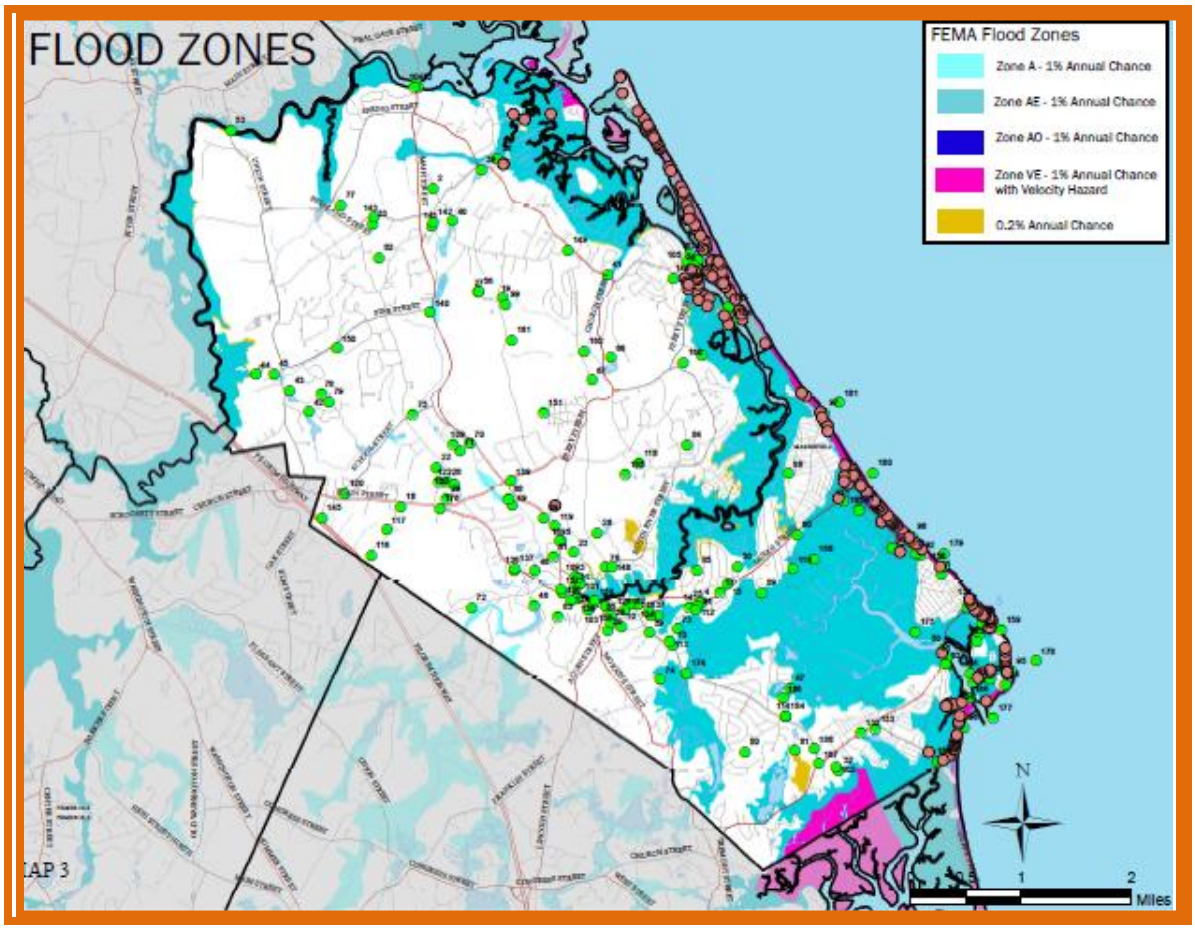
TOWN OF MARSHFIELD
HAZARD MITIGATION PLAN
2013 UPDATE



Metropolitan Area Planning Council

Approved by FEMA
April 22, 2013

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TOWN OF MARSHFIELD HAZARD MITIGATION PLAN
2013 PLAN UPDATE

ACKNOWLEDGEMENTS AND CREDITS

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

MAPC Officers

President:	Michelle Ciccolo
Vice President:	Lynn Duncan
Secretary:	Marilyn Contreras
Treasurer:	Taber Keally
Executive Director:	Marc. D. Draisen

Credits

Project Manager:	Martin Pillsbury
Lead Project Planner:	James Freas
Mapping/GIS Services:	Chris Brown

Massachusetts Emergency Management Agency

Acting Director:	Kurt Schwartz

Department of Conservation and Recreation

Commissioner:	Richard Sullivan

Town of Marshfield, Emergency Management

Director:	Lt. Paul Taber

Local Hazard Mitigation Planning Team

Lt. Paul Taber	Emergency Management
Jack Beagle	Fire Dept.
David E. Carriere	Public Works
Michael Dimeo	Harbor Master
Paul D. Halkiotis, AICP	Town Planner

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TOWN OF MARSHFIELD HAZARD MITIGATION PLAN
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I. EXECUTIVE SUMMARY

Hazard Mitigation planning is a proactive effort to identify measures that can be taken to reduce the dangers to life and property from natural hazard events. Mitigation measures can include regulatory changes impacting development in natural hazard areas, infrastructure improvements, natural resource protection, education programs, and many others. In the communities of the Boston region of Massachusetts, hazard mitigation planning tends to focus most on flooding, the most likely natural hazard to impact these communities. The Federal Disaster Mitigation Act of 2000 requires all municipalities that wish to be eligible to receive FEMA grant funding for hazard mitigation projects, to adopt a local multi-hazard mitigation plan and update this plan in five year intervals.

Planning Process

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

Public participation in this planning process is important for improving awareness of the potential impacts of natural hazards and to build support for the actions the Town takes to mitigate them. The Town hosted two public meetings, the first on September 13 and the second on December 13 and the plan was posted on the Town's website for public review.

Risk Assessment

The Marshfield Hazard Mitigation Plan assesses the potential impacts to the Town from flooding, high winds, winter storms, brush fire, and geologic hazards. Flooding, driven by hurricanes, northeasters and other storms, clearly presents the greatest hazard to the Town, most especially in the coastal areas where storm driven waves top the sea wall and flood adjacent low lying areas.

The Marshfield Local Committee identified those areas where flooding most frequently occurs, comprising 1.31% of the Town's land area, and approximately 117.9 buildings worth an estimated $30,762,518.

Hazard Mitigation Goals

1. Ensure that critical infrastructure sites are protected from natural hazards.

2. Protect existing residential and business areas from flooding.

3. Maintain existing mitigation infrastructure in good condition.

4. Continue to enforce existing zoning and building regulations.

5. Educate the public about zoning and building regulations, particularly with regard to changes in regulations that may affect tear-downs and new construction.

6. Work with surrounding communities to ensure regional cooperation and solutions for hazards affecting multiple communities such as coastal erosion.

7. Encourage future development in areas that are not prone to natural hazards.

8. Educate the public about natural hazards and mitigation measures.

9. Make efficient use of public funds for hazard mitigation.

10. Protect the Town's ability to respond to various natural hazard events.

Hazard Mitigation Strategy

The Marshfield Local Committee identified a number of mitigation measures that would serve to reduce the Town's vulnerability to natural hazard events. These include infrastructure improvements such as continued maintenance and repair to sea walls and upgrades to the Dyke Road Bridge, salt marsh restoration, and public education efforts relating to all natural hazards potentially impacting the Town.

Overall, the hazard mitigation strategy recognizes that mitigating hazards for Marshfield will be an ongoing process as our understanding of natural hazards and the steps that can be taken to mitigate their damages changes over time. Global climate change, erosion of beaches, and a variety of other factors impact the Town's vulnerability, and local officials will need to work together across municipal lines and with state and federal agencies in order to understand and address these changes. The Hazard Mitigation Strategy will be incorporated into other related plans and policies.

Plan Review and Update Process

Table 1 Plan Review and Update

Chapter	Reviews and Updates
III – Public Participation	The Marshfield Local Committee placed an emphasis on public participation for the update of the Hazard Mitigation Plan, discussing strategies to enhance participation opportunities at the local committee meeting. During plan development, the plan was presented to the Board of Selectmen twice in public meetings. The Board of Selectmen's meeting was televised. The plan was also available on the Town's website for public comment.

IV – Risk Assessment	MAPC gathered the most recently available hazard and land use data and met with Town staff to identify changes in local hazard areas and development trends. Town staff reviewed critical infrastructure with MAPC staff in order to create an up-to-date list. MAPC also used the most recently available version of HAZUS and assessed the potential impacts of flooding using the latest data.
V - Goals	The Hazard Mitigation Goals were reviewed by the Local Hazard Mitigation Committee and Goal 6 was modified and Goal 10 added.
VI – Existing Mitigation Measures	The list of existing mitigation measures was updated to reflect current mitigation activities in the Town.
VII & VIII – Hazard Mitigation Strategy	Mitigation measures from the 2005 plan were reviewed and assessed as to whether they were completed, on-going, or deferred. The Local Committee determined whether to carry forward measures into the 2010 plan or delete them. The 2010 Hazard Mitigation Strategy reflects both new measures and measures carried forward from the 2005 plan. The Committee re-prioritized all of these measures based on current conditions.
IX – Plan Adoption & Maintenance	This section of the plan was updated with a new on-going plan implementation review and five year update process that will assist the Town in incorporating hazard mitigation issues into other Town planning and regulatory review processes and better prepare the Town to update the plan in 2016.

As indicated on Table 15, Marshfield made considerable progress on implementing mitigation measures identified in the 2005 Hazard Mitigation Plan. Many of the measures identified in that plan are now considered on-going aspects of the regular work of City staff from the department head level to the regular work of Public Works staff. Individual projects have been incorporated into the Town's capital improvement plan and into revisions of the Town's zoning ordinance and other regulations or policies. Moving forward into the next five year plan implementation period there will be many more opportunities to incorporate hazard mitigation into the Town's decision making processes, most significantly into the update of the Townscape Plan.

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II. INTRODUCTION

Planning Requirements under the Federal Disaster Mitigation Act

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

Massachusetts has taken a regional approach and has encouraged the regional planning agencies to apply for grants to prepare plans for groups of their member communities. The Metropolitan Area Planning Council (MAPC) received a grant from the Federal Emergency Management Agency (FEMA) under the Pre-Disaster Mitigation (PDM) Program, to assist the Town of Marshfield and nine other South Shore communities to update their local Hazard Mitigation Plans, which were first adopted in as part of a South Shore Multi-Jurisdictional Hazard Mitigation Plan. The local Hazard Mitigation Plan updates produced under this grant are designed to individually meet the requirements of the Disaster Mitigation Act for each community.

In order to address multijurisdictional and regional issues, the participating municipalities were afforded the opportunity to meet with their neighboring communities during plan development, and MAPC has also produced a regional document that summarizes the issues and recommendations for the South Shore communities.

What is a Hazard Mitigation Plan?

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

Previous Federal/State Disasters

The Town of Marshfield has experienced 17 natural hazards that triggered federal or state disaster declarations since 1991. These are listed in Table 1 below. The vast majority of these events involved flooding.

Table 2 Previous Federal/State Disaster Declarations

DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS
Hurricane Bob (August 1991)	FEMA Public Assistance Project Grants	Counties of Barnstable, Bristol, Dukes, Essex, Hampden, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Hampden, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk (16 projects)
No-Name Storm (October 1991)	FEMA Public Assistance Project Grants	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk
	FEMA Individual Household Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk (10 projects)
December Blizzard (December 1992)	FEMA Public Assistance Project Grants	Counties of Barnstable, Dukes, Essex, Plymouth, Suffolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Dukes, Essex, Plymouth, Suffolk (7 projects)
March Blizzard (March 1993)	FEMA Public Assistance Project Grants	All 14 Counties
January Blizzard (January 1996)	FEMA Public Assistance Project Grants	All 14 Counties
May Windstorm (May 1996)	State Public Assistance Project Grants	Counties of Plymouth, Norfolk, Bristol (27 communities)

DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS
October Flood (October 1996)	FEMA Public Assistance Project Grants	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
	FEMA Individual Household Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
	Hazard Mitigation Grant Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk (36 projects)
1997	Community Development Block Grant-HUD	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
June Flood (June 1998)	FEMA Individual Household Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester (19 projects)
(1998)`	Community Development Block Grant-HUD	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
March Flood (March 2001)	FEMA Individual Household Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester (16 projects)
February Snowstorm (Feb 17-18, 2003)	FEMA Public Assistance Project Grants	All 14 Counties
January Blizzard (January 22-23, 2005)	FEMA Public Assistance Project Grants	All 14 Counties
Hurricane Katrina (August 29, 2005)	FEMA Public Assistance Project Grants	All 14 Counties
May Rainstorm/Flood (May 12-23, 2006)	Hazard Mitigation Grant Program	Statewide

DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS
April Nor'easter (April 15-27, 2007)	FEMA Public Assistance Project Grants	Barnstable, Berkshire, Dukes, Essex, Franklin, Hampden, Hampshire, Plymouth
	Hazard Mitigation Grant Program	Statewide
Flooding (March, 2010)	FEMA Public Assistance FEMA Individuals and Households Program SBA Loan	Bristol, Essex, Middlesex, Suffolk, Norfolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Statewide

(Source: database provided by MEMA)

FEMA Funded Mitigation Projects

Over the last 20 years the Town of Marshfield has received funding from FEMA for two mitigation projects under the Hazard Mitigation Grant Program. These projects totaled more than $83,000, with $58,052 covered by FEMA grants and $19,349 by local funding. The projects are summarized in Table 2 below.

Table 3 FEMA-Funded Mitigation Projects
(Utilizing the Hazard Mitigation Grant Program)

Year	Project Title	Scope of Work	Total Cost	Federal Funding	Local Funding
1992 (Dec Blizzard)	Emergency Generator	Installation of new 350 KW emergency generator	$70,780.00	$50,000.00	$16,666.00
1996 (October Flood)	Home Retrofitting	Elevation of utilities & flood proofing of basements - 25 homes.	$666,667.00	$480,399.36	$166,667.00

(Source: database provided by MEMA)

Community Profile

The Town of Marshfield is located in Southeastern Massachusetts in Plymouth County. A coastal community 30 miles from Boston, Marshfield has a yearly population of about 24,000 people which grows to about 40,000 in the summer months. The town has a traditional New England government structure with a three-member Board of Selectmen,

a Town Administrator, and an open town meeting. Among the basic services provided to residents are public safety, schools, water and sewer, trash removal, recreation, public library, and senior center.

The town maintains a website at http://www.townofmarshfield.org

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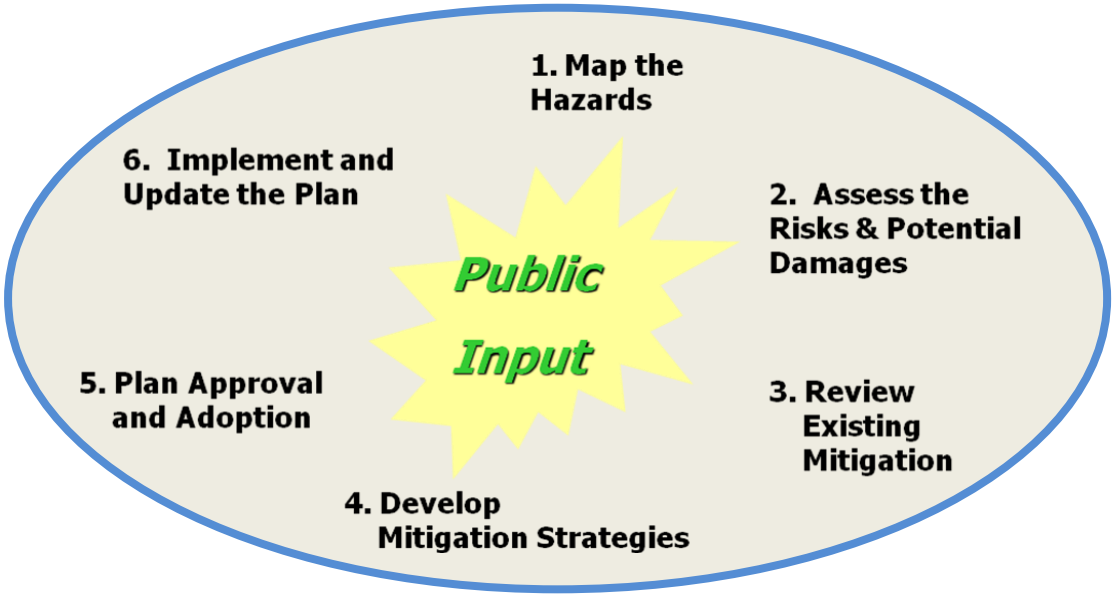
III. PLANNING PROCESS AND PUBLIC PARTICIPATION

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

Planning Process Summary

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



1. Map the Hazards – MAPC relies on data from a number of different federal, state, and local sources in order to map the areas with the potential to experience natural hazards. This mapping represents a multi-hazard assessment of the municipality and is used as a set of base maps for the remainder of the planning process. A particularly important source of information is the knowledge drawn from local municipal staff on where natural hazard impacts have occurred, which is collected. These maps can be found in Appendix B.

2. Assess the Risks & Potential Damages – Working with local staff, critical facilities, infrastructure, vulnerable populations, and other features are mapped and contrasted with the hazard data from the first step to identify those that might represent particular vulnerabilities to these hazards. Land use data and development trends are also incorporated into this analysis. In addition, MAPC develops estimates of the potential impacts of certain hazard events on the community.

3. Review Existing Mitigation – Municipalities in the Boston Metropolitan Region have an active history in hazard mitigation as many have adopted flood plain zoning districts, wetlands protection programs, and other measures as well as enforcing the State building code, which has strong provisions related to hazard resistant building requirements. All current municipal mitigation measures must be documented.

4. Develop Mitigation Strategies – MAPC works with the local municipal staff to identify new mitigation measures, utilizing information gathered from the hazard identification, vulnerability assessments, and the community's existing mitigation efforts to determine where additional work is necessary to reduce the potential damages from hazard events. Additional information on the development of hazard mitigation strategies can be found in Chapter VII.

5. Plan Approval & Adoption – Once a final draft of the plan is complete it is sent to MEMA for the state level review and, following that, to FEMA for approval. Typically, once FEMA has approved the plan the agency issues a conditional approval with the condition being adoption of the plan by the municipality. More information on plan adoption can be found in Chapter IX and documentation of plan adoption can be found in Appendix D.

6. Implement & Update the Plan – Implementation is the final and most important part of any planning process. Hazard Mitigation Plans must also be updated on a five year basis making preparation for the next plan update an important on-going activity. Chapter IX includes more detailed information on plan implementation.

Public participation occurred at two levels; the South Shore Multiple Hazard Community Planning Team (regional committee) and the Marshfield Multiple Hazard Community Planning Team (local committee). In addition, the town held one meeting open to the general public to present the plan and hear citizen input.

Marshfield's Participation in the Regional Committee

On January 15, 2010 a letter was sent notifying the communities of the first meeting of the South Shore Regional Committee and requesting that the Chief Elected Official designate a minimum of two municipal employees and/or officials to represent the community. The following individuals were appointed to represent Marshfield on the regional committee:

Lt. Paul Taber	Emergency Management Director
Paul Tomkavage	Environmental Engineer

The regional committee serves as an opportunity for neighboring communities to discuss hazard mitigation issues of shared concern. In addition, as the same group of MAPC staff is working on each community's plan, these issues of shared concern, and other issues that may arise between neighboring communities, are discussed in greater detail in local committee meetings and resulting actions are reflected in the identified mitigation measures, as noted in Chapter VIII. The South Shore Regional Committee met on February 9, 2010.

The Local Multiple Hazard Community Planning Team

In addition to the regional committee meetings, MAPC worked with the local community representatives to organize a local Multiple Hazard Community Planning Team for Marshfield (local committee). MAPC briefed the local representatives as to the desired composition of that team as well as the need for representation from the business community and citizens at large.

The Local Multiple Hazard Community Planning Team Meetings

On August 18, 2010 MAPC conducted the meeting of the Marshfield Local Committee. The meeting was organized by Paul Taber, Emergency Management Director. The purpose of the meeting was to review the existing plan and mitigation goals, including gathering information on local hazard mitigation issues, updating existing mitigation practices, and determining the status of mitigation measures from the 2005 plan. The meeting also included discussion of new or modified mitigation measures and a process for public involvement and outreach. Table 4 lists the attendees at the team meeting. The agenda for these meeting is included in Appendix A.

Table 4
Attendance at the Marshfield Local Committee Meeting

Name	**Representing**
August 18, 2010	
Lt. Paul Taber	Emergency Management Agency

Table 4 **Attendance at the Marshfield Local Committee Meeting**	
David E. Carriere	Public Works
Jack Beagle	Fire Department
Paul D. Halkiotis, AICP	Planning
Michael Dimeo	Harbor Master

Public Meetings

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

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

The public had an opportunity to provide input to the planning process during a meeting of the Marshfield Board of Selectmen on September 13, 2010 held in the Marshfield Town Hall. The final draft of the plan was presented for public comment at a meeting of the Board of Selectmen on December 13, 2010 at the Seth Ventress Hall. The Board of Selectmen's meetings were video-taped for showing on Marshfield Community Television.

The first meeting was publicized as a regular meeting of the Marshfield Board of Selectmen. The presentation of the final draft was also publicized as a regular Selectmen's meeting. The attendance list for each meeting can be found in Table 5.

Table 5
Attendance at Public Meetings

Name	Representing
First Public Meeting	
Patricia J. Reilly, Chairman	Marshfield Board of Selectmen
John E. Hall, Vice Chair	Marshfield Board of Selectmen
Matt McDonough, Clerk	Marshfield Board of Selectmen
Rocco Longo	Town Administrator
Lt. Paul Taber	Marshfield Emergency Management Agency
James Freas	MAPC
Martin Pillsbury	MAPC
Second Public Meeting	
Patricia J. Reilly, Chairman	Marshfield Board of Selectmen
John E. Hall, Vice Chair	Marshfield Board of Selectmen
Rocco Longo	Town Administrator
Lt. Paul Taber	Marshfield Emergency Management Agency
James Freas	MAPC

Other Opportunities for Public Involvement

Public Review

Town staff were encouraged to reach out to local stakeholders that might have an interest in the Hazard Mitigation Plan including neighboring communities, agencies, businesses, academia, nonprofits, and other interested parties. Draft copies of the Marshfield Hazard Mitigation Plan were posted on the Marshfield Emergency Management Agency website, www.marshfieldpolice.org, and at the Marshfield Public Library. These drafts were updated regularly over the course of the planning process. Members of the public could access the draft document and submit comments or questions.

Planning Timeline

January 15, 2010	Letter to the participating municipalities initiating the project.
February 9, 2010	Meeting of the Regional Committee
August 18, 2010	Meeting of the Local Committee
September 13, 2010	Public Meeting with the Board of Selectmen
December 13, 2010	Public Meeting with the Board of Selectmen
December 15, 2010	Plan submitted to MEMA

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IV. RISK ASSESSMENT

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

Update Process

In order to update Marshfield's risk assessment, MAPC gathered the most recently available hazard and land use data and met with Town staff to identify changes in local hazard areas and development trends. Town staff reviewed critical infrastructure with MAPC staff in order to create an up-to-date list. MAPC also used the most recently available version of HAZUS (described below) and assessed the potential impacts of flooding using the latest data.

Overview of Hazards and Impacts

The Massachusetts Hazard Mitigation Plan 2007 (state plan) provides an in-depth overview of natural hazards in Massachusetts. The state plan indicates that Massachusetts is subject to the following natural hazards (listed in order of frequency); floods, heavy rainstorms, nor'easters or winter storms, coastal erosion, hurricanes, tornadoes, urban and wildfires, drought and earthquakes. Previous state and federal disaster declarations since 1991 are summarized in Table 1.

Table 6 summarizes the hazard risks for Marshfield. This evaluation takes into account the frequency of the hazard, historical records, and variations in land use. This analysis is based on the vulnerability assessment in the Commonwealth of Massachusetts State Hazard Mitigation Plan, 2007. The statewide assessment was modified to reflect local conditions in Marshfield using the definitions for hazard frequency and severity listed below Table 6.

Table 6
Hazard Risks Summary

Hazard	Frequency	Severity
Flooding		
Inland/Riverine	High	Serious
Coastal Storms	High	Serious
Dam Failure	Low	Serious
Ice Jam	Low	Minor
Wind		
Hurricanes	Medium	Serious
Tornadoes	Low	Serious
Nor'easter	High	Serious

Severe Thunderstorm	High	Minor
Winter storms		
Heavy Snow	High	Minor
Ice Storm	High	Minor
Blizzard	High	Serious
Geologic		
Earthquakes	Low	Extensive
Landslides	Low	Minor
Other Natural Hazards		
Brush fires	Medium	Minor

Definitions used in the Commonwealth of Massachusetts State Hazard Mitigation Plan

Frequency

Very low frequency: events that occur less frequently than once in 1,000 years (less than 0.1% per year)

Low frequency: events that occur from once in 100 years to once in 1,000 years (0.1% to 1% per year);

Medium frequency: events that occur from once in 10 years to once in 100 years (1% to 10% per year);

High frequency: events that occur more frequently than once in 10 years (greater than 10% per year).

Severity

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

Serious: Scattered major property damage (more than 50% destroyed); some minor infrastructure damage; wider geographic area (several communities); essential services are briefly interrupted; some injuries and/or fatalities.

Extensive: Consistent major property damage; major damage public infrastructure damage (up to several days for repairs); essential services are interrupted from several hours to several days; many injuries and fatalities.

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

Flood Related Hazards

Flooding was the most prevalent serious natural hazard identified by local officials in Marshfield. Flooding is generally caused by hurricanes, nor'easters, severe rainstorms, and, thunderstorms. Sea level rise has the potential to exacerbate these issues over time.

Regionally Significant Storms

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

- March 1968
- The blizzard of 1978
- January 1979
- April 1987
- October 1991 ("The Perfect Storm")
- October 1996
- June 1998
- March 2001
- April 2004
- May 2006
- April 2007
- March 2010

Overview of Town-Wide Flooding

The Town of Marshfield is subject to two kinds of flooding; coastal flooding where wind and tide leads to flooding along the shore and tidal waterways and inland flooding where the rate of precipitation or amount of water overwhelms the capacity of natural and structured drainage systems to convey water causing it to overflow the system. These two types of flooding are often combined as inland flooding is prevented from draining by the push of wind and tide driven water. Both types of flooding can be caused by major storms, known as northeasters and hurricanes. Northeasters can occur at any time of the year but they are most common in winter. Hurricanes are most common in the summer and early fall. Marshfield, being north of Cape Cod, is particularly vulnerable to northeasters because the area is not protected by the sheltering arm of Cape Cod. Northeasters cover a larger area than hurricanes although the winds are not as high. They also generally last long enough to include at least one high tide, which causes the most severe flooding. Large rain storms or snowfalls can also lead to inland flooding.

Inland/Riverine Flooding

Most of the Town's waterways remain tidally influenced for their entire length in Marshfield such that inland flooding is very closely related to coastal flooding conditions. High tides and coastal flooding can prevent water from draining out of the streams, rivers, and stormwater conveyance systems leading to flooding well away from coastal

areas. Much of this type of flooding is contained within existing wetland areas, reinforcing the need to protect and maintain these areas as a mitigation measure.

Coastal Flooding

Sea wall failure and coastal erosion are related issues increasingly impacting towns along the Massachusetts coast. Rising sea levels have led to increased rates of erosion along beaches and coastlines and the undermining of sea walls, some of which in the Boston region are many decades old. Sea walls protect the buildings behind them from storm damage and their failure can lead to increased property damage. Similarly, intact beaches with dunes dissipate wave energy, protecting buildings behind them. As the beaches erode away, this protection is lost. In some cases, sea walls can accelerate beach erosion. In April of 2010, 500 feet of sea wall in Marshfield collapsed due to undermining of its foundation from erosion. Town Meeting approved $1.4 million to replace the structure on May 18th.

Reports completed in 2005 and 2007 assessed the status of Marshfield's publicly owned sea walls. For the 2005 study, the project area included two isolated sites on the North and South Rivers and most of the shoreline from Rexham Beach south to the Marshfield/Duxbury town line as well as town-owned structures in Green Harbor. The inspected sites were grouped into nine geographic areas. The report includes a priority rating system of 1-9 with the lower numbers representing the highest priority improvements. Structures rated with #1 represent emergency conditions while structures rated as #9 are new with no repairs needed.

There were no structures in Marshfield rated 1-3. Four structures were rated with a 4, ten structures were rated as a 5, thirteen were rated as a 6, thirteen were rated as a 7, none were rated as an 8 and two were rated as a 9. In discussing the priority ratings, the report states that:

> "The lowest listed rating for the areas under this study is a value of 4. This rating was given to the structure located at Area 3 – Fieldston (Structure 3-4) Area 4 – Ocean Bluff (Structures 4-1 and 4-3) and Area 5 – Ocean Street/Hewitt's Point (Structure 5-6). These structures were given a rating of 4, because of public safety concerns or their current deteriorated condition and their location within a high-energy area, which is prone to additional damage by future storms. Such damage would result in repair costs much higher than the current costs for repair."

The 2007 study was initiated by the Massachusetts Coastal Hazards Commission in order to assess the capacity of coastal structures to resist major coastal storms and prevent storm damage. For the Marshfield portion of the study, 32 structures were identified with a total cost for repairs of $22.4 million. Six of these structures were given a 'D' rating indicating that they would be susceptible to some level of damage or failure during a major storm event. The cost of repairs to these structures was estimated at $12 million.

FEMA has indicated in their latest rules that post hazard event reconstruction or repair funding for coastal protection structures will only be made available where the damage can be directly attributed to the storm event. Therefore, in order to receive this funding, the Town must maintain records of maintenance and repair activities that demonstrate the status of each structure.

Dams and Dam Failure

The Department of Conservation and Recreation (DCR) Office of Dam Safety lists 15 dams in Marshfield. Thirteen of the dams are rated as low hazard or non-jurisdictional, and two are rated as being significant hazards. The Town has identified as many as 66 dams, including those on DCR's list as well as many smaller structures found on mill ponds and cranberry bogs. The majority of these dams pose no threat because the impoundments are very small and there is no development downstream. Many of these dams are privately owned on private property and not directly visible to the public.

Dam failure can arise from two types of situations. Dams can fail because of structural problems independent of any storm event. Dam failure can follow an earthquake by causing structural damage. Dams can fail structurally because of flooding arising from a storm or they can overspill due to flooding.

In the event of a dam failure, the energy of the water stored behind even a small dam can cause loss of life and property damage if there are people or buildings downstream. The number of fatalities from a dam failure depends on the amount of warning provided to the population and the number of people in the area in the path of the dam's floodwaters.

The Marshfield Comprehensive Emergency Management Plan has a section on dam failure. The plan notes that dam failure in general is infrequent but has the potential for severe impacts. An issue for dams in Massachusetts is that many were built in the 19th century without the benefits of modern engineering or construction oversight.

The Massachusetts DCR has three hazard classifications for dams:

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

In general, DCR requires that dams that are rated as low hazard be inspected every ten years while dams that are rated as significant hazards must be inspected every five years.

Chandler's Pond Dam – There are two privately owned dams which hold back water from Chandlers Pond; both are located at the north end of the pond. One, the so called Chandlers Pond Dam is a concrete structure and was built in 1917 and is located at the west side of the pond and is over passed by a private drive. The second is located at the east side of the pond and discharges to a culvert that passes under Pudding Hill Lane. It is also concrete but its date of construction is not known. The Department of Environmental Management listing of the Chandlers Pond Dam (State ID# 7-12-171-1n, Nat ID # MA02150) is for the 1917 dam and this is only one of the two dams which could constitute a 'significant hazard'.

Magoun Pond Dam – The Dam is located off Union Street. Dam construction is earth and stone for the main wall of the south end of the pond. A private road runs atop this earth and stone wall giving access to homes east of the dam. The dam has two outlets, the eastern most is the main dam and the western most would appear to have been a later construction. This Town owned dam is rated as a significant hazard by DCR, (State ID 7-12-171-9, Nat ID MA02153).

Oakman Pond Dam – The dam is located on Millpond Lane off Union Stret. The Development dates from 1985 and the Dam and spill ways are prefabricated concrete. This privately owned dam is rated as a significant hazard by DCR, (State ID 7-12-171-13, Nat ID MA00351).

Ice Jam

Ice jams occur in cold weather when normally flowing water begins to freeze effectively damming the waterway and causing localized flooding in the area. There is no recent history of ice jams leading to flooding in Marshfield and Town staff did not identify this hazard as an issue for the Town. As coastal Massachusetts experiences somewhat warmer winters than the western part of the State and tidal waters are less subject to freezing, this hazard is unlikely to be an issue in the Town.

Potential Flood Hazard Areas

Information on flood hazard areas was taken from two sources. The first was the National Flood Insurance Rate Maps. The FIRM flood zones are shown on Map 3 in Appendix B. The second was discussions with local officials. The Locally Identified Areas of Flooding described below were identified by Town staff as areas where flooding is known to occur. These areas do not necessarily coincide with the flood zones from the FIRM maps. They may be areas that flood due to inadequate drainage systems or other local conditions rather than location within a flood zone. The numbers correspond to the numbers on Map 8, "Hazard Areas". The numbers do not reflect priority order.

Locally Identified Areas of Flooding

1) Brant Rock: Flooding in the Brant Rock area occurs primarily in the esplanade area, a low-lying area just inland from the sea wall where there is a collection of businesses and residences. Flooding is caused by sea splash over as waves overtop the sea wall and lack of drainage. The esplanade area floods two to three times a year to a depth of one to two feet.

2) Bass Creek/Fieldston: The Fieldston area is subject to frequent flooding during rainfall events and wash over of the sea wall during coastal storms. This flood water collects in the vicinity of Monitor and Mayflower Roads due to low elevations, high water table, and restrictions in the drainage ditch into Bass Creek. The upper reaches of Bass Creek are heavily impacted by sediment and overgrown with little elevation change further limiting drainage. The Town has begun work on improving drainage conditions in Bass Creek.

3) Sea Wash Over or Splash Over: Most of Marshfield's ocean coastline is protected by sea walls and along the entire length of these walls there is periodic sea splash over where ocean waters top the sea wall. These waves carry debris, including cobble stones, and can bring enough water over the wall as to cause flooding in adjacent low lying streets and properties. Splash over occurs during storm events and can also occur at times when storms pass further out at sea and drive waves towards the coast. Many of the locally identified flood areas listed here that are along the coast flood, at least in part, due to sea wash over events.

4) Rexhame Beach

5) Neptune Road

6) Damons Point

7) Green Harbor

8) Veteran's Park

9) Ocean Street & South River

Repetitive Loss Structures

There are 156 repetitive loss structures in Marshfield, a decrease from the 186 structures identified in the 2005 plan. As defined by the Community Rating System (CRS) of the National Flood Insurance Program (NFIP), a repetitive loss property is any property which the NFIP has paid two or more flood claims of $1,000 or more in any given 10-year period since 1978. For more information on repetitive losses see http://www.fema.gov/business/nfip/replps.shtm.

The majority of Marshfield's repetitive loss properties are single family residential structures with only 10 non-residential, one 2-4 family, two condos, and one other residential structure.

Table 7
Repetitive Loss Properties Summary

Flood Zone	Single Family Residential Structures	Multi-Family Residential Structures	Commercial, Industrial, or Institutional Structures	Total Repetitive Loss Properties
FEMA Zone A	118	2	10	130
FEMA Zone V	13	0	0	13
FEMA .2% annual chance	3	0	0	3
Total: FEMA Flood Zones*	**134**	**2**	**10**	**146**
Brant Rock	3	0	8	11
Bass Creek/Fieldston	3	0	0	3
Sea Wash Over	27	1	0	28
Rexhame Beach	0	0	0	0
Neptune Road	10	0	0	10
Damons Point	0	0	0	0
Green Harbor	4	0	1	5
Veteran's Park	0	0	0	0
Ocean Street & South River	0	0	0	0
Total: Locally Identified Areas of Flooding*	**47**	**1**	**9**	**57**

* Note totals for repetitive loss properties in FEMA flood zones and locally identified areas of flooding do not necessarily match the total number of repetitive loss properties in the community as there is considerable overlap between the two types of flood area and not all repetitive loss properties are located in an identified flood zone.

Wind Related Hazards

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

Hurricanes

Between 1858 and 2000, Massachusetts has experienced approximately 32 tropical storms, nine Category 1 hurricanes, five Category 2 hurricanes and one Category 3 hurricane. This equates to a frequency of once every six years. A hurricane or storm track is the line that delineates the path of the eye of a hurricane or tropical storm. There have been no recorded hurricane or tropical storm tracks through Marshfield. However, the Town does experience the impacts of the wind and rain of hurricanes and tropical storms regardless of whether the storm track passed through the town. The hazard mapping indicates that the 100 year wind speed is 110 miles per hour.

Some of the hurricanes that have passed through the region include:

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

*Category 3

The Marshfield Comprehensive Emergency Management Plan indicates that the town is highly vulnerable to hurricanes. A hurricane is a violent wind and rainstorm with wind speeds of 74-200 miles per hour. A hurricane is strongest as it travels over the ocean and is particularly destructive to coastal property as the storm hits the land. Hurricanes generally occur between June and November.

Tornados

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

Nor'easters

Featuring strong northeasterly winds blowing in from the ocean over coastal areas, nor'easters are relatively common in the winter months in New England occurring one to two times a year and frequently lead to coastal flooding and erosion. The storm radius of a nor'easter can be as much as 1,000 miles and these storms feature sustained winds of 10

to 40 mph with gusts of up to 70 mph. These storms are accompanied by heavy rains or snows, depending on temperatures.

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

Severe Thunderstorms

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

Winter Storms

Winter storms are the most common and most familiar of the region's hazards that affect large geographic areas. The majority of blizzards and ice storms in the region cause more inconvenience than they do serious property damage, injuries, or deaths. However, periodically, a storm will occur which is a true disaster, and necessitates intense large-scale emergency response. Occasionally winter storms can also hinder the tidal exchange in tidally restricted watersheds and result in localized flooding within these areas. Ice build-up at gate structures can also damage tide gates and increase the hazard potential as a result of malfunctioning tide gates. Winter storms are a combination hazard because they often involve wind, ice and heavy snow fall. The average annual snowfall for most of the Town is 36.1 - 48 inches.

Heavy Snows

Severe snow accumulation can have a number of different impacts on a community. Hazardous driving conditions can impact emergency response and vulnerable citizens in need of services, heavy snow on tree branches can cause them to fall and damage electric lines, and, in extreme situations, heavy snow can collapse cave in building roofs.

The most significant winter storm in recent history was the "Blizzard of 1978," which resulted in over 3 feet of snowfall and multiple day closures of roadways, businesses, and schools. Historically, severe winter storms have occurred in the following years:

Blizzard of 1978	February 1978
Blizzard	March 1993
Blizzard	January 1996
Severe Snow Storm	March 2001

Severe Snow Storm	December 2003
Severe Snow Storm	January 2005

More recently, 2008 was a record year for snowfall. By the end of the February 2008, Boston's Logan International Airport broke a new February record for total precipitation. In March 2008, many cities and towns in Massachusetts exceeded the highest snowfall records. The above-average snowfall that season increased groundwater and surface water levels to a high level, and contributed to flooding experienced in spring 2008.

Information on winter storm related hazards can be found on Map 6 in Appendix B.

Ice Storm

The ice storm category covers a range of different weather phenomena that collectively involve rain or snow being converted to ice in the lower atmosphere leading to potentially hazardous conditions on the ground. While ice pellets and sleet are examples of these, the greatest hazard is created by freezing rain conditions, which is rain that freezes on contact with hard surfaces leading to a layer of ice on roads, walkways, trees, and other surfaces. The conditions created by freezing rain can make driving particularly dangerous and emergency response more difficult. The weight of ice on tree branches can also lead to falling branches damaging electric lines.

Blizzards

Blizzards include all of the hazards associated with heavy snows but also accompanied by winds of at least 35 mph and temperatures below 20 degrees Fahrenheit. Historical occurrences of blizzards are included in the above winter storm listing.

Geologic Hazards

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

Earthquakes

According to the State Hazard Mitigation Plan, New England experiences an average of five earthquakes per year. From 1627 to 1989, 316 earthquakes were recorded in Massachusetts. Most have originated from the La Malbaie fault in Quebec or from the Cape Anne fault located off the coast of Rockport. The region has experienced larger earthquakes, of magnitude 6.0 to 6.5 in 1727 and 1755. Other notable earthquakes occurred here in 1638 and 1663 (Tufts University). There have been no recorded earthquake epicenters within Marshfield.

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

Landslides

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

The entire Town has been classified as having a low risk for landslides.

Other Natural Hazards

Brush Fires

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

The Marshfield Fire Department responds to very few wood, brush, and grass fires of varying sizes annually. Marshfield's forests are primarily composed of pitch pine, mixed conifer, oak, and oak mixed, which are considered by the State fire officials to be the forest types at highest risk for wildfires.

Within the past year there were no wildfires that resulted in significant property damage. Marshfield's wildfires tend to be in the more remote wooded areas. The following areas of Town were identified as having the highest potential for brush fires. The numbers correspond to the numbers on Map 8, "Hazard Areas":

10) Cherry Hill

11) Cedar Hill

12) Sweets Hill

13) Mill Pond Area

14) Forest & Pine Streets

15) Carolina Hill

Land Use and Development Trends

Existing Land Use

The most recent land use statistics available from the state are from aerial photography done in 2005. Table 7 shows the acreage and percentage of land in 10 categories. If the four residential categories are aggregated, residential uses make up 26.78% of the area of the town (4,891.84 acres). The highest percentage is undeveloped lands which comprises 38.76%, which is 7,081.78 acres.

Table 8
2005 Land Use

Land Use Type	**Acres**	**Percent**
High Density Residential	682.91	3.74
Medium Density Residential	1,139.87	6.24
Low Density Residential	3,069.06	16.8
Non-Residential, Developed	665.5	3.64
Commercial	243.62	1.33
Industrial	64.33	.35
Transportation	77.81	.43
Agriculture	407.2	2.23
Undeveloped	7,081.78	38.76
Undeveloped Wetland	4,837.12	26.48
Total	***18,269.21***	***100.00***

Economic Elements

While Marshfield does not have a quantitative measure of the impact of specific businesses, industries, or areas on its local economic conditions, the local committee did describe two economic drivers within the Town that face potential damage during a coastal natural hazard event. These were businesses located along the waterfront, most especially in the Brant Rock area, and the commercial fishing fleet located at Green Harbor and consisting of between 45 and 50 fishing vessels.

Historic, Cultural, and Natural Resource Areas

The Local Committee identified four historic sites of cultural importance to the Town, the Daniel Webster House, the Marcia Thomas House, the Isaac Winslow House, and Seth Ventress. These buildings are located outside of the most significant hazard areas, away from the coast and floodplain areas.

Development Trends

Historically, Marshfield's development has been driven by beach oriented development along the coast. Inland development of residential and commercial areas only followed as the Town became more readily accessible to Boston. The larger and more easily development parcels in Marshfield have already been developed or otherwise made unavailable for future development, limiting new development to small subdivisions of six to 15 new homes. A few multi-family and commercial structures could also be built over time, but there is unlikely to be a major new development in the near future, with the possible exception of the proposed Enterprise Park. Extensive wetlands and floodplains limit the land available for development.

Potential Future Development

MAPC consulted with town staff to determine areas that are likely to be developed in the future, defined for the purposes of this plan as a ten year time horizon. These areas are shown on Map 2, "Potential Development" and are described below. The letter for each site corresponds to the letters on Map 2.

A) Garden Gate – Four lot residential development.

B) Cranberry Cover – 13 lot Open Space Residential Development (OSRD).

C) Marshawk – 13 lot OSRD.

D) John Shem & White Oaks – 18 total residential lots.

E) Matuxet – 15 lot residential development

F) Welch Healthcare – 140 unit age restricted multi-family development.

G) Enterprise Park – Industrial park with mixed use commercial, 900,000 square feet.

H) Wind Chime Lane – Four lot residential development.

Vulnerability Assessment

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

Future Development in Hazard Areas

Table 9 shows the relationship of these parcels to two of the mapped hazards. This information is provided so that planners can ensure that development proposals comply with flood plain zoning and that careful attention is paid to drainage issues.

Table 9: Relationship of Potential Development to Hazard Areas		
Parcel	**Landslide risk**	**Flood Zone**
Garden Gate	Low	61.3%
Cranberry Cove	Low	No
Marshawk	Low	No
John Shem & White Oaks	Low	No
Matuxet	Low	No
Welch Healthcare	Low	No
Enterprise Park	Low	No
Wind Chime Lane	Low	2.77%

Critical Infrastructure in Hazard Areas

Critical infrastructure includes facilities that are important for disaster response and evacuation (such as emergency operations centers, fire stations, water pump stations, etc.) and facilities where additional assistance might be needed during an emergency (such as nursing homes, elderly housing, day care centers, etc.). These facilities are listed in Table 10 and are shown on all of the maps in Appendix B.

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

Explanation of Columns in Table 10

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

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

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

Column 4: Landslide Risk: The fourth column indicates the degree of landslide risk for that site. This information came from NESEC. The landslide information shows areas with either a low susceptibility or a moderate susceptibility to landslides based on mapping of geological formations. This mapping is highly general in nature. For more information on how landslide susceptibility was mapped, refer to http://pubs.usgs.gov/pp/p1183/pp1183.html.

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

> **Zone A** (1% annual chance) - Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study (FIS) by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs (base flood elevations) or depths are shown within this zone. Mandatory flood insurance purchase requirements apply.
>
> **Zone AE and A1-A30** (1% annual chance) - Zones AE and A1-A30 are the flood insurance rate zones that correspond to the 100-year floodplains that are determined in the FIS by detailed methods. In most instances, BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.
>
> **Zones X500** (.2% annual chance) - Zone X500 is the flood insurance rate zone that correspond to the 500-year floodplains that are determined in the Flood Insurance Study (FIS) by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no BFEs (base flood elevations) or depths are shown within this zone.
>
> **Zone VE** (1% annual chance) - Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply

Column 6: Locally-Identified Flood Area: The locally identified areas of flooding were identified by Town staff as areas where flooding occurs. These areas do not necessarily coincide with the flood zones from the FIRM maps. They may be areas that flood due to inadequate drainage systems or other local conditions rather than location within a flood zone. The numbers correspond to the numbers on Map 8, "Hazard Areas".

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

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

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

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

Table 10: Relationship of Critical Infrastructure to Hazard Areas

ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Category	Brushfire Risk
1	Fire Station # 1	Fire Station	Low susceptibility	No	No	0	No
2	Fire Station #2	Fire Station	Low susceptibility	No	No	0	No
3	Marshfield Fire Dept Busine	Fire Station	Low susceptibility	No	No	0	No
4	Marshfield Police Dept Busi	Police Department	Low susceptibility	No	No	0	No
5	Verizon Telephone Exchange	Telephone Exchange	Low susceptibility	No	No	0	No
9	Brant Rock Food Market	Food	Low susceptibility	AE	No	4	No
10	Shaw Market	Food	Low susceptibility	No	No	0	No
13	Chandlers Gas Co. Inc.	Fuel Depot (propane)	Low susceptibility	No	No	0	No
14	Prence Grant Apt	Eh Handicap	Low susceptibility	No	No	0	No
15	Winslow Village #1	Elderly Housing	Low susceptibility	No	No	0	No
16	Road To Responsibility Day Program	Special Needs	Low susceptibility	No	No	0	No
17	Winslow Village #2	Elderly Housing	Low susceptibility	No	No	0	No
18	Williams Coal & Oil Co.	Fuel Depot	Low susceptibility	No	No	0	No
19	Eames Way Elementery School	School	Low susceptibility	No	No	0	No
20	Marshfield	Elderly	Low	No	No		

Table 10: Relationship of Critical Infrastructure to Hazard Areas

ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Category	Brushfire Risk
	Housing Auth.	Housing	susceptibility			0	No
21	Road To Responsibility	Special Needs	Low susceptibility	AE	No	2	No
22	Martinson Elementary School	School	Low susceptibility	No	No	0	No
23	Marshfield Fair & Special Events	Gathering Area	Low susceptibility	No	No	0	No
25	Marshfield Emergency Management	EOC	Low susceptibility	No	No	0	No
26	South River Pumping Station	Water Pump Station	Low susceptibility	No	No	0	No
27	Radio Tower-carolina Hill	Police Comm Tower	Low susceptibility	No	No	0	No
28	Marshfield High School	School	Low susceptibility	No	No	0	No
29	Furnace Brook Middle School	School	Low susceptibility	No	No	0	No
30	Daniel Webster School	School	Low susceptibility	No	No	0	No
31	South River School	School	Low susceptibility	No	No	0	No
32	Gov Edward Winslow School	School Nuclear Plume Shelter	Low susceptibility	No	No	0	No
33	Steeple Day CareSchool	Day Care	Low susceptibility	No	No	0	No
34	Trailer Park Blackmans Point	Trailer Park	Low susceptibility	No	Splashover	0	No
35	Marshfield Town Hall	Town Hall	Low susceptibility	No	No	0	No

Table 10: Relationship of Critical Infrastructure to Hazard Areas

ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Category	Brushfire Risk
36	Post Office	Post Office	Low susceptibility	No	No	0	No
37	Ventress Library Public	Library	Low susceptibility	No	No	0	No
38	Damons Point Pond Dam	Dam	Low susceptibility	AE	No	4	No
39	Louis Pond Dam	Dam	Low susceptibility	AE	No	0	No
40	Wales Pond Dam	Dam	Low susceptibility	A	No	0	No
41	Little Pond Dam	Dam	Low susceptibility	No	No	0	No
42	Magoun Pond Dam	Dam	Low susceptibility	No	No	0	No
43	Oakman Pond Dam	Dam	Low susceptibility	A	No	0	No
44	Mounce Pond Dam	Dam	Low susceptibility	0.2 PCT ANNUAL CHANCE FLOOD HAZARD	No	2	No
45	Hatch Pond Dam	Dam	Low susceptibility	A	No	0	No
46	Chandlers Pond Dam	Dam	Low susceptibility	A	No	0	No
47	Daniel Webster Pond Dam	Dam	Low susceptibility	AE	No	4	No
48	Parsons Pond Dam	Dam	Low susceptibility	A	No	0	No
49	Furnace Pond Dam	Dam	Low susceptibility	No	No	0	No

Table 10: Relationship of Critical Infrastructure to Hazard Areas

ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Category	Brushfire Risk
50	Dyke Rd Dam	Dam	Low susceptibility	AE	No	1	No
51	Green Harbor Marina	Marina	Low susceptibility	AE	No	1	No
52	North River Bridge Rt 3A	Bridge	Low susceptibility	AE	No	1	No
53	Union Street Bridge	Bridge	Low susceptibility	AE	No	1	No
54	Erikson Marine	Marina	Low susceptibility	AE	No	1	No
55	Bridge Way Inn	Marina	Low susceptibility	0.2 PCT ANNUAL CHANCE FLOOD HAZARD	No	0	No
56	PD Radio Tower	Water Tower/ Not In	Low susceptibility	No	No	0	No
57	Marshfield Yacht Club	Marina	Low susceptibility	AE	No	1	No
59	Rand Handy Oil Co	Fuel Depot Oil	Low susceptibility	No	No	0	No
60	Rexhame General Food Store	Food	Low susceptibility	No	No	0	No
61	Grace Ryder Apartments	Elderly Housing	Low susceptibility	No	No	0	No
63	Green Harbor Yacht Club	Marina	Low susceptibility	AE	No	1	No
64	Marshfield Town Pier	Pier	Low susceptibility	AE	No	1	No
65	Taylor Marine	Marina	Low susceptibility	AE	No	0	No

Table 10: Relationship of Critical Infrastructure to Hazard Areas

ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Category	Brushfire Risk
66	Church Street Water Pumping Station	Water Pump Station	Low susceptibility	No	No	0	No
67	Ferry St Water Pumping Station	Water Pump Station	Low susceptibility	No	No	0	No
68	Furnace Brook # 1 Water Pumping Station	Water Pump Station	Low susceptibility	No	No	0	No
69	Furnace Brook # 3 Water Pumping Station	Water Pump Station	Low susceptibility	No	No	0	No
70	Furnace Brook # 2 Water Pumping Station	Water Pump Station	Low susceptibility	No	No	0	No
71	Water Treatment Facility	Water Pump Station	Low susceptibility	No	No	0	No
72	Water Pump Station Mt Skirgo Rd	Water Pump Station	Low susceptibility	No	No	0	No
73	Parsonage #1 Pump Station	Water Pump Station	Low susceptibility	No	No	0	No
74	Parsonage #2 Water Pump Station	Water Pump Station	Low susceptibility	No	No	0	No
75	School St Water Pumping Station	Water Pump Station	Low susceptibility	No	No	0	No
76	South River Water Pump Station	Water Pump Station	Low susceptibility	No	No	0	No
77	Spring St Water Pump	Water Pump Station	Low susceptibility	No	No	0	No

Table 10: Relationship of Critical Infrastructure to Hazard Areas

ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Category	Brushfire Risk
	Station						
78	Union #1 Water Pump Station	Water Pump Station	Low susceptibility	No	No	0	No
79	Union #2 Water Pump Station	Water Pump Station	Low susceptibility	No	No	0	No
80	Webster #1 Water Pump Station	Water Pump Station	Low susceptibility	No	No	0	No
81	Webster #2 Water Pump Station	Water Pump Station	Low susceptibility	No	No	0	No
82	Water Standpipe Forest St	Water Pump Station	Low susceptibility	No	No	0	No
83	Pudding Hill Lane Water Tank	Water Pump Station	Low susceptibility	No	No	0	No
84	Telegraph Hill Water Tank	Water Pump Station	Low susceptibility	No	No	0	No
85	Anderson Drive Waste Water Pump Station	Waste Water Pump Station	Low susceptibility	No	No	0	No
86	Avon Street Waste Water Pump Station	Waste Water Pump Station	Low susceptibility	AE	No	1	No
87	Central Street Waste Water Pump Station	Waste Water Pump Station	Low susceptibility	AE	No	1	No
88	Homestead Ave Waste Water Pump Station	Waste Water Pump Station	Low susceptibility	No	No	0	No
89	Macker Terrace Waste Water Pump Station	Waste Water Pump Station	Low susceptibility	AE	No	4	No
90	Waste Water Treatment Plant	Waste Water Treatment Plant	Low susceptibility	No	No	3	No

Table 10: Relationship of Critical Infrastructure to Hazard Areas

ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Category	Brushfire Risk
91	Waste Water Main Pump Station	Waste Water Pump Station	Low susceptibility	AE	No	2	No
92	St Annes Church	Church / Nuclear Plume Shelter	Low susceptibility	AO	No	0	No
93	Plymouth Avenue Wastewater Pump Station	Waste Water Pump Station	Low susceptibility	AE	No	2	No
94	Marshfield DPW Operations	Dpw Barn	Low susceptibility	No	No	0	No
95	Brant Rock Sea Wall	Sea Wall	Low susceptibility	VE	No	1	No
96	Bay Ave Sea Wall	Sea Wall	Low susceptibility	VE	No	0	No
97	Rexhame Sea Wall	Sea Wall	Low susceptibility	VE	No	2	No
98	Foster Ave Sea Wall	Sea Wall	Low susceptibility	VE	Splashover	1	No
99	Medflight	Heliport	Low susceptibility	No	No	0	No
100	Medflight	Heliport	Low susceptibility	No	No	0	No
101	Medflight	Heliport	Low susceptibility	No	No	0	No
102	Medflight	Heliport	Low susceptibility	No	No	0	No
103	Taylor Lumber Propane Storage	Fuel Depot	Low susceptibility	No	No	0	No
104	Mary's Boat Livery	Boat Yard	Low susceptibility	AE	No	1	No

Table 10: Relationship of Critical Infrastructure to Hazard Areas

ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Category	Brushfire Risk
105	Medflight	Heliport	Low susceptibility	No	Neptune Rd	0	No
106	Sea Street Bridge	Bridge	Low susceptibility	AE	No	0	No
107	Julians Street Bridge	Bridge	Low susceptibility	AE	No	0	No
108	Ridge Road Public Launch ramp	Boat Launch	Low susceptibility	AE	No	0	No
109	Funace Brook # 4 WPS	Water Pump Station	Low susceptibility	No	No	0	No
110	Shoreline Aviation / Town Airport	Airport	Low susceptibility	No	No	4	No
111	St Annes by the sea Shelter	Shelter	Low susceptibility	AO	No	0	No
112	Town of Marshfield Fuel Station	Fuel Depot	Low susceptibility	No	No	0	No
113	Prence Grant Elderly Housing	Elderly Housing	Low susceptibility	No	No	0	No
114	Marshfield Senior Center	Elderly Housing	Low susceptibility	No	No	0	No
116	Bay State Gas	Lng Storage Facility	Low susceptibility	No	No	0	No
117	WATD media/ Radio Station	Radio Tower	Low susceptibility	No	No	0	No
118	WATD media/ Fire Municipal Radio System	Radio Tower	Low susceptibility	No	No	0	No
119	Cherub Child Dev Center	Day Care	Low susceptibility	No	No	0	No
120	Childrens	Day Care	Low	No	No	0	No

Table 10: Relationship of Critical Infrastructure to Hazard Areas

ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Category	Brushfire Risk
	World		susceptibility				
121	Marshfield Rec Complex	Recreation	Low susceptibility	No	No	0	No
122	Marshfield HS Waste water Treatment Facility	Waste Water Treatment	Low susceptibility	No	No	0	No
124	CVS	Pharmacy	Low susceptibility	No	No	0	No
125	Rite Aid	Pharmacy	Low susceptibility	No	No	0	No
126	Gas Station	Gas Station	Low susceptibility	No	No	0	No
127	Sunoco Gas Station	Gas Station	Low susceptibility	No	No	0	No
128	Shell Gas Station	Gas Station	Low susceptibility	No	No	0	No
129	Hess Gas Station	Gas Station	Low susceptibility	No	No	0	No
130	Citgo Gas Station	Gas Station	Low susceptibility	No	No	0	No
131	Coastal Gas Station	Gas Station	Low susceptibility	AE	No	1	No
132	Ceder View Filling Station	Gas Station	Low susceptibility	No	No	0	No
133	Assumption Church	Church	Low susceptibility	No	No	0	No
134	Victory Baptist Church	Church	Low susceptibility	AO	No	0	No

Table 10: Relationship of Critical Infrastructure to Hazard Areas

ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Category	Brushfire Risk
135	First Congregation	Church	Low susceptibility	No	No	0	No
136	Marshfield United Methodist Church/ Sinegoge	Church	Low susceptibility	No	No	0	No
137	Pudding Hill Pre School	School	Low susceptibility	No	No	0	No
139	Jehovah Witness Kingdom Hall	Church	Low susceptibility	No	No	0	No
140	St Christeens Parish	Church	Low susceptibility	No	No	0	No
141	North Community Church	Church	Low susceptibility	No	No	0	No
142	Christian Science Church	Church	Low susceptibility	No	No	0	No
143	Trinity Episcopal	Church	Low susceptibility	No	No	0	No
144	St Teresas Church	Church	Low susceptibility	No	No	0	No
145	Industrial Comm. Cell Tower/Radio	Cell Tower	Low susceptibility	No	No	0	No
148	NSTAR Sub Station	Electric Sub Station	Low susceptibility	No	No	0	No
149	NSTAR Sub Station	Electric Sub Station	Low susceptibility	No	No	0	No
150	NSTAR Sub Station	Electric Sub Station	Low susceptibility	No	No	0	No
151	Comcast Studio	Satelite Comm	Low susceptibility	No	No	0	No

Table 10: Relationship of Critical Infrastructure to Hazard Areas

ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Category	Brushfire Risk
154	Beach Street Bridge	Bridge	Low susceptibility	AE	Green Harbor	1	No
155	Canal Street Bridge	Bridge	Low susceptibility	AE	No	1	No
156	Willow Street Bridge	Bridge	Low susceptibility	AE	No	0	No
157	Rt 3A South River Bridge	Bridge	Low susceptibility	A	Veteran's Park	0	No
158	Ocean Bluff Rip Rap Wall	Rip Rap	Low susceptibility	VE	Splashover	1	No
159	Brant Rock Rip Rap	Rip Rap	Low susceptibility	VE	Splashover	1	No
160	Coastguard Relay antenna	Cell Tower	Low susceptibility	No	No	0	No
161	Carolina Hill Water Tank	Water Tank	Low susceptibility	No	No	0	No
162	Ferry #2 Well	Well	Low susceptibility	No	No	0	No
163	Bridgeway E Marina	Marina	Low susceptibility	AE	No	2	No
164	Whites Ferry Marina	Marina	Low susceptibility	AE	No	2	No
165	Solid Waste Transfer Station	Tranfer Station	Low susceptibility	No	No	0	No
166	Timber Bulk Head	Bulk Head	Low susceptibility	VE	No	1	No
168	Hangar at Airport	Hangar	Low susceptibility	AE	No	2	No
169	Verizon switching	Switch station	Low susceptibility	No	No	0	No

Table 10: Relationship of Critical Infrastructure to Hazard Areas

ID	NAME	TYPE	Landslide Risk	FEMA Flood Zone	Locally-Identified Flood Area	Hurricane Surge Category	Brushfire Risk
	stations hard-line phones						
174	NSTAR Sub Station LAT 42.0458 LON -70.4140	Electric Sub Station	Low susceptibility	AE	No	4	No
175	NSTAR Sub Station 710 LAT 42.0886 LON -70.6544	Electric Sub Station	Low susceptibility	AE	No	2	No
176	Roach Brothers	Supermarket	Low susceptibility	No	No	0	No
182	Marshfield Library	Disaster Recovery Center	Low susceptibility	No	No	0	No
183	Monopole	Monopole	Low susceptibility	No	No	4	No
184	Emergency Reception Center	EOC	Low susceptibility	No	No	0	No
185	Road to Responsibility	Special Needs	Low susceptibility	AE	No	2	No
186	Daniel Webster House	Historical Cultural Site	Low susceptibility	No	No	0	No
187	Winslow House	Historical Cultural Site	Low susceptibility	No	No	0	No
188	Marcia Thomas	Historical Cultural Site	Low susceptibility	No	No	0	No
189	Seth Ventress Building	Historical Cultural Site	Low susceptibility	No	No	0	No

Damage Assessments

An estimation of damages was performed for hurricanes, earthquakes, and flooding. The methodology used for hurricanes and earthquakes was the HAZUS-MH software. The methodology for flooding was developed specifically to address the issue in many of the communities where flooding was not solely related to location within a floodplain.

Introduction to HAZUS-MH

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

> "HAZUS-MH is a nationally applicable standardized methodology and software program that contains models for estimating potential losses from earthquakes, floods, and hurricane winds. HAZUS-MH was developed by the Federal Emergency Management Agency (FEMA) under contract with the National Institute of Building Sciences (NIBS). Loss estimates produced by HAZUS-MH are based on current scientific and engineering knowledge of the effects of hurricane winds, floods and earthquakes. Estimating losses is essential to decision-making at all levels of government, providing a basis for developing and evaluating mitigation plans and policies as well as emergency preparedness, response and recovery planning.
>
> HAZUS-MH uses state-of-the-art geographic information system (GIS) software to map and display hazard data and the results of damage and economic loss estimates for buildings and infrastructure. It also allows users to estimate the impacts of hurricane winds, floods and earthquakes on populations."

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

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

However, for the purposes of this plan, the analysis is useful. This plan is attempting to only generally indicate the possible extent of damages due to certain types of natural disasters and to allow for a comparison between different types of disasters. Therefore, this analysis should be considered to be a starting point for understanding potential

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

Estimated Damages from Hurricanes

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

Though there are no recorded instances of a hurricane equivalent to a 500 year storm passing through Massachusetts, this model was included in order to present a reasonable "worst case scenario" that would help planners and emergency personnel evaluate the impacts of storms that might be more likely in the future, as we enter into a period of more intense and frequent storms.

Table 11
Estimated Damages from Hurricanes

	100 Year	500 Year
Building Characteristics		
Estimated total number of buildings	9,050	9,050
Estimated total building replacement value (Year 2002 $) (Millions of Dollars)	$2,291	$2,291
Building Damages		
# of buildings sustaining minor damage	1,654	3,389
# of buildings sustaining moderate damage	266	1,536
# of buildings sustaining severe damage	14	390
# of buildings destroyed	18	338
Population Needs		
# of households displaced	31	538
# of people seeking public shelter	7	110
Debris		
Building debris generated (tons)	4,315.52	28,232.28
Tree debris generated (tons)	15,300.48	50,190.72
# of truckloads to clear building debris	176	1,125
Value of Damages (Thousands of dollars)		
Total property damage	$35,901.47	$287,771,.10
Total losses due to business interruption	$3,614.50	$36,154.67

Estimated Damages from Earthquakes

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

Table 12
Estimated Damages from Earthquakes

	Magnitude 5.0	**Magnitude 7.0**
Building Characteristics		
Estimated total number of buildings	9,050	9,050
Estimated total building replacement value (Year 2002 $) (Millions of dollars)	$2,291	$2,291
Building Damages		
# of buildings sustaining slight damage	1,256	1,306
# of buildings sustaining moderate damage	313	3,547
# of buildings sustaining extensive damage	36	2,534
# of buildings completely damaged	4	1,439
Population Needs		
# of households displaced	18	1,810
# of people seeking public shelter	3	364
Debris		
Building debris generated (tons)	Not available	Not available
Value of Damages (Millions of dollars)		
Total property damage	$94.40	$1,358.13
Total losses due to business interruption	$3.31	$99.82

Estimated Damages from Flooding

MAPC did not use HAZUS-MH to estimate flood damages in Marshfield. In addition to technical difficulties with the software, the riverine module is not a reliable indicator of flooding in areas where inadequate drainage systems contribute to flooding even when those structures are not within a mapped flood zone. In lieu of using HAZUS, MAPC developed a methodology to give a rough approximation of flood damages.

Marshfield is 28.64 square miles or 18,326.81 acres. Approximately 240.21 acres have been identified by local officials as areas of flooding. This amounts to 1.31 % of the land area in Marshfield. The number of structures in each flood area was estimated by applying the percentage of the total land area to the number of structures (9,050) in Marshfield; the same number of structures used by HAZUS for the hurricane and earthquake calculations. HAZUS uses a value of $253,105.30 per structure for the building replacement value in Marshfield. This was used to calculate the total building replacement value in each of the flood areas. The calculations were done for a low estimate of 10% building damages and a high estimate of 50% as suggested in the FEMA September 2002 publication, "State and Local Mitigation Planning how-to guides" (Page 4-13). The range of estimates for flood damages is $3,076,251.87- $15,381,259.35. These calculations are not based solely on location within the floodplain or a particular type of storm (i.e. 100 year flood).

Table 13
Estimated Damages from Flooding

ID	Flood Hazard Area	Approximate Area in Acres	% of Total Land Area in Marshfield	# of Structures	Replacement Value	Low Estimate of Damages	High Estimate of Damages
1	Brant Rock	10.54	.06	5.4	$1,374,361.78	$137,436.18	$687,180.89
2	Bass Creek / Fieldston	23.94	.13	11.8	$2,977,783.85	$297,778.39	$1,488,891.93
3	Splashover	105.49	.58	52.5	$13,285,497.20	$1,328,549.72	$6,642,748.60
4	Rexhame Beach	63.34	.35	31.7	$8,017,110.38	$801,711.04	$4,008,555.19
5	Neptune Road	15.27	.08	7.2	$1,832,482.37	$183,248.24	$916,241.19
6	Damons Point	3	.02	1.8	$458,120.59	$45,812.06	$229,060.30

Table 13
Estimated Damages from Flooding

ID	Flood Hazard Area	Approximate Area in Acres	% of Total Land Area in Marshfield	# of Structures	Replacement Value	Low Estimate of Damages	High Estimate of Damages
7	Green Harbor	11.47	.06	5.4	$1,374,361.78	$137,436.18	$687,180.89
8	Veteran's Park	2.06	.01	.9	$229,060.30	$22,906.03	$114,530.15
9	Ocean St & South River	5.09	.03	2.7	$687,180.89	$68,718.09	$343,590.44
Totals		***240.21***	***1.31***	***118.6***	***$30,006,898.84***	***$3,000,689.88***	***$15,003,449.42***

V. HAZARD MITIGATION GOALS

The Marshfield Local Multiple Hazard Community Planning Team met on August 18, 2010. At that meeting, the team reviewed and discussed the goals from the 2005 Hazard Mitigation Plan for the Town of Marshfield. Reflective of Town staff's increasing knowledge and familiarity with hazard mitigation planning and the potential impacts of natural hazard events on Marshfield, the local committee modified Goal 6 to emphasize the regional nature of coastal erosion issues and added Goal 10.

The following ten goals were endorsed by the Committee for the 2010 update of the Marshfield Hazard Mitigation Plan:

1. Ensure that critical infrastructure sites are protected from natural hazards.

2. Protect existing residential and business areas from flooding.

3. Maintain existing mitigation infrastructure in good condition.

4. Continue to enforce existing zoning and building regulations.

5. Educate the public about zoning and building regulations, particularly with regard to changes in regulations that may affect tear-downs and new construction.

6. Work with surrounding communities to ensure regional cooperation and solutions for hazards affecting multiple communities such as coastal erosion.

7. Encourage future development in areas that are not prone to natural hazards.

8. Educate the public about natural hazards and mitigation measures.

9. Make efficient use of public funds for hazard mitigation.

10. Protect the Town's ability to respond to various natural hazard events.

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VI. HAZARD MITIGATION STRATEGY

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

What is Hazard Mitigation?

Hazard mitigation means to permanently reduce or alleviate the losses of life, injuries and property resulting from natural hazards through long-term strategies. These long-term strategies include planning, policy changes, education programs, infrastructure projects and other activities. FEMA currently has three mitigation grant programs: the Hazards Mitigation Grant Program (HGMP), the Pre-Disaster Mitigation program (PDM), and the Flood Mitigation Assistance (FMA) program. The three links below provide additional information on these programs.

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

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

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

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

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

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

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

Existing Mitigation Measures

Existing Multi-Hazard Mitigation Measures

Comprehensive Emergency Management Plan (CEMP) – Every community in Massachusetts is required to have a Comprehensive Emergency Management Plan. These plans address mitigation, preparedness, response and recovery from a variety of natural and man-made emergencies. These plans contain important information regarding flooding, hurricanes, tornadoes, dam failures, earthquakes, and winter storms. Therefore, the CEMP is a mitigation measure that is relevant to all of the hazards discussed in this plan.

Communications Equipment – The Town has an array of communications equipment that would assist public safety efforts during a natural hazard event. The Town is currently upgrading this system, which includes a Town owned tower at Pleasant Street and facilities on two other privately owned towers. Another Town owned tower is planned as well as a repeater at the Brant Rock fire station.

Emergency Power Generators – Emergency power generators can be found in a number of Town buildings. These generators serve to protect government functionality during and immediately after a natural hazard event and also serve the operation of emergency shelters. Locations include: Town Hall, Police/EOC, Central Fire Station, Council on Aging Building, DPW Building, Governor Winslow School, Furnace Brook School, South River School, Daniel Webster School, High School, Martinson School, Eames Way School, and the School Administration Building.

Massachusetts State Building Code – The Massachusetts State Building Code contains many detailed regulations regarding wind loads, earthquake resistant design, flood-proofing, and snow loads.

Regional Emergency Management Planning Committee (REPC) – Marshfield is a member of a regional emergency planning committee together with Kingston, Duxbury, and Plymouth.

Public Information & Outreach – The Town provides information to residents and business owners relating to a range of potential natural hazards, most especially with regard to flooding, hurricanes, and northeasters.

Existing Flood Hazard Mitigation Measures

National Flood Insurance Program (NFIP) – Marshfield participates in the NFIP with 1,359 policies in force as of the May 31, 2010. FEMA maintains a database on flood insurance policies and claims. This database can be found on the FEMA website at http://www.fema.gov/business/nfip/statistics/pcstat.shtm
The following information is provided for the Town of Marshfield:

Flood insurance policies in force (as of May 31, 2010)	1,359
Coverage amount of flood insurance policies	$295,378,600
Premiums paid	$1,587,446
Total losses (all losses submitted regardless of the status)	1,266
Closed losses (Losses that have been paid)	1,058
Open losses (Losses that have not been paid in full)	1
CWOP losses (Losses that have been closed without payment)	207
Total payments (Total amount paid on losses)	$13,566,199.47

The Town complies with the NFIP by enforcing floodplain regulations, maintaining up-to-date floodplain maps, and providing information to property owners and builders regarding floodplains and building requirements.

Since the 2005 plan, the policies in force have increased by 210 and the total losses have increased by 95. The total payments, as of December 21, 2004, were $12,503,630.53, approximately $1 million less than the most recent figure.

CRS Program Participation – The Town of Marshfield participates in the Community Rating System (CRS) program, gaining a reduction in flood insurance rates for property owners in the Town in exchange for mitigation actions taken to reduce the Town's potential vulnerability to flooding. The program functions on a rating system, with an individual community's rating being based on the number of points they receive, with points allocated for each flood mitigation measure enacted. The Town of Marshfield currently has a rating of Class 8, resulting in a 10% reduction in flood insurance rates in the Town.

Public Works Operations/Maintenance Activities – The Public Works Department actively maintains the Town's storm drain system. The following specific activities serve to maintain the capability of the drainage system through the reduction of sediment and litter build up and proper maintenance and repair.

- *Street sweeping* – Street sweeping is conducted twice annually.

- *Catch basin cleaning* – 3013 catch basins cleaned annually (some biannually as needed).

- *Roadway treatments* – Calcium Chloride is used for snow/ice treatment.

Floodplain Management Plan – Coupled with the 1994 Management Plan, the 1996 Flood Plain Management Plan collected all existing flood mitigation measures into one document, identified new potential measures, and re-affirmed the importance of pro-active action with regard to flooding in the Town of Marshfield.

The Townscape Plan: A Comprehensive Plan for the Town of Marshfield – Given Marshfield's coastal location, natural hazard mitigation ideas and strategies are referenced in the plan. These references include identification of coastal flood protection infrastructure as a critical issue calling for enhanced maintenance and repair and the recommendation that the Town research storm damage mitigation.

Conservation/Recreation Open Space Plan – An element of the Townscape Plan, the Open Space Plan includes recommendations related to the acquisition of land in the Green Harbor Reclamation Area, which has a history of flooding. There are already 800 acres of protected land in this area; the plan calls for a total of 900 acres. When this plan is updated, contributions to Natural Hazard Mitigation should be added to the criteria used to identify potential land for conservation.

Floodplain Zoning District – Zoning is intended to protect the public health and safety through the regulation of land use. The Marshfield Zoning Bylaw includes a Floodplain District (Article XV). The purposes of this district are:

A. Protect human life and health and minimize danger to emergency response officials in the event of flooding;
B. Minimize expenditure of public money for flood control projects and emergency response and clean up;
C. Reduce damage to public and private property and utilities resulting from flooding waters and debris; and
D. Ensure that the Town of Marshfield qualifies for participation in the National Flood Insurance Program.

The Floodplain District is an overlay district, defined by the 100-year floodplain as designated by FEMA. Within the District, the following requirements must be met:

- Lowest floor or basement of any new or substantially improved commercial or residential structure to be elevated to at least one foot above the base flood elevation level;

- All utilities to be located and constructed at or above base flood elevation to reduce or eliminate flood damage;
- No basements constructed below the base flood elevation for new and substantially improved residential structure;
- No land alterations resulting in increased runoff to detriment of other properties;
- Flood proofing for fuel oil, toxic or hazardous materials stored below the base flood elevation
- In V zones, all new constructions within V Zones shall be located landward of the reach of mean high tide;
- In V zones, proper elevation of new construction and substantial improvements on anchored pilings or columns.
- In V zones, unobstructed areas or breakaway walls under the lowest floor;
- In V zones, no fill for structural support of buildings; and,
- In V zones, no alteration of coastal dunes.
- In V zones, no encroachments in floodways.

Subdivision Rules and Regulations - The Marshfield Subdivision Rules and Regulations contains provisions intended to reduce the impacts of floods and erosion. Through its design and layout standards, the bylaws contribute to the Town's overall efforts to mitigate the risks for damage through flooding. Some of the contributing provisions include the following:

- Grading standards for maintaining the natural topography;
- Drainage plan standards which enhance natural drainage systems;
- Watershed-level storm drainage analysis for developments in excess of 50 dwelling units;
- Drainage design analysis for all proposed developments that mitigate the 10, 25 and 100 year storm events;
- No increase in stormwater runoff volume from pre-development to post-development conditions.
- Vegetative buffers of 30-50' separating proposed structures and detention/siltation structures, and point source stormwater discharges.
- Standards for acceptable storm water runoff velocities (2-10 ft/second range).
- Guidelines for limiting disturbed areas to no more than 50' wide, 100' long, and 20% of a single lot, or five acres of the overall tract.
- Best management practices for stormwater management.

Wetlands Protection By-Law – The purpose of the Wetlands Protection By-Law (Article 37) is to further protect the Town's shores, ponds, rivers, and wetlands for, among other reasons, flood control, erosion and sedimentation control, and public safety. The by-law builds on the State Wetlands Protection Act offering more stringent controls over dredging and filling activities. Any activity that might fill or otherwise alter these resource areas requires a permit from the Marshfield Conservation Commission.

Coastal Wetlands Zoning District - The Coastal Wetlands District (section 13.02) is an overlay district established for the following purposes:

- Protecting the health and safety of residents whose lands are subject to seasonal or periodic tidal flooding;
- Preservation of salt marshes and tidal flats (thereby maintaining their functions of drainage and flood control, as well as filtration of contaminants); and,
- Maintaining the purity of water and the safe operation of utilities subject to damage in floods.

The Zoning Bylaws allow for wastewater treatment facilities, water works, pumping stations and parks as permitted uses. However, the district regulations prohibit the following uses:

- Structures intended for permanent occupancy and having water or sewerage facilities (except for alterations to grandfathered uses);
- Dumping, filling, excavating or transferring of any earth material;
- No ponds, pools or changes in water courses unless through issuance of a Special Permit.

Further, provisions under this bylaw require that not more than 20% of the lot area needed to meet minimum area requirements of the zoning district be within the Coastal Wetlands District.

Inland Wetlands Zoning District - In terms of general purpose and intent, The Inland Wetlands District (section 13.01) is similar to the Coastal Wetlands District. In addition to its goals of preserving streams and rivers and conserving sensitive watershed areas, this wetlands district overlay is intended to "protect the health and safety of persons and property against the hazards of flooding and contamination." The district includes principally areas containing soils that drain poorly. The district regulations are less restrictive than those in the coastal areas are. Key development requirements are as follows:

- Special permit for structures intended for human occupancy or use on a permanent basis, and having water and sewage facilities;
- Special permit for dumping, filling, and excavating of earth material; and,
- Special permit for creation of ponds or pools and for changes to watercourses.

In addition to the special permit requirements, the following key development conditions apply to projects within the Inland Wetlands District:

- Floor level of area to be occupied by human beings as living or working space needs to be 4 feet above the seasonal high water table and not subject to periodic flooding;

- If basement is below the seasonal high water table and affords possibility of human occupancy at some future date, adequate perimeter drainage and foundation are to be installed, and furnace and utilities are to be protected from the effects of leaching;
- Provision of safe and adequate means of vehicular and pedestrian passage in the event of flooding; and,
- If lot is served by an on-lot septic system, the leaching areas are to be constructed in areas where the maximum groundwater elevation is less than four feet below the bottom of the leaching area.

Stormwater Management Overlay District – The Stormwater Management Overlay District is intended to limit impervious surfaces and stormwater run-off in a designated area north of the South River. By promoting infiltration of storm water where it lands, the potential for flooding can be reduced.

DCR dam safety regulations – The state has enacted dam safety regulations mandating inspections and emergency action plans. All new dams are subject to state permitting.

Elevating Repetitive Loss Properties - The Town, through a Coastal Advisory Committee, administered a grant program to assist homeowners with elevating their homes. The homeowner was responsible for 25% of the cost of the work. A FEMA Hazard Mitigation Grant funded much of this work.

Seawalls, Jetties, and Dikes - The Town of Marshfield coastline is protected by a series of seawalls, jetties and dikes. Studies of this protection system have indicated that repairs are necessary.

Existing Wind Hazard Mitigation Measures

CEMP – The Marshfield Comprehensive Emergency Management Plan contains a section on hurricanes. It lists five generic mitigation measures:

- Develop and disseminate emergency public information and instructions concerning hurricane preparedness and safety.
- Community leaders should ensure that Marshfield is enrolled in the National Flood Insurance Program.
- Develop and enforce local building codes to enhance structural resistance to high winds and flooding. Build new construction in areas that are not vulnerable to direct hurricane effects.
- Make informed decisions concerning protecting natural attributes such as beaches and dunes with breakwaters and sea walls. Review National Flood Insurance Rate Maps and Hurricane Evacuation Maps for possible impact on the community.
- Maintain plans for managing all hurricane emergency response activities.

The CEMP includes a map of areas of hurricane vulnerability. This area is essentially the coastal area from South River to Green Harbor bounded by Plain, Ferry and River Streets.

The Marshfield CEMP outlines three generic mitigation measures for tornadoes.

- Develop and disseminate emergency public information and instructions concerning tornado safety, especially guidance regarding in-home protection and evacuation procedures, and locations of public shelters.
- Strict adherence should be paid to building code regulations for all new construction.
- Maintain plans for managing tornado response activities. Refer to the non-institutionalized, special needs and transportation resources listed in the Resource Manual.

Mobile Home Zoning – The zoning bylaw does not allow mobile homes that are traditionally very vulnerable to wind damage. There is one non-conforming trailer park that predates the zoning bylaw. Approximately 30 trailers were seriously damaged in the 1991 storm and were condemned.

Massachusetts State Building Code – The town enforces the Massachusetts State Building Code whose provisions are generally adequate to protect against most wind damage. The code's provisions are the most cost-effective mitigation measure against tornados given the extremely low probability of occurrence. If a tornado were to occur, the potential for severe damages would be extremely high.

Public Education – The Town's Emergency Coordinator distributes a publication entitled" Against the Wind: Protecting Your Home from Hurricane Wind Damage" to interested homeowners.

Tree-trimming program – The electric and telephone utilities trim branches near the electric lines while Town staff maintain trees in other areas.

Existing Winter Storm Hazard Mitigation Measures

Snow disposal –The town conducts general snow removal operations with its own equipment and has adequate space for snow storage as needed.

Existing Geologic Hazard Mitigation Measures

Massachusetts State Building Code – The State Building Code contains a section on designing for earthquake loads (780 CMR 1612.0). Section 1612.1 states that the purpose of these provisions is "to minimize the hazard to life to occupants of all buildings and non-building structures, to increase the expected performance of higher occupancy structures as compared to ordinary structures, and to improve the capability of essential facilities to function during and after an earthquake". This section goes on to state that due to the complexity of seismic design, the criteria presented are the minimum

considered to be "prudent and economically justified" for the protection of life safety. The code also states that absolute safety and prevention of damage, even in an earthquake event with a reasonable probability of occurrence, cannot be achieved economically for most buildings.

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

Existing Other Hazard Mitigation Measures

Burn Permits – The Town fire department requires a written permit for outdoor burning, which includes explanation of the related regulations and precautions for the permit-holder to take. The permit-holder must call the fire department on the proposed burn day to confirm weather conditions are suitable for outdoor burning.

Subdivision/Development Review – The Fire Department participates in the review of new subdivisions and development projects.

Public Education - The Fire Department has a public education program aimed at educating school children. The Fire Department Webpage (www.marshfieldfire.org) has a link to a fire prevention tip page.

Table 14- Marshfield Existing Mitigation Measures			
Type of Existing Mitigation Measures	**Area Covered**	**Effectiveness/ Enforcement**	**Improvements/ Changes Needed**
MULTIPLE HAZARDS			
Comprehensive Emergency Management Plan (CEMP)	Town-wide.	Emphasis is on emergency response.	None.
Communications Equipment	Town-wide.	Effective	Further funding needed.
Massachusetts State Building Code	Town-wide.	Effective for new construction.	None.
Emergency Power Generators	Town-wide.	Effective.	Upgrade generators as needed; provide generators at additional locations; provide alternative fuel sources and generator power source flexibility.
Participation in the Regional Emergency Planning Committee (REPC)	Town-wide.	A forum for cooperation on natural and manmade disasters.	None.
Public Information & Outreach	Town-wide		
FLOOD HAZARDS			
Participation in the National Flood Insurance Program (NFIP)	Areas identified on the FIRM maps.	There are 1,359 policies in force.	Encourage all eligible homeowners to obtain insurance.
CRS Program Participation	Town-wide	Class 8	Seek more CRS points.
Public Works Operations/Maintenance Activities	Town-wide.	Effective.	
Floodplain Management Plan	Town-wide		
Townscape Plan	Town-wide		Include a new section on Climate Change in the next update.
Open Space Plan	Town-wide		

Table 14- Marshfield Existing Mitigation Measures			
Type of Existing Mitigation Measures	**Area Covered**	**Effectiveness/ Enforcement**	**Improvements/ Changes Needed**
Zoning – Floodplain District	Town-wide.	Effective for new construction.	
Subdivision Rules and Regulations	Town-wide		
Wetlands Protection By-Law	Resource Areas	Effective	
Coastal Wetlands Zoning District	Resource Areas		
Inland Wetlands Zoning District	Resource Areas		
Stormwater Management Overlay District	Area north of South River		
DCR Dam Safety Regulations	Dams	Effective	
Elevating Repetitive Loss Properties	Repetitive Loss Properties		Apply for funding to re-institute this program.
Seawalls, Jetties, and Dikes	Coastline		Major improvements needed towards repair and maintenance. Additional funding required. Create new committee to address.
WIND HAZARDS			
CEMP	Town-wide		
Mobile Home Zoning	Town-wide		
The Massachusetts State Building Code	Town-wide.	Effective for most situations except severe storms	None.
Public Education	Town-wide		
Tree trimming program	Town-wide.	Satisfactory.	
WINTER HAZARDS			
Snow Disposal Site			
GEOLOGIC HAZARDS			

Table 14- Marshfield Existing Mitigation Measures			
Type of Existing Mitigation Measures	**Area Covered**	**Effectiveness/ Enforcement**	**Improvements/ Changes Needed**
The Massachusetts State Building Code	Town-wide.	Effective.	None.
OTHER HAZARDS			
Burn Permit	Town-wide.	Effective.	None.
Development Review	Town-wide.	Effective.	None.
Public Education	Town-wide		

Implementation Progress on Previous Plans

At a meeting of the Marshfield Hazard Mitigation Committee, Town staff reviewed the mitigation measures identified in the 2005 South Shore Regional Pre-Disaster Mitigation Plan Marshfield Annex and determined whether each measure had been implemented or deferred. For implemented projects, they were categorized as either complete or in-process, with the latter referring to projects begun but not yet completed. In-process measures are carried forward into the 2013 Marshfield Hazard Mitigation Plan Update. Of those measures that had been deferred, the committee evaluated whether the measure should be deleted or carried forward into the 2013 Marshfield Hazard Mitigation Plan Update. The decision on whether to delete or retain a particular measure was based on the committee's assessment of the continued relevance or effectiveness of the measure and whether the deferral of action on the measure was due to the inability of the Town to take action on the measure.

Table 15
Mitigation Measures from the 2005 Plan

Mitigation Measures	Priority	Implementation Responsibility	2011 Status
Stormwater drainage system - cleaning and repairs	High	DPW	In-process (This highly necessary task will never be complete but Town staff will continue to implement according to need, funding, and manpower)
Stormwater Drainage system improvements	High	DPW	In-process (Several specific improvements have been completed but more are needed and new ones identified following floods)
Bass Creek Drainage area	High	DPW	In-process (Phase I Complete)
Tidegate management plan	Medium	DPW	Implemented
Bridge and Roadway Management Plan	Medium	DPW, & Planning	Implemented
Sea wall Master Plan	Medium	DPW	Implemented

Table 15
Mitigation Measures from the 2005 Plan

Mitigation Measures	Priority	Implementation Responsibility	2011 Status
Sump pump by-law	Medium	DPW, & Planning, Building department	Implemented
Saltmarsh restoration	High	Conservation Commission	In-process (Restoration projects are completed as funding is available or through requirements placed on permit applicants under the wetlands protection regulations)
Development of an up to date GIS system	Medium	DPW, Planning, & IT	Implemented
Up to date drainage map	Low	DPW & IT	Implemented
Dam Master plan	Medium	Planning, Conservation Commission	In-process (Implementation has begun, more time needed)
Well Head Protection	Medium	DPW, Planning	In-process (Need more time and funding to support this program)
Stormwater By-law with slope regulations	Medium	DPW, Planning, Conservation Commission	Implemented
Update WWTF Procedures / I & I	Low	DPW	In-process (Completed as time and funding are available)
Acquisition of Repetitive Loss Properties	Medium	Conservation Commission	Deferred (Lack of funding)
Acquisition of Vacant Flood-prone Lands	Medium	Conservation Commission	Deferred (Lack of funding)
Amend the Zoning Bylaw – Development in V Zones	Medium	Planning Board	Delete (No support for the proposed regulation)

Table 15
Mitigation Measures from the 2005 Plan

Mitigation Measures	Priority	Implementation Responsibility	2011 Status
Amend the Zoning Bylaw – Sea Level Rise	Medium	Planning Board	Implemented
Amend Zoning Bylaw – Communications Towers	High	Planning Board	Delete (New building codes for these structures makes this amendment unnecessary)
Severe Cold Temperature Plan	Medium	School Department with Marshfield EMA	Implemented
Public Education	Low	Fire Department	In-process (The Town maintains good hazard education materials and updates these as necessary)

The Town of Marshfield has been very active in pursuing implementation of measures from the Hazard Mitigation Plan. Most of the identified measures have been implemented or begun and Town staff do a good job of advancing these measures to the benefit of Town residents and businesses.

Further information on the status of several of the projects listed above can be found in the mitigation measure descriptions following.

Regional and Inter-Community Considerations

Some hazard mitigation issues are strictly local. The problem originates primarily within the municipality and can be solved at the municipal level. Other issues are inter-community issues that involve cooperation between two or more municipalities in a local area. There is a third level of mitigation which is regional; involving a state, regional, or federal agency concerning an issue that involves numerous municipalities across a wide area of the metropolitan region.

Inter-Community Considerations

Shoreline Environment – The coastal shoreline of the South Shore area is a dynamic environment where forces of erosion and deposition of sand are constantly at work changing the beach profile. This process disregards municipal boundaries as sand and other materials are moved along the coast. Shoreline protection measures such as sea

walls, jetties, and others have an impact on this process with the potential of building up sand in some areas while striping it away from others. Municipalities along the South Shore should work to understand how these processes are at work locally and consider mutually beneficial means of protecting their shore side communities from the impacts of storm damage.

Regional Issues

Climate Change and Sea Level Rise – The entirety of Massachusetts's coastal environment faces potential risk from Climate Change and associated sea level rise. Models incorporating current trends indicate a gradual rise in global temperature, with a consequent increase in the volume of water in the world's ocean due to thermal expansion as the water warms and the addition of water from melting ice sheets and glaciers. Projections for sea level rise by the end of this century range from four to 33 inches. Higher temperatures and higher sea levels will result in a greater frequency and intensity of storms and higher flood levels.

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

Regional Partners - In many communities, mitigating natural hazards, particularly flooding, is more than a local issue. The drainage systems that serve these communities are a complex system of storm drains, roadway drainage structures, pump stations and other facilities owned and operated by a wide array of agencies including but not limited to the Town of Marshfield, the Department of Conservation and Recreation (DCR), and Massachusetts Department of Transportation (MDOT). The planning, construction, operations, and maintenance of these structures are integral to the flood hazard mitigation efforts of communities. These agencies must be considered the communities regional partners in hazard mitigation. These agencies also operate under the same constraints as communities do, including budgetary and staffing constraints and numerous competing priorities. In the sections that follow, the plan includes recommendations for activities where cooperation with these other agencies may be necessary. Implementation of these recommendations will require that all parties work together to develop solutions.

Proposed Hazard Mitigation Measures

Flood Hazard Mitigation Measures

A) Sea Wall Repair, Maintenance, & Upgrade: Based on the recommendations of the reports issued on the status of Marshfield's sea walls, create a strategy for annual predictable funding for on-going sea wall repair and maintenance. Establish a system for documentation of repair and maintenance activities. Seek opportunities to fund individual sea wall upgrade projects that will address the potential for rising sea levels and increased storm intensity. The Board of Selectmen is forming a Shore Front Protection Committee to guide this process.

B) Elevate Repetitive Loss Structures: Re-constitute the grant program to assist property owners with repetitive loss structures in elevating their homes. In the previous program the homeowner was responsible for 25% of the cost of the work. Consider applying this program to commercial structures as well.

C) Dyke Road Bridge: The Dyke Road Bridge serves both to connect the villages of Brant Rock and Green Harbor and as a flood control structure, protecting the Green Harbor River marsh from tidal salt-water inundation and homes along the eastern side of this marsh from tide driven flooding. The bridge itself also serves as an important emergency evacuation route for Brant Rock residents. Town engineers believe tides and flooding are undermining the bridge, which is 70 to 80 years old. This mitigation measure would include both an engineering study of the bridge and the steps necessary to structurally enhance the bridge and its flood control capabilities.

D) Stormwater Drainage System – Cleaning & Repairs: Continue to clean all catch basins, manholes, and drop-inlets; clean/snake all clogged lines; rebuild defective and broken drainage structures. This measure increases the effectiveness of existing stormwater infrastructure, promoting drainage.

E) Stormwater Drainage System Improvements: Continue to implement improvements in targeted areas prone to flooding such as the Rexham area, Brant Rock, Peregrine, White Drive, Rugani Avenue, Forest Street, South River Street, Snow Road, and other areas identified as local areas of concern for flooding. Install new catch basins as needed.

F) Bass Creek Drainage Area: Continue to implement drainage system improvements to more effectively move drainage into Bass Creek from the Fieldston area. Increase the capacity of drainage pipes and catch basins in the area.

G) Saltmarsh Restoration: Continue to restore salt marshes in the Polder area to their original condition by addressing the Phragmites invasion and creating additional natural flood storage areas. This work is primarily carried out as part of mitigation for other projects impacting wetlands in the area. The Town will continue to look for opportunities to advance wetland restoration in this area.

H) Well Head Protection: Install new stormwater management infrastructure to protect against storm water pollution of the wellheads of the towns public water supply in the Forest Street and Ferry Street area.

I) Acquisition of Repetitive Loss Properties: Consider acquisition of repetitive loss properties.

J) Townscape Plan Update: Include a section on Climate Change and its potential impacts on Marshfield in the next update of the Townscape Plan.

K) Update WWTF Procedures / I & I: Continue the process of updating operating procedures of the wastewater treatment facility to address and mitigate Inflow and Infiltration.

Measures to Ensure Compliance with NFIP

L) Floodplain Management: Continue to enforce the Floodplain Zoning District (Article XV) and associated building regulations for floodplain areas. Update this district to remain consistent with FEMA guidelines and floodplain mapping.

M) Floodplain Mapping: Maintain up to date maps of local FEMA identified floodplains.

N) Acquisition of Vacant Flood Prone Lands: Acquire priority open space parcels in floodplain areas in order to maintain flood storage and water infiltration capacity. These parcels may also be used for general conservation and recreation purposes.

Wind Hazard Mitigation Measures

The Local Hazard Mitigation Committee did not identify any additional hazard mitigation measures in this category beyond existing mitigation measures, which were deemed to be adequate given the risks and vulnerabilities presented.

Winter Storm Hazard Mitigation Measures

The Local Hazard Mitigation Committee did not identify any additional hazard mitigation measures in this category beyond existing mitigation measures, which were deemed to be adequate given the risks and vulnerabilities presented.

Geologic Hazard Mitigation Measures

O) Public Building Assessments: Assess the earthquake vulnerability of all public buildings.

Other Natural Hazards

The Local Hazard Mitigation Committee did not identify any additional hazard mitigation measures in this category beyond existing mitigation measures, which were deemed to be adequate given the risks and vulnerabilities presented.

Multi-Hazard Mitigation Measures

P) Emergency Power Generators: Upgrade all emergency power generators in emergency shelters and critical facilities as needed; provide alternative fuel sources and generator power source flexibility.

Q) Public Education: Continue efforts at public education addressing all potential natural hazards in Marshfield. Take advantage of existing State and Federal public information materials that can be made available to residents and businesses in the Town. Continue to reach out specifically to residents and businesses in areas particularly prone to flooding and provide them with information on steps they can take to reduce their vulnerabilities to property damage during flood events. Use public education efforts around hazard preparedness to build support for efforts to implement hazard mitigation measures.

Prioritization of Mitigation Activities

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

The decisions on priorities were made at a meeting of the local committee. Priority setting was based on local knowledge of the hazard areas, including impacts of hazard events and the extent of the area impacted and the relation of a given mitigation measure to the Town's identified goals. In addition, MAPC asked the local committee to take into consideration factors such as the number of homes and businesses affected, whether or not road closures occurred and what impact closures had on delivery of emergency services and the local economy, anticipated project costs, whether the town currently had the technical and administrative capability to carry out the mitigation measures, whether any environmental constraints existed, and whether the town would be able to justify the costs relative to the anticipated benefits.

The table below demonstrates the prioritization analysis. For each mitigation measure, municipal staff identified the geographic extent of the potential benefiting area, estimated an overall benefit in terms of High, Medium or Low, a cost as outlined above in terms of High (greater than $50,000), Medium ($10,000 to $49,000), or Low (less than $10,000 or staff time), and based on these factors, prioritized each mitigation measure as High,

Medium or Low. The level of benefit created by a project was based on an estimate of the number of homes, businesses, or people served by the mitigation action and an estimate of the costs or damages avoided via implementation of the mitigation measure. Where a more exact estimate of cost was know, this number was used instead. With this assessment, the Committee was able to identify an approximate timeframe in which the municipality would attempt to complete the mitigation measure.

Table 16 Mitigation Measure Prioritization

Mitigation Action	Geographic Area	Benefit	Estimated Cost	Priority	Time Frame
Flood Hazard Mitigation Measures					
A) Sea Wall Repair, Maintenance, & Upgrades	Ocean Coastline	High	High	High	2013-2017
B) Elevate Repetitive Loss Structures	Repetitive Loss Areas	High	High	High	2013-2017
C) Dyke Road Bridge	Green Harbor River	High	High $70,000	High	2013-2014
D) Stormwater Drainage System—Cleaning & Repair	Town-wide	High	High (Annual)	High	2013-2017
E) Stormwater Drainage System Improvements	Identified Target Areas	High	High	High	2013-2017
F) Bass Creek Drainage Area	Fieldston Area	High	Medium	High	2013-2017
G) Saltmarsh Restoration	Polder Area	Medium	Low	High	2013-2017
H) Well Head Protection	Town Wellheads	High	High	High	2013-2017
I) Acquisition of Repetitive Loss Properties	Repetitive Loss Areas	High	High	Medium	2013-2017
J) Townscape Plan Update	Town-wide	Low	Low	Medium	2013-2014

Table 16 Mitigation Measure Prioritization					
Mitigation Action	**Geographic Area**	**Benefit**	**Estimated Cost**	**Priority**	**Time Frame**
K) Update WWTF Procedures / I&I	Town-wide	Medium	Low	Medium	2013-2017
L) Floodplain Management	Floodplain	High	Low	High	2013-2017
M) Floodplain Mapping	Floodplain	High	Low	High	2013-2017
N) Acquisition of Vacant Flood Prone Lands	Floodplain	High	High	High	2013-2017
Geologic Hazard Mitigation Measures					
O) Public Building Assessment	Public Buildings	Medium	Low	Medium	2013-2017
Multi-Hazard Mitigation Measures					
P) Emergency Power Generators	Critical Facilities	High	High	High	2013-2017
Q) Public Education	Town-wide	Medium	Low	High	2013-2017

Introduction to Potential Mitigation Measures (Table 17)

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

Hazard Area – Each mitigation measure is intended to address one or more of the natural hazard potentially impacting Marshfield, such as Flooding, Wind, Fire, and Earthquake. Where the proposed measure is intended to address a specific locally identified area of concern, this area is identified as well.

Description of the Mitigation Measure – The description of each mitigation measure is brief and cost information is given only if cost data were already available from the community. The cost data represent a point in time and would need to be adjusted for inflation and for any changes or refinements in the design of a particular mitigation measure.

Measure Type – There are six different types of pre-disaster mitigation measures identified by FEMA for which a community may apply for Hazard Mitigation funding.

Implementation Responsibility – The designation of implementation responsibility was done by MAPC based on a general knowledge of what each municipal department is responsible for. It is likely that most mitigation measures will require that several departments work together and assigning staff is the sole responsibility of the governing body of each community.

Time Frame – The time frame was based on a combination of the priority for that measure, the complexity of the measure and whether or not the measure is conceptual, in design, or already designed and awaiting funding. Because the time frame for this plan is five years, the timing for all mitigation measures has been kept within this framework. The identification of a likely time frame is not meant to constrain a community from taking advantage of funding opportunities as they arise.

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

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

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

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

United States Department of Agriculture – The USDA has programs by which communities can get grants for firefighting needs. See the link below for some example.

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

Abbreviations Used in Table 17

FEMA Mitigation Grants includes:
- FMA = Flood Mitigation Assistance Program.
- HMGP = Hazard Mitigation Grant Program.
- PDM = Pre-Disaster Mitigation Program

ACOE = Army Corps of Engineers.

MHD = Massachusetts Highway Department.

EOT = Executive Office of Transportation.

DCR = Department of Conservation and Recreation

DHS/EOPS = Department of Homeland Security/Emergency Operations

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

USDA = United States Department of Agriculture

Table 17
Marshfield Potential Mitigation Measures

Mitigation Measure	Measure Type	Implementation Responsibility	Priority	Time Frame	Potential Funding Sources
Flood Hazard Mitigation Measures					
A) Sea Wall Repair, Maintenance, & Upgrades	Structural Projects	DPW	High	2013-2017	ACOE / Marshfield
B) Elevate Repetitive Loss Structures	Property Protection	Planning, Emergency Management	High	2013-2017	FEMA
C) Dyke Road Bridge	Structural Projects	DPW, Emergency Management	High	2013-2014	FEMA / Marshfield
D) Stormwater Drainage System—Cleaning & Repair*	Structural Projects	DPW	High	2013-2017	Marshfield
E) Stormwater Drainage System Improvements*	Structural Projects	DPW	High	2013-2017	Marshfield
F) Bass Creek Drainage Area*	Structural Projects	DPW	High	2013-2017	Marshfield
G) Saltmarsh Restoration*	Natural Resource Protection	Conservation Commission	High	2013-2017	Marshfield
H) Well Head Protection*	Structural Projects	DPW, Planning	High	2013-2017	Marshfield
I) Acquisition of Repetitive Loss Properties*	Property Protection	Emergency Management, Planning	Medium	2013-2017	FEMA
J) Townscape Plan Update	Prevention & Public Education	Planning	Medium	2013-2014	Marshfield

Table 17
Marshfield Potential Mitigation Measures

Mitigation Measure	Measure Type	Implementation Responsibility	Priority	Time Frame	Potential Funding Sources
K) Update WWTF Procedures / I&I	Structural Projects	DPW	Medium	2013-2017	Marshfield
L) Floodplain Management	Preventive	Planning	High	2013-2017	Marshfield
M) Floodplain Mapping	Public Education	Planning	High	2013-2017	Marshfield
N) Acquisition of Vacant Flood Prone Lands*	Natural Resource Protection	Conservation Commission	High	2013-2017	Marshfield / DCR / Community Preservation Act
Geologic Hazard Mitigation Measures					
O) Public Building Assessment	Property Protection	Building Department, DPW	Medium	2013-2017	Marshfield
Multi-Hazard Mitigation Measures					
P) Emergency Power Generators	Emergency Services Protection	Emergency Management	High	2013-2017	FEMA / Marshfield
Q) Public Education*	Public Education	Emergency Management	High	2013-2017	Marshfield

* Mitigation measures carried forward from the 2005 Marshfield Hazard Mitigation Plan.

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VII. PLAN ADOPTION AND MAINTENANCE

Plan Adoption

The Marshfield Hazard Mitigation Plan Update was adopted by the Board of Selectmen on September 17, 2012. See Appendix D for documentation. The plan was approved by FEMA on April 22, 2013 for a five-year period that will expire on April 22, 2018. See Approval letter in Appendix E.

Plan Maintenance

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

Implementation Schedule

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

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

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

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

At this point, the Hazard Mitigation Implementation Team may decide to undertake the update themselves, contract with the Metropolitan Area Planning Council to update the

plan or to hire another consultant. However the Hazard Mitigation Implementation Team decides to update the plan, the group will need to review the current FEMA hazard mitigation plan guidelines for any changes. The update of the Marshfield Hazard Mitigation Plan will be forwarded to MEMA and DCR for review and to FEMA for approval.

Integration of the Plans with Other Planning Initiatives

Upon approval of the Marshfield Hazard Mitigation Plan by FEMA, the Local Hazard Mitigation Implementation Team will provide all interested parties and implementing departments with a copy of the plan and will initiate a discussion regarding how the plan can be integrated into that department's ongoing work. At a minimum, the plan will be reviewed and discussed with the following departments:

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

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

VIII. LIST OF REFERENCES

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

Town of Marshfield, General By-laws.

Town of Marshfield, Zoning Bylaw

The Townscape Plan: A Comprehensive Plan for the Town of Marshfield, 1998 (Updated 2005).

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

FEMA, Local Multi-Hazard Mitigation Planning Guidance; July 1, 2008.

FEMA, Flood Insurance Rate Maps for Marshfield, MA, 2010

Metropolitan Area Planning Council, Geographic Information Systems Lab

Metropolitan Area Planning Council, Regional Plans and Data

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APPENDIX A
MEETING AGENDAS

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Don Boyce
DIRECTOR

Richard Sullivan
COMMISSIONER

Marc D. Draisen
EXECUTIVE DIRECTOR

SOUTH SHORE HAZARD MITIGATION PLANNING TEAM

Braintree
Cohasset
Hingham
Hull
Marshfield
Milton
Quincy
Randolph
Scituate
Weymouth

THE COMMONWEALTH OF MASSACHUSETTS

Deval Patrick, Governor

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

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

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

South Shore Hazard Mitigation Planning Team

First Meeting

Tuesday, February 9, 10:00 AM

McCulluch Building
(Whipple Senior Center)
Weymouth, MA
(See map & directions attached)

AGENDA

10:00 WELCOME & INTRODUCTIONS

10:05 OVERVIEW OF HAZARD MITIGATION PLANNING & GRANTS

- State Hazard Mitigation Plan & FEMA Grants–Sarah White, MEMA
- Regional & Local Mitigation Plans - Martin Pillsbury, MAPC

10:20 UPDATING THE SOUTH SHORE HAZARD MITIGATION PLAN

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

10:50 GETTING STARTED: MAPPING AND CRITICAL FACILITIES DATABASE FOR THE SOUTH SHORE PLAN UPDATE

- Chris Brown, GIS Analyst, MAPC

11:15 NEXT STEPS / ADJOURN

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

Meeting Agenda
Local Multiple Hazard Community Planning Team
Marshfield, MA

August 18, 2010 10:00 AM - 12:00 PM
Marshfield Town Hall, 870 Moraine Street

---

1. Overview of Project Scope and Status. Chapter I

2. Introduce Marshfield Hazard Mitigation Planning map series and digitized ortho photo. Identify Flood and Fire Hazard Areas and areas of future potential development. Ch III & Appendix B

3. Review and Assess Plan Goals. Ch IV

4. Review Existing Mitigation Measures. Ch V

5. Review Mitigation Measures from the 2005 Plan. Ch VI

6. Discuss Potential Mitigation Measures. Ch VII

7. Prioritize Mitigation Measures. Ch VII

8. Discuss Public Involvement and Outreach. Ch II

9. Next steps: 1) Finalize mitigation measures; 2) submit draft plan to Work Group for comment; 3) submit draft to MEMA and FEMA

Project Overview - MAPC received a grant to update *Hazard Mitigation Plans* for the communities of Braintree, Cohasset, Hingham, Hull, Marshfield, Milton, Quincy, Randolph, Scituate, and Weymouth. MAPC is working with the ten communities to update plans to mitigate potential damages of natural hazards such as floods, winter storms, hurricanes, earthquakes, and wild fires, before such hazards occur. The federal *Disaster Mitigation Act of 2000* requires that all municipalities adopt a *Pre-Disaster Mitigation Plan* for natural hazards and update those plans every five years, in order to remain eligible for FEMA Hazard Mitigation Grants.

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

APPENDIX B
HAZARD MAPPING

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

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

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

Map1: Population Density – This map uses the US Census block data for 2000 and shows population density as the number of people per acre in seven categories with 60 or more people per acre representing the highest density areas.

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

Map 3: Flood Zones – The map of flood zones used the FEMA NFIP Flood Zones as its source. For more information, refer to the FEMA Map Service Center website http://www.msc.fema.gov. The definitions of the flood zones are described in detail on this site as well. The flood zone map for each community also shows critical infrastructure and municipally owned and protected open space.

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

The landslide information shows areas with either a low susceptibility or a moderate susceptibility to landslides based on mapping of geological formations. This mapping is

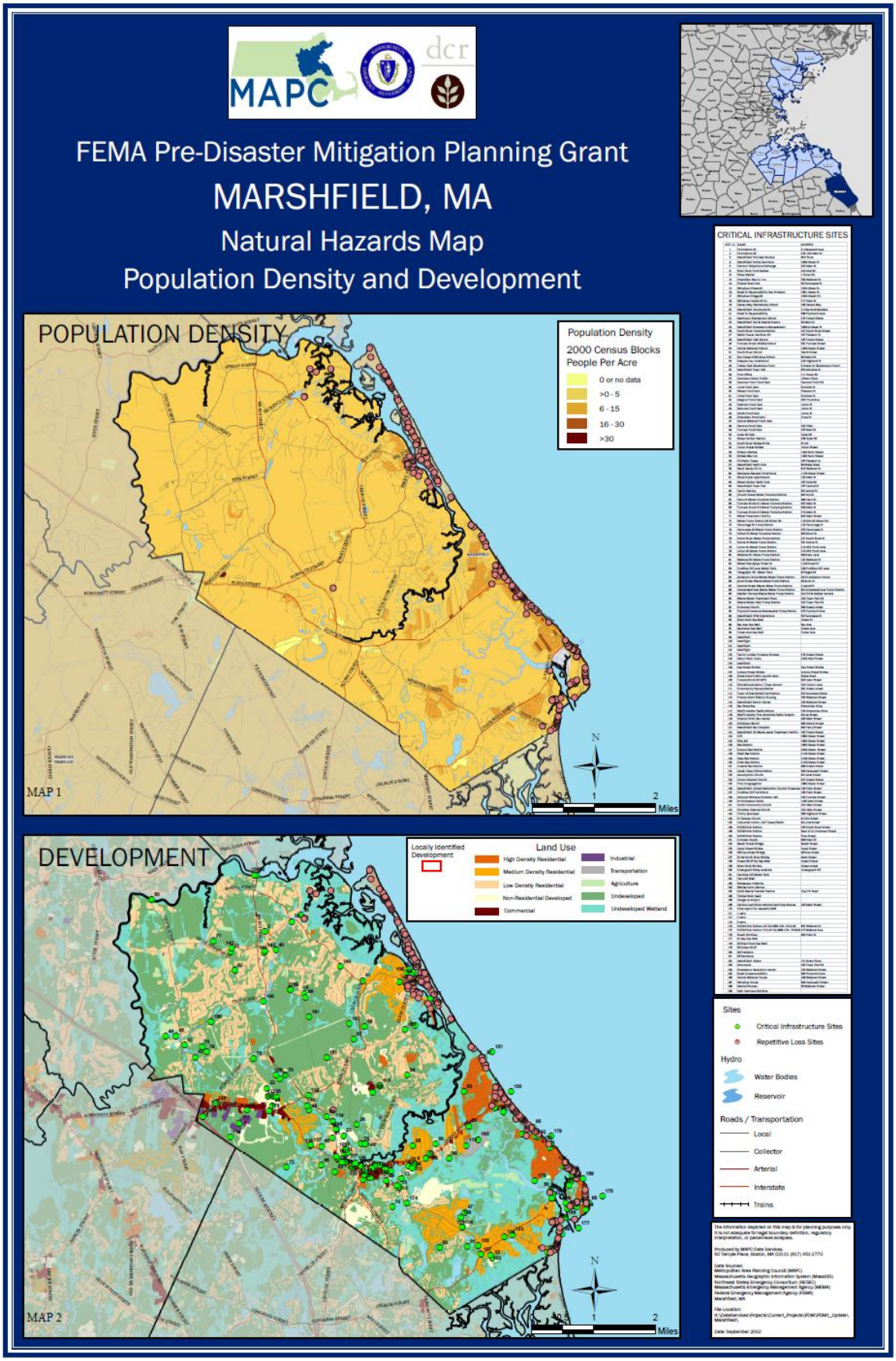
highly general in nature. For more information on how landslide susceptibility was mapped, refer to http://pubs.usgs.gov/pp/p1183/pp1183.html.

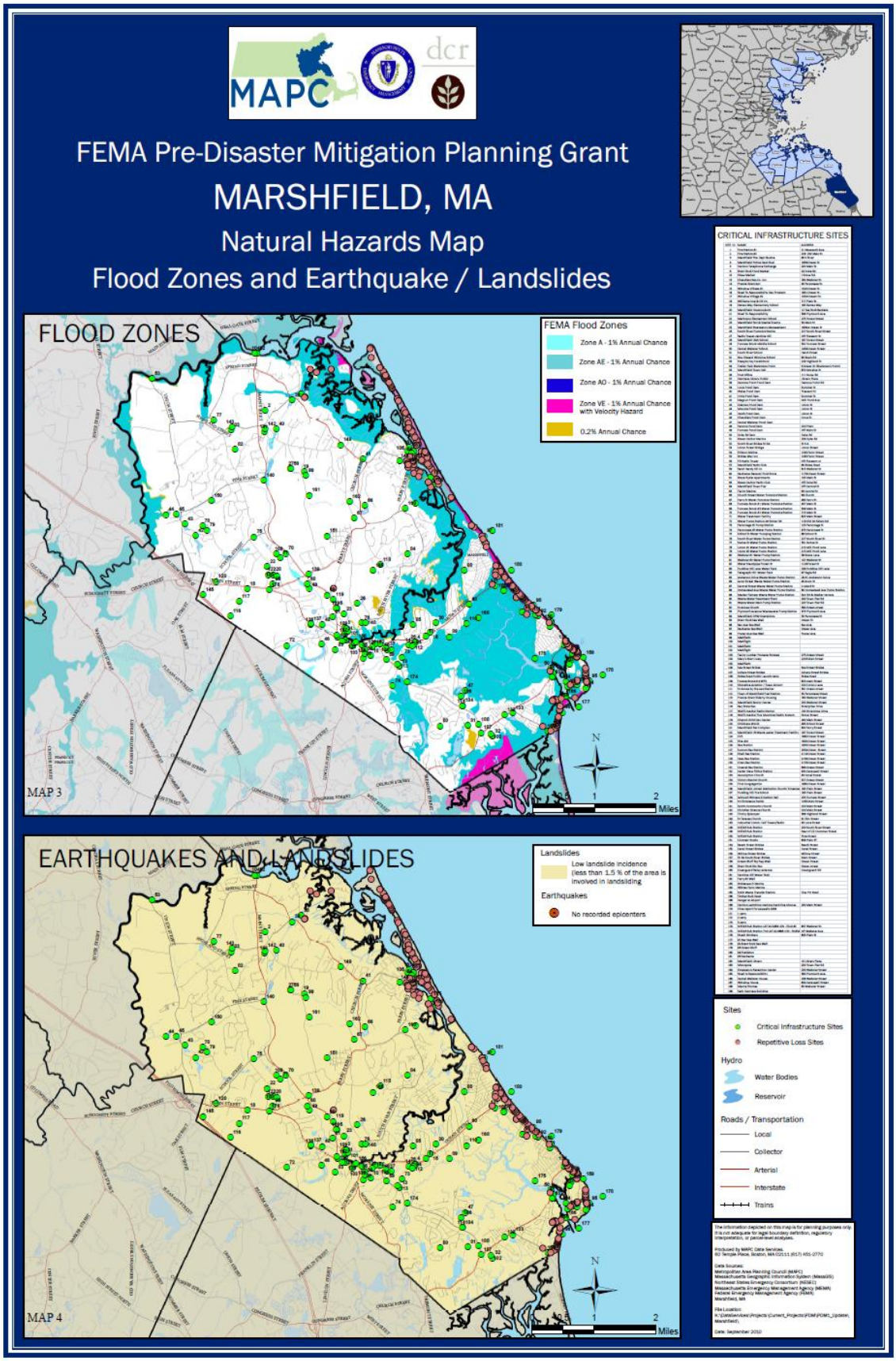
Map 5: Hurricanes and Tornadoes – This map shows a number of different items. The map includes the storm tracks for both hurricanes and tropical storms. This information must be viewed in context. A storm track only shows where the eye of the storm passed through. In most cases, the effects of the wind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

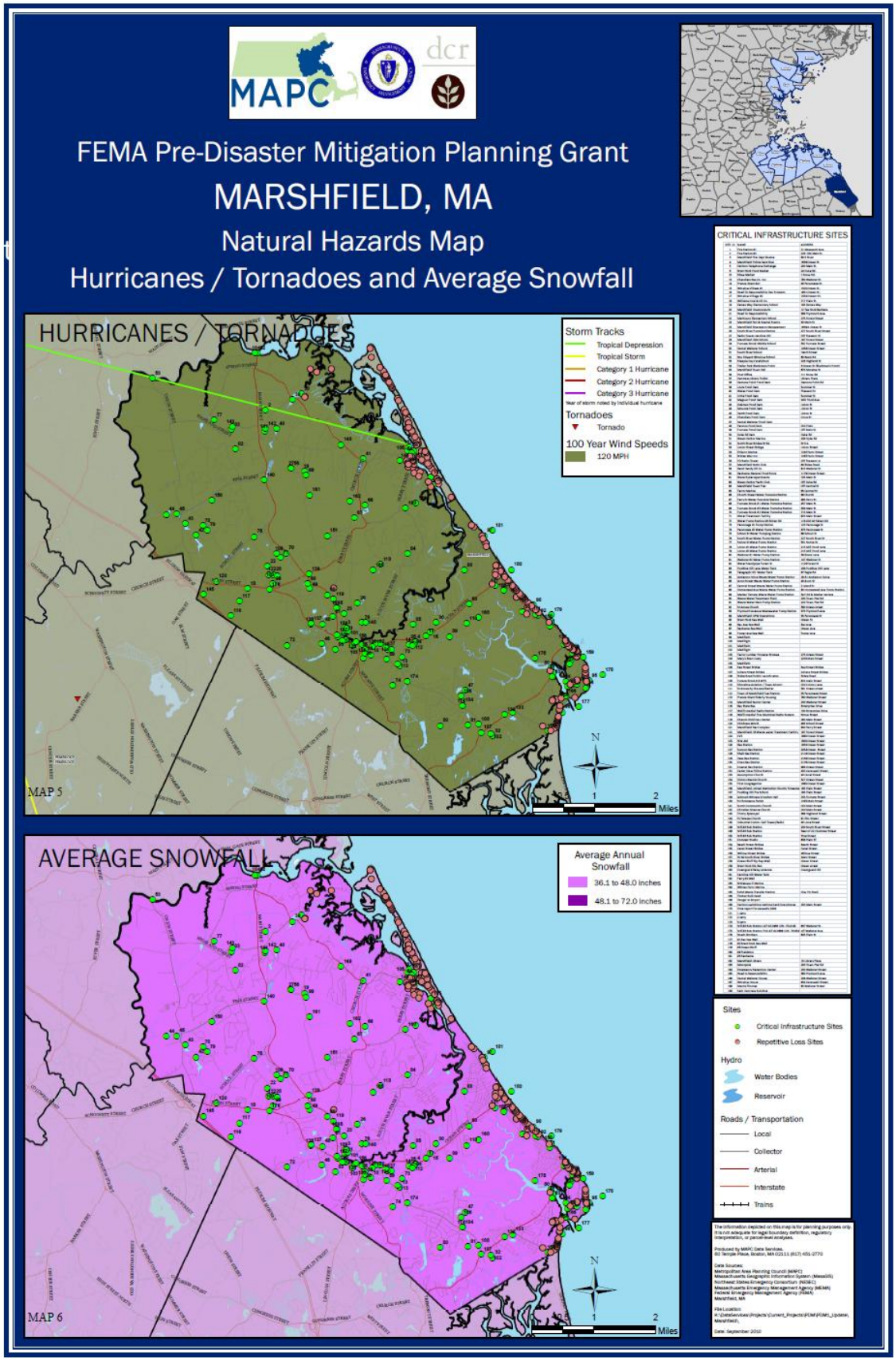
Map 6: Average Snowfall - - This map shows the average snowfall and open space. It also shows storm tracks for nor'easters, if any storms tracked through the community.

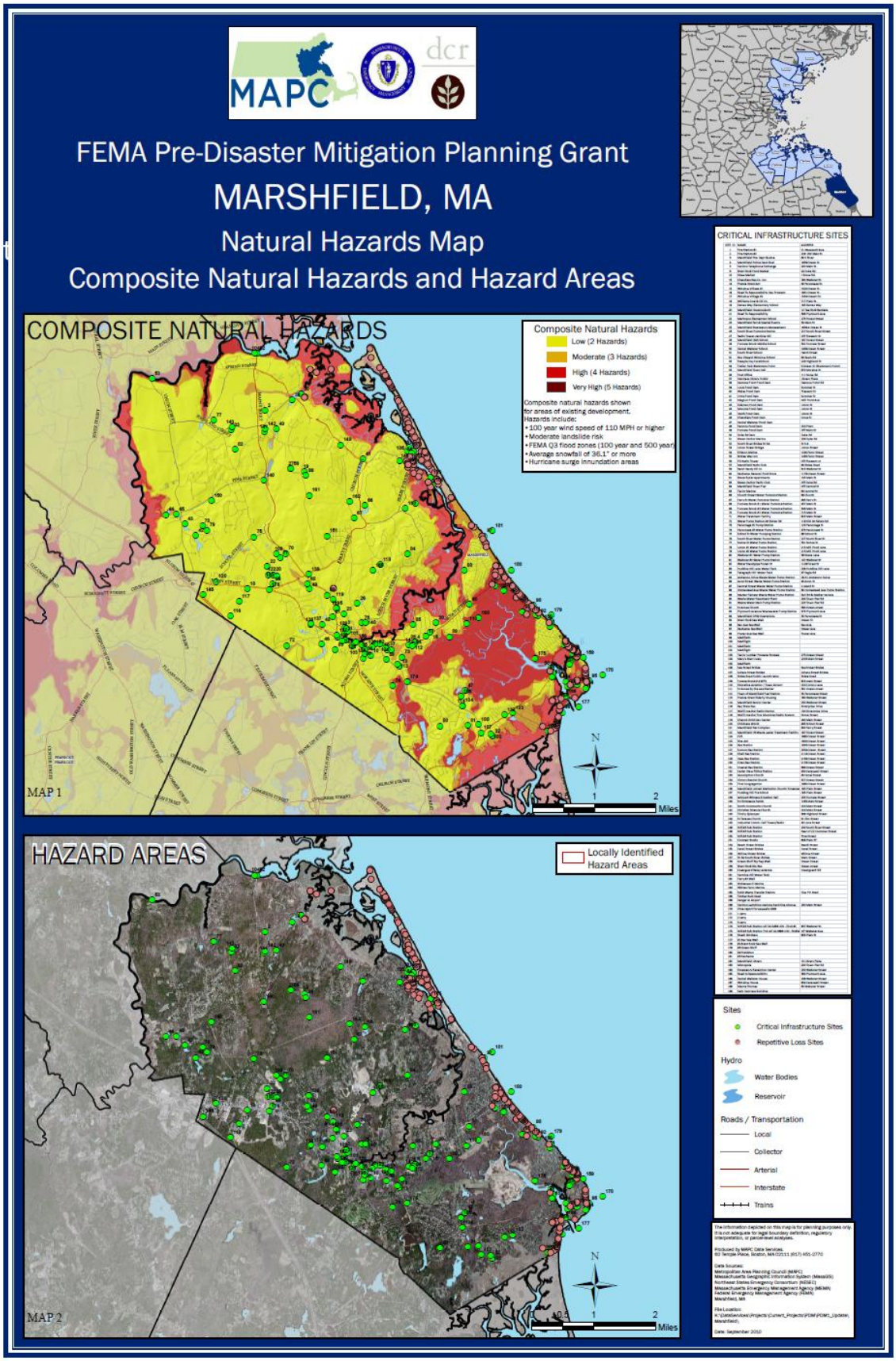
Map 7: Composite Natural Hazards - This map shows four categories of composite natural hazards for areas of existing development. The hazards included in this map are 100 year wind speeds of 110 mph or higher, low and moderate landslide risk, FEMA Q3 flood zones (100 year and 500 year) and hurricane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

Map 8: Hazard Areas – For each community, locally identified hazard areas are overlaid on an aerial photograph dated April, 2008. The critical infrastructure sites are also shown. The source of the aerial photograph is Mass GIS.


MAPC
dcr
FEMA Pre-Disaster Mitigation Planning Grant
MARSHFIELD, MA
Natural Hazards Map
Population Density and Development
POPULATION DENSITY
Population Density
2000 Census Blocks
People Per Acre
0 or no data
>0 - 5
6 - 15
16 - 30
>30
MAP 1
N
0 0.5 1 2
Miles
DEVELOPMENT
Locally Identified Development
Land Use
High Density Residential
Medium Density Residential
Low Density Residential
Non-Residential Developed
Commercial
Industrial
Transportation
Agriculture
Undeveloped
Undeveloped Wetland
MAP 2
N
0 0.5 1 2
Miles
CRITICAL INFRASTRUCTURE SITES
Sites
Critical Infrastructure Sites
Repetitive Loss Sites
Hydro
Water Bodies
Reservoir
Roads / Transportation
Local
Collector
Arterial
Interstate
Trains


MAPC
dcr
FEMA Pre-Disaster Mitigation Planning Grant
MARSHFIELD, MA
Natural Hazards Map
Flood Zones and Earthquake / Landslides
FLOOD ZONES
FEMA Flood Zones
Zone A - 1% Annual Chance
Zone AE - 1% Annual Chance
Zone AO - 1% Annual Chance
Zone VE - 1% Annual Chance with Velocity Hazard
0.2% Annual Chance
MAP 3
N
1
2
Miles
EARTHQUAKES AND LANDSLIDES
Landslides
Low landslide incidence (less than 1.5 % of the area is involved in landsliding
Earthquakes
No recorded epicenters
MAP 4
CRITICAL INFRASTRUCTURE SITES
Sites
Critical Infrastructure Sites
Repetitive Loss Sites
Hydro
Water Bodies
Reservoir
Roads / Transportation
Local
Collector
Arterial
Interstate
Trains


MAPC
dcr
FEMA Pre-Disaster Mitigation Planning Grant
MARSHFIELD, MA
Natural Hazards Map
Hurricanes / Tornadoes and Average Snowfall
HURRICANES / TORNADOES
Storm Tracks
Tropical Depression
Tropical Storm
Category 1 Hurricane
Category 2 Hurricane
Category 3 Hurricane
Year of storm noted by individual hurricane
Tornadoes
Tornado
100 Year Wind Speeds
120 MPH
MAP 5
N
0 0.5 1 2
Miles
AVERAGE SNOWFALL
Average Annual Snowfall
36.1 to 48.0 inches
48.1 to 72.0 inches
MAP 6
CRITICAL INFRASTRUCTURE SITES
Sites
Critical Infrastructure Sites
Repetitive Loss Sites
Hydro
Water Bodies
Reservoir
Roads / Transportation
Local
Collector
Arterial
Interstate
Trains


MAPC
dcr
FEMA Pre-Disaster Mitigation Planning Grant
MARSHFIELD, MA
Natural Hazards Map
Composite Natural Hazards and Hazard Areas
COMPOSITE NATURAL HAZARDS
Composite Natural Hazards
Low (2 Hazards)
Moderate (3 Hazards)
High (4 Hazards)
Very High (5 Hazards)
Composite natural hazards shown for areas of existing development.
Hazards include:
• 100 year wind speed of 110 MPH or higher
• Moderate landslide risk
• FEMA Q3 flood zones (100 year and 500 year)
• Average snowfall of 36.1" or more
• Hurricane surge inundation areas
MAP 1
N
0 0.5 1 2 Miles
HAZARD AREAS
Locally Identified Hazard Areas
MAP 2
N
0 0.5 1 2 Miles
CRITICAL INFRASTRUCTURE SITES
Sites
Critical Infrastructure Sites
Repetitive Loss Sites
Hydro
Water Bodies
Reservoir
Roads / Transportation
Local
Collector
Arterial
Interstate
Trains

APPENDIX C
DOCUMENTATION OF PUBLIC PARTICIPATION

Board of Selectmen

Monday, September 13, 2010 at 7:30 PM
Selectmen's Hearing Room

AGENDA

ANNOUNCEMENT
Meeting is being recorded

TOWN ADMINISTRATOR BRIEF

APPOINTMENTS

7:45 P.M.	Matt's Auto Service – Class II License
8:00 P.M.	Paul Taber – Hazard Mitigation Plan
8:15 P.M.	DAV, Chapter 35 – Update on status of Manager

ACTION ITEMS

1) Marshfield Chamber of Commerce – One Day Entertainment License
2) North Community Church – One Day Entertainment License
3) Designation of Special Municipal Employees
4) Block Party – Aunt Lizzie's Lane

DISCUSSION

1) Community Preservation Committee Appointment

ACCEPTANCE OF MINUTES
August 23, 2010

EXECUTIVE SESSION

1) Step III Grievance Hearing
2) Step III Grievance Hearing
3) Collective Bargaining Negotiations

Marshfield Town Hall

870 Moraine St., Marshfield, MA 02050

Board of Selectmen

Monday, December 13, 2010 at 7:30 PM
Seth Ventress Hall

AGENDA

ANNOUNCEMENT

Meeting is being recorded

TOWN ADMINISTRATOR BRIEF

APPOINTMENTS

7:45 P.M. Paul Taber – Hazard Mitigation Plan

ACTION ITEMS

1) Vote on Seasonal Population
2) Renewal of Annual Package Store Licenses
3) Renewal of Annual Common Victualler Licenses
4) Renewal of Annual Class II Licenses
5) Renewal of Sunday Entertainment Licenses
6) Requests for Extension of Hours on New Years Eve
7) Reappointment of Constables
8) Marshfield Fire Department – Permission to Accept Donation
9) DPW – Authorization to Borrow
10) New Appointment to Capital Budget Committee

ACCEPTANCE OF MINUTES

November 29, 2010; December 3, 2010; and December 6, 2010

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APPENDIX D
DOCUMENTATION OF PLAN ADOPTION

Rocco J. Longo
Town Administrator

Town of Marshfield

Board of Selectmen
870 Moraine Street
Marshfield, Massachusetts 02050
Tel: 781-834-5563 Fax: 781-834-5527

CERTIFICATE OF ADOPTION
BOARD OF SELECTMEN
TOWN OF MARSHFIELD, MASSACHUSETTS

A RESOLUTION ADOPTING THE TOWN OF MARSHFIELD
HAZARD MITIGATION PLAN

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

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

WHEREAS, a duly-noticed public meeting was held by the BOARD OF SELECTMEN on December 13, 2010, and

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

NOW, THEREFORE BE IT RESOLVED that the Town of Marshfield BOARD OF SELECTMEN adopts the Hazard Mitigation Plan, in accordance with M.G.L. 40 §4 or the charter and bylaws of the Town of Marshfield.

ADOPTED AND SIGNED this Date: 9/17/12

BOARD OF SELECTMEN

Matthew J. McDonough, Chairman

Stephen G. Robbins, Vice Chairman

John E. Hall, Clerk

ATTEST

APPENDIX E

FEMA Plan Approval Letter

U.S. Department of Homeland Security
FEMA Region I
99 High Street, 6th Floor
Boston, MA 02110

FEMA

April 22, 2013

Matthew J. McDonough, Selectboard Chair
Marshfield Board of Selectmen
Town of Marshfield
870 Maraine Street
Marshfield, MA 02050

Dear Mr. McDonough:

Thank you for the opportunity to review the Town of Marshfield, MA Hazard Mitigation Plan. The Department of Homeland Security (DHS), Federal Emergency Management Agency (FEMA) Region I has evaluated the plan for compliance with 44 CFR Part 201. The plan satisfactorily meets all of the mandatory requirements set forth by the regulations. Congratulations on this achievement!

With this plan approval, the Town is eligible to apply to Massachusetts Emergency Management Agency for mitigation grants administered by FEMA. Requests for mitigation funding will be evaluated individually according to the specific eligibility requirements of each of these programs. A specific mitigation activity or project identified in your community's plan may not meet the eligibility requirements for FEMA funding, and even eligible mitigation activities are not automatically approved.

Approved mitigation plans are eligible for points under the National Flood Insurance Program's Community Rating System (CRS). Complete information regarding the CRS can be found at ***www.fema.gov/business/nfip/crs.shtm*** or through your local floodplain manager.

The Town's Hazard Mitigation Plan must be reviewed, revised as appropriate, and resubmitted to FEMA for approval within **five years of the plan approval date of March 29, 2013** in order to maintain eligibility as an applicant for mitigation grants. Over the next five years, we encourage the Town to continue updating the plan's assessment of vulnerability, adhere to its maintenance schedule, and begin implementing, when possible, the mitigation actions proposed in the plan.

Once again, thank you for your continued dedication to public service demonstrated by preparing and adopting a strategy for reducing future disaster losses. Should you have any questions, please do not hesitate to contact Marilyn Hilliard at (617) 956-7536.

Sincerely,

Paul F. Ford
Acting Regional Administrator

PFF: mh

cc: Richard Zingarelli, Massachusetts State Hazard Mitigation Officer
Martin Pillsbury, MAPC Environmental Division Manager
Marybeth Groff, CFM, MEMA

Enclosure