- Lead – Police Department
- Supporting – Chamber of Commerce, Marblehead EMA
- Financing Options – N/A
- Cost – Staff time
- Time Frame – Short term
- Benefit – Predictable, safe evacuation process

## **PUBLIC EDUCATION AND AWARENESS**

#### *Advise Homeowners in Floodplain*

Install a small pamphlet in the tax bills of citizens whose homes lie within the 100-year floodplain and advise them to visit the official Town website to learn more about the risks and hazards they face, as well as mitigation actions they can perform.

- Priority Score -
- Lead – Engineering Department
- Supporting – Planning Department
- Financing Options – N/A
- Cost – Staff time
- Time Frame – Short term
- Benefit – Informed public

Official Town of Marblehead Website

Expand the official Town website ([www.marblehead.org](http://www.marblehead.org)) to increase public outreach with links to mitigation activities, evacuation procedures as described in the Comprehensive Emergency Management Plan, links to FEMA 100-year floodplain maps, and other natural disaster-related links, such as hurricane preparation and FEMA's *Home Builder's Guide to Coastal Construction* (Publication #499), FEMA's *Coastal Construction Manual* (Publication #55CD Third Edition), *No Adverse Impact (NAI) Coastal Land Management Guidelines* developed by the Association of State Floodplain Managers, and other FEMA publications, as applicable.

- Priority Score -
- Lead – Engineering Department
- Supporting – Planning Department
- Financing Options – N/A
- Cost – Staff time
- Time Frame – Short term
- Benefit – Informed public



Action	VOLUNTARY DISASTER RESISTANCE PROGRAM	
Criterion:	Cost	Benefit
Social	-1	2
Technical	0	3
Administrative	0	3
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	0
Sub-total	-1	17
Total Score		
Priority 16		

Action	VOLUNTARY DISASTER ASSISTANCE PROGRAM	
Criterion:	Cost	Benefit
Social	-1	2
Technical	0	3
Administrative	0	3
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	0
Sub-total	-1	17
Total Score		
Priority 16		

Action	CONTINUITY OF OPERATIONS PLAN	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	-1	3
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	0
Sub-total	-1	18
Total Score		
Priority 17		

Simple Score (emphasizes costs and benefits)

low cost = -1

medium cost = -2

high cost = -3

N/A = 0

low benefit = 1

medium benefit = 2

high benefit = 3

N/A = 0

2

Action	PUBLIC INFORMATION, OUTREACH AND INCENTIVE PROGRAM	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	-1	3
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	3
Sub-total	-1	21
Total Score		
Priority	20	

Action	GIS INTEGRATION TOWN-WIDE	
Criterion:	Cost	Benefit
Social	-2	3
Technical	0	3
Administrative	-3	2
Political	0	3
Legal	0	3
Economic	-3	3
Environmental	0	0
Sub-total	-8	17
Total Score		
Priority	9	

Action	GIS SOFTWARE/PROGRAM UPGRADE	
Criterion:	Cost	Benefit
Social	-2	3
Technical	0	3
Administrative	-3	2
Political	0	3
Legal	0	3
Economic	-3	3
Environmental	0	0
Sub-total	-8	17
Total Score		
Priority	9	

Simple Score (emphasizes costs and benefits)

low cost = -1

medium cost = -2

high cost = -3

N/A = 0

low benefit = 1

medium benefit = 2

high benefit = 3

N/A = 0

Action	RECOVERY AND RECONSTRUCTION BY LAW	
Criterion:	Cost	Benefit
Social	-3	3
Technical	0	3
Administrative	-2	0
Political	-3	0
Legal	-3	0
Economic	0	3
Environmental	0	3
Sub-total	-11	12
Total Score		
Priority	1	

Action	LOW-IMPACT DEVELOPMENT	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	0	3
Political	0	3
Legal	0	1
Economic	0	3
Environmental	0	3
Sub-total	0	19
Total Score		
Priority	19	

Action	DEBMS MANAGEMENT PLAN	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	-2	0
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	3
Sub-total	-2	18
Total Score		
Priority	18	

Simple Score (emphasizes costs and benefits)

low cost = -1

medium cost = -2

high cost = -3

N/A = 0

low benefit = 1

medium benefit = 2

high benefit = 3

N/A = 0

Action	DEVELOP SUMMERLINE MANAGEMENT PLAN	
Criterion:	Cost	Benefit
Social	-2	3
Technical	0	3
Administrative	-3	1
Political	-3	3
Legal	0	3
Economic	-1	0
Environmental	0	3
Sub-total	-9	16
Total Score		
Priority 7		

Action	DEVELOP OVERWASH/SAND/RUBBISH REMOVAL PLAN	
Criterion:	Cost	Benefit
Social	-1	3
Technical	-1	3
Administrative	-1	0
Political	0	3
Legal	0	3
Economic	-2	3
Environmental	0	3
Sub-total	-5	18
Total Score		
Priority 13		

Action	ENROLL IN THE COMMUNITY RAINWATER SYSTEM	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	-3	3
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	0
Sub-total	-3	18
Total Score		
Priority 15		

Simple Score (emphasizes costs and benefits)

low cost = -1

medium cost = -2

high cost = -3

N/A = 0

low benefit = 1

medium benefit = 2

high benefit = 3

N/A = 0



Action	OPEN SPACE ACQUISITION	
Criterion:	Cost	Benefit
Social	0	3
Technical	-2	3
Administrative	-1	1
Political	-2	3
Legal	0	3
Economic	-3	3
Environmental	0	3
Sub-total	-8	19
Total Score		
Priority 8		

Action	NON-RESIDENTIAL STRUCTURES IN THE FLOODPLAIN	
Criterion:	Cost	Benefit
Social	-1	3
Technical	-1	3
Administrative	-3	0
Political	-1	2
Legal	-2	2
Economic	0	3
Environmental	0	3
Sub-total	-8	16
Total Score		
Priority 8		

Action	BUILDING CODE COMPLIANCE ENFORCEMENT	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	0	3
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	3
Sub-total	0	21
Total Score		
Priority 21		

Simple Score (emphasizes costs and benefits)

low cost = -1

medium cost = -2

high cost = -3

N/A = 0

low benefit = 1

medium benefit = 2

high benefit = 3

N/A = 0

Action	DISASTER BENEFIT (DRY/WEET FLOODPROOF) # FLOODING PROGRAM	
Criterion:	Cost	Benefit
Social	-1	3
Technical	-1	3
Administrative	-3	0
Political	-1	2
Legal	-2	2
Economic	0	3
Environmental	0	3
Sub-total	-8	16
Total Score		
Priority 8		

Action	BUSINESS CONTINUATION	
Criterion:	Cost	Benefit
Social	-1	3
Technical	0	3
Administrative	-2	0
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	0
Sub-total	-3	15
Total Score		
Priority 13		

Action	HISTORIC SIGNIFICANCE	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	-2	0
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	0
Sub-total	-2	15
Total Score		
Priority 13		

Simple Score (emphasizes costs and benefits)

low cost = -1

medium cost = -2

high cost = -3

N/A = 0

low benefit = 1

medium benefit = 2

high benefit = 3

N/A = 0

Action	SCHOOL VULNERABILITY	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	-2	0
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	0
Sub-total	-2	15
Total Score		
Priority 13		

Action	ENSURING THE SAFETY OF ELDERLY & PUBLIC HOUSING	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	-1	2
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	0
Sub-total	-1	17
Total Score		
Priority 16		

Action	ELDERLY & SPECIAL NEEDS RESIDENTS	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	-1	2
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	0
Sub-total	-1	17
Total Score		
Priority 16		

Simple Score (emphasizes costs and benefits)

low cost = -1

medium cost = -2

high cost = -3

N/A = 0

low benefit = 1

medium benefit = 2

high benefit = 3

N/A = 0

Action	CONTAIN HAZARDOUS MATERIALS	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	-1	3
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	3
Sub-total	-1	21
Total Score		
Priority 20		

Action	PRESERVATION OF WATER SUPPLY RESERVOIRS & WATERSHEDS	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	-1	3
Political	0	3
Legal	0	3
Economic	-3	1
Environmental	0	3
Sub-total	-4	19
Total Score		
Priority 15		

Action	UNINTERRUPTED MUNICIPAL WATER SUPPLY	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	-1	3
Political	0	3
Legal	0	3
Economic	-3	1
Environmental	0	3
Sub-total	-4	19
Total Score		
Priority 15		

Simple Score (emphasizes costs and benefits)

low cost = -1

medium cost = -2

high cost = -3

N/A = 0

low benefit = 1

medium benefit = 2

high benefit = 3

N/A = 0



Action	UNINTERRUPTED WASTEWATER COLLECTION	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	-1	3
Political	0	3
Legal	0	3
Economic	-3	1
Environmental	0	3
Sub-total	-4	19
Total Score		
Priority	18	

Action	INSTALL WARNING LIGHTS AT THE CAUSEWAY	
Criterion:	Cost	Benefit
Social	-1	3
Technical	-1	3
Administrative	-1	1
Political	0	0
Legal	0	0
Economic	-3	3
Environmental	0	0
Sub-total	-6	10
Total Score		
Priority	4	

Action	INVESTIGATE BURIED WATER	
Criterion:	Cost	Benefit
Social	-2	3
Technical	-2	1
Administrative	-3	0
Political	-2	0
Legal	-3	0
Economic	0	3
Environmental	-3	0
Sub-total	-13	7
Total Score		
Priority	-6	

Simple Score (emphasizes costs and benefits)

low cost = -1

medium cost = -2

high cost = -3

N/A = 0

low benefit = 1

medium benefit = 2

high benefit = 3

N/A = 0

Action	INVESTIGATE SHORF LINE PROTECTION MEASURES AT DEVEREUX BRAM.	
Criterion:	Cost	Benefit
Social	-1	3
Technical	0	3
Administrative	-3	1
Political	-1	3
Legal	0	3
Economic	0	3
Environmental	0	3
Sub-total	-5	19
Total Score		
Priority 14		

Action	PLEASANT ST. AREA DRAINAGE IMPROVEMENTS	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	-2	3
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	3
Sub-total	-2	21
Total Score		
Priority 19		

Action	LOCALIZED FLOODING OF ROADWAYS	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	-2	0
Political	0	3
Legal	0	3
Economic	-1	2
Environmental	0	3
Sub-total	-3	17
Total Score		
Priority 14		

Simple Score (emphasizes costs and benefits)

low cost = -1

medium cost = -2

high cost = -3

N/A = 0

low benefit = 1

medium benefit = 2

high benefit = 3

N/A = 0

Action	BARNEGAT LANDING	
Criterion:	Cost	Benefit
Social	0	3
Technical	-3	3
Administrative	-3	0
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	0
Sub-total	-6	15
Total Score		
Priority 9		

Action	PHILIP CANAL WHARF	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	-3	0
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	0
Sub-total	-3	15
Total Score		
Priority 12		

Action	COMMERCIAL ST. LANDING	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	-3	0
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	0
Sub-total	-3	15
Total Score		
Priority 12		

Simple Score (emphasizes costs and benefits)

low cost = -1

medium cost = -2

high cost = -3

N/A = 0

low benefit = 1

medium benefit = 2

high benefit = 3

N/A = 0

Action	LUFF STREET BOATYARD	
Criterion:	Cost	Benefit
Social	0	3
Technical	-1	3
Administrative	-3	0
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	0
Sub-total	-4	15
Total Score		
Priority	11	

Action	PANICKERS BOATYARD	
Criterion:	Cost	Benefit
Social	0	3
Technical	-2	3
Administrative	-3	0
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	0
Sub-total	-5	15
Total Score		
Priority	10	

Action	FOUNT BIRAM	
Criterion:	Cost	Benefit
Social	0	3
Technical	-3	3
Administrative	-3	0
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	0
Sub-total	-6	15
Total Score		
Priority	9	

Simple Score (emphasizes costs and benefits)

low cost = -1

medium cost = -2

high cost = -3

N/A = 0

low benefit = 1

medium benefit = 2

high benefit = 3

N/A = 0



Action	GRADE 6/7/8'S BRAM	
Criterion:	Cost	Benefit
Social	0	3
Technical	-3	3
Administrative	-3	0
Political	0	3
Legal	0	3
Economic	-1	3
Environmental	0	0
Sub-total	-7	15
Total Score		
Priority	8	

Action	COMPLETE THE COMMUNITY HUMANITARIAN PREPAREDNESS COURSE	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	0	3
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	3
Sub-total	0	21
Total Score		
Priority	21	

Action	MAINTAIN VARIOUS ENAWARD NAMES	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	-1	2
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	0
Sub-total	-1	*17
Total Score		
Priority	16	

Simple Score (emphasizes costs and benefits)

low cost = -1

medium cost = -2

high cost = -3

N/A = 0

low benefit = 1

medium benefit = 2

high benefit = 3

N/A = 0

Action	PUBLISH EVACUATION ROUTES	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	-1	3
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	3
Sub-total	-1	21
Total Score		
Priority	20	

Action	COORDINATE EVAC. PLANS W/ NEIGHBORING COMMUNITIES	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	-1	2
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	0
Sub-total	-1	17
Total Score		
Priority	16	

Action	TRUST EVACUATION AND SHELTER	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	-1	1
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	0
Sub-total	-1	16
Total Score		
Priority	15	

Simple Score (emphasizes costs and benefits)

low cost = -1

medium cost = -2

high cost = -3

N/A = 0

low benefit = 1

medium benefit = 2

high benefit = 3

N/A = 0

Action	ADVISE HOMEOWNERS IN THE FLOODPLAIN	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	-2	1
Political	0	3
Legal	0	3
Economic	0	2
Environmental	0	3
Sub-total	-2	18
Total Score		
Priority	16	

Action	OFFICIAL TOWN OF MANAGER'S WEBSITE	
Criterion:	Cost	Benefit
Social	0	3
Technical	0	3
Administrative	-2	1
Political	0	3
Legal	0	3
Economic	0	3
Environmental	0	0
Sub-total	-2	16
Total Score		
Priority	14	

Action		
Criterion:	Cost	Benefit
Social		
Technical		
Administrative		
Political		
Legal		
Economic		
Environmental		
Sub-total		
Total Score		
Priority		

Simple Score (emphasizes costs and benefits)

- low cost = -1
- medium cost = -2
- high cost = -3
- N/A = 0

- low benefit = 1
- medium benefit = 2
- high benefit = 3
- N/A = 0

## Sign in Sheet

March 12, 2013 - 2:00 PM

[illegible]



## Appendix C

### Natural Hazards Mitigation Plan Adoption