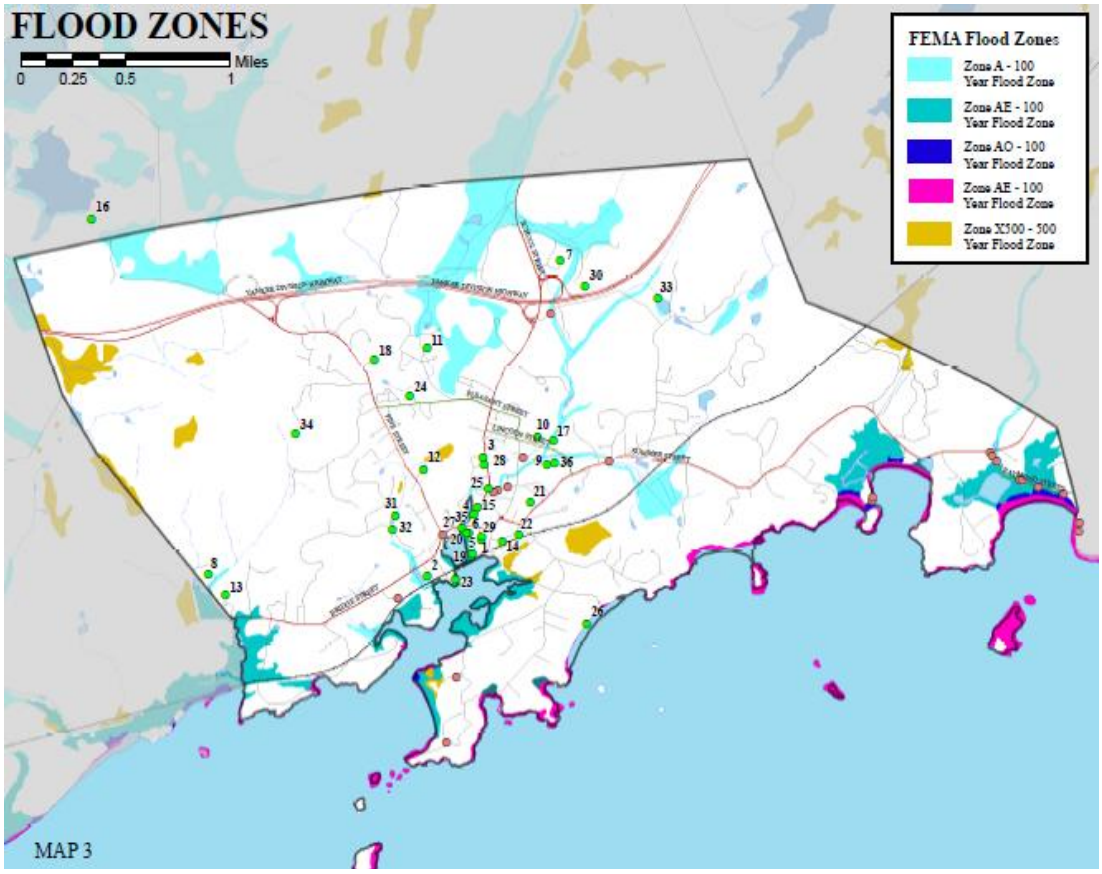
TOWN OF MANCHESTER-BY-THE-SEA
HAZARD MITIGATION PLAN



MAPC
METROPOLITAN AREA PLANNING COUNCIL

Metropolitan Area Planning Council

Final Plan
Approved by FEMA October 18, 2012

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MANCHESTER-BY-THE-SEA HAZARD MITIGATION PLAN

ACKNOWLEDGEMENTS AND CREDITS

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

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I. 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. 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 Manchester-by-the-Sea and 16 other communities develop their local Hazard Mitigation Plans. The local Hazard Mitigation Plans produced under this grant are designed to meet the requirements of the Disaster Mitigation Act for each community.

What is Hazard Mitigation?

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

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II. COMMUNITY PROFILE

Overview

The Town of Manchester-by-the-Sea-by-the-Sea was included in a grant of land to the Massachusetts Bay Colony made in 1629 by Charles I who signed their charter in that year. By June of the same year the first ship, the Talbot, dropped anchor in Manchester-by-the-Sea Harbor carrying settlers for the new town. Formally incorporated in 1645, the young community displayed its moral foundations by adopting a set of laws and regulations that prohibited the slave trade, made cruelty to animals a civil offence and forbade imprisonment for debt.
Historians point out that these goodly beginnings may have led the colonists to go overboard as they continued to try to legislate all behavior with laws about how to conduct a courtship, laws against "excess in apparel" or "immodest laying out of theire haire". In 1644 a tide-mill was established, in 1668 a sawmill was built, and in 1684 Aaron Bennett set up a grist mill. Foreshadowing its maritime future, John Norton began building ships on land granted him near the shore in 1684. By 1700 the prosperous burghers of Manchester-by-the-Sea were able to pay Masconomet, the sagamore of the Agawam Indians, 3 pounds and 19 shillings in silver money for all rights to the lands on which the town stood.

The town's economy was based on some farming and a lot of fishing for cod and mackerel, and Manchester-by-the-Sea men were known as good mariners. In 1810, 50 masters of vessels were Manchester-by-the-Sea residents. Manchester-by-the-Sea men were patriotic as well and they served in the successful assault on Louisburg in Canada, while the town meeting raised money to support the Minute Men. The life of the town was largely maritime, with a fishing fleet, fish yards and fish storage warehouses until the decay of the fishing industry freed workers for the newly expanded woodworking and cabinet making jobs.

In 1845 a new phase opened in the town when the first summer resident, poet Richard Dana, built his vacation home. Manchester-by-the-Sea quickly became a very fashionable watering place for wealthy people from the city and the town gained an increasingly important summer population. In 1868 the original Town Hall was built, while the public library was given to the town by the Hon. T. Jefferson Coolidge, a summer resident in 1886.

In modern times, Manchester-by-the-Sea has retained its reputation as a fashionable summer address, while developing a new suburban population as a handsome residential community.

(Narrative based on information provided by the Massachusetts Historical Commission and is taken from the Community Profile on the website maintained by the Department of Housing and Community Development)

The Town is governed by a Board of Selectmen with a Town Administrator. The town operates under the open town meeting format. The 2009 population was 5,260 people and there were 2,327 housing units in the year 2008.

The town maintains a website at http://www.Manchester-by-the-Sea.ma.us/Pages/index.

Existing Land Use

The most recent land use statistics available from the state are based on aerial photography done in 1999. Table 1 shows the acreage and percentage of land in 21 categories. If the four residential categories are aggregated, residential uses make up 31.7% of the area of the town. The highest percentage land use is Forest at 56.74% of the total area.

Table 1
Land Use (1999)

Land Use Type	**Acres**	**%**
Cropland	4.70	0.09
Pasture	19.65	0.39
Forest	2718.71	54.44
Non-forested wetlands	56.74	1.14
Mining	14.57	0.29
Open land	100.32	2.01
Participatory recreation	127.95	2.56
Spectator recreation	0	0.00
Water recreation	55.97	1.12
Multi-family residential	8.37	0.17
High density residential (less than ¼ acre lots)	189.33	3.79
Medium density residential (¼ - ½ acre lots)	215.04	4.31
Low density residential (larger than ½ acre lot)	1169.98	23.43
Salt water wetlands	44.69	0.89
Commercial	35.05	0.70
Industrial	26.43	0.53
Urban open	46.37	0.93
Transportation	124.80	2.5
Waste disposal	1.25	0.02
Water	31.26	0.63
Woody perennials	2.78	0.06
Total	***4,993.96***	

For more information on how the land use statistics were developed and the definitions of the categories, please go to http://www.mass.gov/mgis/lus.htm.

Potential Future Land Uses

MAPC consulted with town staff to determine areas that have been recently or are likely to be developed in the future. 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. *Coolidge Common* (Future)

Coolidge Common is a proposed 40B development. The project is currently in the town's permitting process.

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III. PUBLIC PARTICIPATION

Public participation occurred at two levels; the Metro Boston Upper North Shore Multiple Hazard Community Planning Team (regional committee) and the Manchester-by-the-Sea 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.

Manchester-by-the-Sea's Participation in the Regional Committee

On March 14, 2008, a letter was sent notifying the communities of the first meeting of the Metro Boston Upper North Shore Regional Committee and requesting that the Chief Elected Official designate two municipal employees and/or officials to represent the community. The following individuals served to represent Manchester-by-the-Sea on the regional committee:

Clinton Hatch	Manchester-by-the-Sea Police Department
Steven Kenney	Manchester-by-the-Sea DPW Director
Andrew Paskalis	Manchester-by-the-Sea Fire Department- Chief
Wayne Melville	Town Administrator

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. Resulting actions are reflected in the identified mitigation measures, as noted in Chapter VIII.

The Greater Boston Upper North Shore Regional Hazard Mitigation Team met on April 15, 2008 and September 30, 2008.

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 Manchester-by-the-Sea (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 14/September 30, 2008 and March 19, 2010, MAPC conducted the meetings of the Manchester-by-the-Sea Local Committee. The meetings were organized by Wayne Melville, Town Administrator. The purpose of the first meeting was to introduce the PDM program and to gather information on local hazard mitigation practices and sites.

The second and third meetings were to focus on verifying information gathered by MAPC staff, developing hazard mitigation goals, STAPLEE criteria, and the discussion of potential mitigation measures and prioritization. Table 2 lists the attendees at each meeting of the team. The agendas for these meetings are included in Appendix A.

Table 2
Attendance at the Manchester-by-the-Sea Local Committee Meetings

Name	Representing
August 14, 2008	
Matthew Casparius	Parks and Recreation Director
Steven Kenney	Manchester-by-the-Sea DPW Director
Andrew Paskalis	Manchester-by-the-Sea Fire Department-Chief
Wayne Melville	Town Administrator
Alexa Richards	Parks and Recreation Intern
September 30, 2008 & March 19, 2010	
Carol McMahon	Cape Ann Emergency Planning Team
Steven Kenney	Manchester-by-the-Sea DPW Director
Andrew Paskalis	Manchester-by-the-Sea Fire Department-Chief
Wayne Melville	Town Administrator
Matthew Casparius	Parks and Recreation Director

The Public Meeting
The plan was introduced to the public at a meeting of the Board of Selectmen on July 19, 2010. The meeting was held in the Manchester-by-the-Sea Town Hall. The meeting was publicized as a regular Selectmen's meeting. The attendance list for the meeting can be found in Table 3.

Table 3
Attendance at the July 19, 2010 Board of Selectmen's Public Meeting

Name	Representing
Wayne Melville	Town Administrator
Thomas Kehoe	Chairman, Board of Selectmen
Mary Hardwick	Board of Selectmen
Lee Spence	Board of Selectmen
Sam Cleaves	MAPC
A number of individuals	The general public

Local Stakeholder Involvement

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. These stakeholders had an opportunity to participate in the public meeting, which was subject to the requirements of the Open Meeting Law requiring that the agenda for the meeting be advertised in a local paper of general circulation and posted in a public location. Manchester Board of Selectmen agendas are also posted on the Town's website and in advance of the public meeting. The plan was also available on the web and the presentation form the public meeting shown on community cable, both easily accessible to the various local stakeholders that would have an interest in the plan.

Planning Timeline

March 14, 2008	Letter to the participating communities initiating the project.
APRIL 15, 2008	First meeting of the Regional Committee
September 30, 2008	Second meeting of the Regional Committee
AUGUST 14, 2008	First meeting of the Local Committee
September 30, 2010	Second meeting of the Local Committee
March 19, 2010	Third meeting of the Local Committee
July 19,2010	Public meeting with the Board of Selectmen (shown daily over a two week period following the meeting on local cable)
December 17, 2010	Plan submitted to MEMA

IV. OVERVIEW OF HAZARDS AND VULNERABILITY

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, coastal erosion, hurricanes, tornadoes, urban and wildfires, drought and earthquakes.

Table 5 summarizes the hazard risks for Manchester-by-the-Sea. This evaluation takes into account the frequency of the hazard, historical records and variations in land use. This analysis uses the same vulnerability assessment methodology used in the Commonwealth of Massachusetts State Hazard Mitigation Plan, October 2007.

Table 4
Hazard Risks Summary

Hazard	Frequency	Severity
Flooding	High	Serious
Winter storms	High	Serious
Hurricanes	Medium	Serious - extensive
Earthquakes	Low	Catastrophic
Tornadoes	Low	Extensive
Landslides	Low	Minor
Brush fires	Medium	Minor
Dam failures	Low	Serious

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

The state plan indicates that Massachusetts is one of the 10 states that account for 76% of all repetitive loss buildings in the United States. Flooding was the most prevalent serious natural hazard identified by local officials in Manchester-by-the-Sea. Flooding is caused by hurricanes, nor'easters, severe rainstorms and thunderstorms.

Regionally Significant Storms

There have been a number of major rain storms that have resulted in significant flooding in northeastern Massachusetts over the last fifty years. Significant storms include:

- August 1954
- March 1968
- January 1979
- April 1987
- October 1991 ("The Perfect Storm")
- October 1996
- June 1998
- March 2001
- April 2004
- May 2006
- April 2007
- March 2010

Flood-Related Hazards

Overview of the North Coastal Watershed and Flooding

Manchester-by-the-Sea is located in the North Coastal Watershed, which is a study in contrasts. The northern reaches of the North Coastal Watershed include the southern tier of the Hampton and the Seabrook salt marsh complexes, while further south, the watershed is dominated by the rocky shores of Cape Ann, which provide the most distinctive rocky coastline in all of Massachusetts. The southern reaches of the watershed consist of an irregular coastline of rocky peninsulas, interspersed with embayments, pockets of salt marsh and vibrant estuaries.
The North Coastal Watershed has a total drainage area of approximately 168 square miles. It encompasses all or part of five river sub-basins, including the Danvers, Essex, Saugus, Pines, and Annisquam Rivers. There are approximately 2,428 acres of lakes and ponds in the watershed. The North Coastal encompasses all or part of 26 Massachusetts municipalities, and supports a population of approximately 500,000 people. The major resources in the region include a major lobster fishery, as well as shell fishing.

Watershed Priorities

- Work to reduce contaminated stormwater emanating from street drainage systems along highways and local roads
- Implement sustainable growth management techniques and innovative land use planning, specifically in the Town of Essex, by addressing wastewater management
- Conserve and protect open space
- Prevent the introduction of invasive plant species and reduce the loss of productive shellfish habitat
- Determine the impacts of growth on drinking water supplies and work to maintain adequate base flows in rivers and streams

(From: MA Office of Energy and Environmental Affairs)

Locally Identified Areas of Flooding

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 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". The numbers do not reflect priority order.

1. *Central Manchester-by-the-Sea Drainage System* (Flooding)
   Mitigation to the central Manchester-by-the-Sea drainage system is the town's top priority issue. The system originates at Millet Swamp and then flows north into the Sawmill River. The Sawmill River flows north, under Route 128 and continues in a northeastern arc, turns south under Route 128, between the Essex Country Club (golf course), south under Lincoln Street, east along Brook Street, and finally south under School Street where it empties into the Inner Harbor. In all, the system is approximately 2.7 miles in length and shown on a map, resembles a giant question mark.

   Flooding, in terms of frequency and severity, ranges from frequent street closings and minor property damages in small storms, to catastrophic property damages and roadways filled with up to 6 feet of water in severe storm events. Flooding generally occurs in the roadways and properties along Lincoln Street, School Street, Norwood Avenue, Putnam Circle, Brook Street, Union Street, and Knight Road. About every 10 years a major storm causes severe to catastrophic damages in this system; the most recent being the Mother's Day Storm of 2006, when the following occurred: the bridge on School Street was washed out; there was up to 6 feet of water on parts of Brook Street, School Street, Norwood Avenue and Putnam Road; approximately 150 single family houses were damaged; and spotted flooding as far north as the Essex Country Club. The Essex County Club golf course acts to absorb much of the upstream flooding. Flooding on Union Street (also State Route 127) and School Street is a major concern for the town, as these roadways serve as major arteries in and out of Manchester-by-the-Sea. In the case of an emergency, blockage of these roadways becomes a major public safety hazard as emergency response is hindered.

   There are several contributing factors to the flooding of this system. These factors include a lack of upstream storage, an undersized culvert at the intersection of Brook Street, Knight Circle and School Street; narrow channel walls between Brook Street and the Sawmill Brook which cause accelerated water flow; a lack of a flood channel on North Street; and an undersized dam outlet at the Sawmill Brook Tidal dam (that empties into the Inner Harbor) which causes backups in the whole system. The stone retaining wall from Brook Street to the dam outlet is constructed out of old granite blocks that are on the verge of collapse. The channel now resembles small pond and if this structure were to give way several properties, including the Fire Station would be at risk of breach flooding. The culvert at Brook Street, Knight Circle and School Street opens with a stone arch culvert and transitions into an aluminum culvert. The system is vastly undersized and backups in most rain events.

   The town has identified the following measures to mitigate the flooding: enlargement of the School Street, Knight Circle, and Brook Street culvert and/or making this culvert into and actual raised bridge; overhauling of the Inner Harbor drainage outlet; increasing the size of the Route 127 culvert; and increasing the size of the stone walled channels along School Street.

Mitigation to the Central Manchester-by-the-Sea Drainage System is the highest priority for the town of Manchester-by-the-Sea, with improvements to the lower portions of the system as first priority. The reason for this is because if mitigation measures were conducted upstream first, that would increase downstream flooding. Therefore it is important to start at the Sawmill Brook Tidal Dam and work up the system. The town would like to develop an overall feasibility and implementation study for the downtown areas affected, followed by actions to improve drainage and safety.

2. *Old Essex Road* (Flooding)
   There are about 12 single family homes, a senior living facility, and affected by roadway flooding along Old Essex Road. Major flooding, with a depth of approximately 2½ feet, occurs about once every 10 years in this area. There are also two sewer lift stations at risk in the event of a severe storm event. Neither has sustained any flooding, but both pose significant infiltration and backup potential. Old Essex Road flooding is usually caused by a high water table or backups at the Millet Swamp, which causes the water body to exceed its banks. Additionally, beaver activity in the vicinity serves further exacerbates flooding. This area needs to be included in the Central Manchester-by-the-Sea drainage plan.

3. *School Street* (Sewer/Flooding)
   This area should also be included in the overall downtown drainage action plan. School Street resides in a low lying area of town and in the event of a large storm; street flooding infiltrates the sewer system. This results in sewerage popping the caps off manhole covers and emptying waste into the street. The Local Committee recalls that there were two sewer overflow events on School Street in recent years. Stormwater infiltration inflow is an issue for the town sewer system, with backups contributing to sewer overflow on School Street.

   Drainage improvements to Sawmill Brook and improving stormwater infiltration inflow may potentially mitigate this problem.

   Direct mitigation could include putting in a sewer cutoff at the School Street and Brook Street intersection which would prevent infiltration inflow from going down School Street. The Local Committee estimates this project to cost approximately $350,000. Mitigation to this site is a high priority.

4. *Sewer Treatment Plant* (Flooding/Sewer)
   The Sewer Treatment Plant is an area of concern for the town and needs to be incorporated into drainage study plan as well. The Plant resides near parcels that sustain reoccurring flooding and the town fears that in the event of a 100 year storm (or larger), the Plant may be susceptible to inflow and cause backups into streets and homes. For immediate mitigation, the town has proposed diverting stormwater away from the Plant by improving the drainage system.

5. *Blue Heron Lane* (Flooding)
   There is reoccurring residential flooding in the Blue Heron Lane vicinity which is also related to the Millet Swamp in area #2 above. The cause of this flooding is an undersized culvert. Also, many of the homes in this area are built on fill in the location water of a natural above ground drainage system. The manmade system is inadequate and results in flooding during large rain storms.

6. *Bennett's Brook Neighborhood* (Flooding)
   The land area near Bennett's Brook, from Walker Road to Highwood Road is subject to frequent flooding. Flooding results in partial to complete road closures and damages to about 50 single family homes. There are multiple homes along this corridor that have each filed multiple insurance claims, and one house that has three sump-pumps, and still sustains regular flood damages. Flooding in this area results from two route causes; one, the land area was formerly low lying wetlands; and two, the area is spotted with a handful of undersized culverts. A comprehensive drainage study could serve as a prelude for determining potential mitigation measures. Mitigation to the Bennett Brook Neighborhood is a high priority.

7. *Raymond Street* (Flooding)
   There are about 25 to 30 single family houses and several multi-family houses along Raymond Street that are subject to reoccurring flooding. In addition, the Local Committee recalls the roadway itself being rendered impassible at least twice in recent years. Flooding results from excessive high tides and storm surge. Since Raymond Street is low lying and since drainage naturally flows into the ocean or into Clark Pond, tidal and surge waters are left with nowhere to drain until the ocean recedes. Septic inundation is a secondary issue of flooding. There is a potential 40B development on Route 127 to the north, and stormwater runoff from this development could further exacerbate existing flooding. Additionally, Magnolia Harbor, which is south of Raymond Street, has been dealing with foul odor issues, which result from heightened amounts of bacteria in the water. Residents along Raymond Street are improving the drainage infrastructure from Clark's Pond to Kettle Cove on the west, which may help improve drainage away from the roadway.

8. *Ocean Street* (Flooding)
   Ocean Street, which abuts the Atlantic coastline has been washed out and rebuilt twice in the last six years. The problem is causes by ocean surge, which comes in and undercuts and washes out the roadway. Even with the recessed nature of Kettle Cove, the cove endures strong wave action and surge in the event of storm event that originates from the south. A Local Committee suggested installing a jetty or breaker, but acknowledged it might not be economic feasible, as well as the unknown environmental effects.
9. *Magnolia Avenue* (Flooding)

Magnolia Avenue, as well as 6 single family homes along the roadway, have been subject to reoccurring flooding. Flooding is frequent, with damages occurring about twice yearly. Flooding is caused by backups at the Wolf Brook culvert located at Magnolia Avenue and Overledge Road. Enlarging this culvert should help prevent upstream backups on Magnolia Avenue. The system originates upstream in Gloucester, and maintaining healthy flow of the stream is important to both Manchester-by-the-Sea and Gloucester. Mitigation to the culvert would cost approximately $20,000 and is a medium priority for the town.

10. *Highland Avenue* (Flooding)
    In the event of large storm event, water backs up at the Bridge Street intersection, turning the roadway into a dam. This happens about once each year. Flooding is caused by several factors; there are large hill on either side of the road which empty stormwater on the low and level gradients of the roadway, a lack of flood storage and a lack of adequate drainage. On a side note, the town reports high a fecal count in the in the water in this area. The Local Committee suggested that the installation of roadside berms and additional catch basins would help to mitigate the flooding.

Repetitive Loss Structures

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

There are 19 repetitive loss structures in Manchester-by-the-Sea, 15 single family homes and four (4) non-residential properties. These 19 properties have experienced a total of 43 losses (35 residential and 8 non-residential) between 1978 and 2007. Damage claims over this period totaled $806,428, including $523,529 for residential properties and $282,898 for non-residential properties. Repetitive loss data used was the best available during plan drafting period of 2008-2010.

All but five of the town's repetitive loss properties are located within designated flood zones A and AE. Eleven of the properties are located along the coast in the southern part of town, seven are located near the town center, and one is in the northern part of town at the junction of Route 128 and School Street.

Dams

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.

Dam Failures

The local committee did not identify dam failure as an issue for the community. The local team determined that there are no issues of dam failure associated with these dams. None of these dams have been reported to have failed in the past or appear to threaten the community with adverse impacts. However, the replacement or enlargement of the one town-owned dam, the Central Street/Sawmill Brook Dam, as part of a larger flooding mitigation effort for the Downtown area, is a top natural hazard mitigation priority for the Town.

The local Hazard Mitigation Planning Team identified four dams in Manchester, which are listed in Table 5 and shown on the maps in Appendix B:

- Central Street Dam/Saw Mill Brook Dam: The only town-owned dam in Manchester-by-the-Sea. Interviews with the Department of Public Works Director indicate that the dam, though undersized to match existing drainage conditions, is maintained regularly and that it is considered to be in good condition. The dam is the end point of an undersized drainage system, which is one of the Town's primary natural hazard mitigation issues listed in this plan.
- Small Brook Dam: small private dam, listed in good condition
- Forster Road Dam: small private dam, listed in fair condition
- Gorman Pond Dam: small private dam, listed in fair condition

Wind-related hazards

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

There has been one Category One hurricane that has tracked through Manchester-by-the-Sea. A hurricane or storm track is the line that delineates the path of the eye of a hurricane or tropical storm. The hazard mapping indicates that the 100 year wind speed is 110 -120 miles per hour. There have been no tornadoes recorded within the town limits.

Winter Storms

In Massachusetts, northeast coastal storms known as nor'easters occur 1-2 times per year. Winter storms are a combination hazard because they often involve wind, ice and heavy snow fall. The average annual snowfall for the town is 48-72 inches.

The most significant winter storm in recent history was the "Blizzard of 1978", which resulted in over 3 feet of snowfall and high winds that caused 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
Severe Snow Storm	December, 2010

2008 was a record year for snowfall. By the end of February, 2008, Boston's Logan International Airport reported record snowfall for total precipitation and by March of 2008, many cities and towns in Massachusetts had established record annual snowfall totals. In both 2008 and 2010, high snowfall amounts led to increased groundwater and surface water amounts, contributing to spring flooding events in Manchester and many other communities.

Fire Related Hazards

The Manchester-by-the-Sea Fire Department responds to approximately 10-15 brush fires annually and does consider brush fires a serious hazard. Very few have resulted in any significant property damage and there have been no deaths as a result of brush fires. There are fire prevention access and brush management issues in some of the areas associated with more frequent brush fires.

The Fire Department has some dedicated forest fire apparatus but would be more effective with updated equipment. There have been no deaths as a result of brush fires.

The areas with the highest incidence of brush fires are in the wooded western parts of town, including the Crooked Lane neighborhood, as well as land adjacent to Route 128.

Geologic Hazards

Regional Overview

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). There have been no recorded earthquake epicenters within Manchester-by-the-Sea.

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.

Most municipal officials acknowledged that earthquakes were the hazard for which their community was least prepared. There have been no recorded earthquake epicenters within Manchester-by-the-Sea. There have been no historical recorded effects on the Town associated with earthquake impacts originating from outside of Manchester-by-the-Sea.
Although new construction under the most recent building codes generally will be built to seismic standards, much of the development in the town predates the most recent building code.

Landslides

The entire town is classified as having a low risk for landslides. Town officials and the public did not identify any problems with areas of geologic instability such as sinkholes or subsidence, or any past occurrences with landslides, sinkholes or subsidence.

Geologic hazards include earthquakes, landslides, sinkhole, subsidence, and unstable soils such as fill, peat and clay. Most town officials admitted that earthquakes were the hazard for which their community was least prepared. 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.

Critical Infrastructure in Hazard Areas

Critical infrastructure includes facilities that are important for disaster response and evacuation (such as emergency operations centers, fire stations, hospitals, etc.) and facilities where additional assistance might be needed during an emergency (such as nursing homes, elderly housing, day care centers, etc.). It also includes facilities that might pose a particular danger during a natural disaster such as a sewage treatment plant or chemical facility. These facilities are listed in Table 5 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.

Landslides - The entire town is considered to have a low risk for landslides and therefore, all critical infrastructures sites fall within this hazard category.

Earthquakes – All areas of the town have a low risk for earthquakes.

Explanation of Columns in Table 5.

Column 1: ID #: The first column in Table 6 is an ID number which appears on the maps that are part of this plan. See Appendix B.

Column 2: Site 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: Site 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:

Column 6: Locally Identified Areas of Flooding: 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: Average annual snowfall: The snowfall mapping indicates that there are two bands of snowfall in southeastern Massachusetts. An entry of "high" indicates an annual average of 48.1 – 72 inches of snow. An entry of "low" indicates a range of 36-48 inches.

Table 5: Relationship of Critical Infrastructure to Hazard Areas

ID #	NAME	TYPE	Landslide	Within FEMA Flood Zone	Within Locally Identified Area of Flooding	Average Annual Snow Fall	Hurricane Surge Areas (Category#)
1	Magic Years Nursery School	DayCare	Low Susceptibility	No	No	High	0
2	Shore Nursery School	DayCare	Low Susceptibility	No	No	High	0
3	Tara Montessori School	School	Low Susceptibility	No	No	High	0
4	Manchester-by-the-Sea Fire Department	Fire Station	Low Susceptibility	No	No	High	2
5	Manchester-by-the-Sea Police Headquarters	Police Station	Low Susceptibility	No	No	High	2
6	Manchester-by-the-Sea-by-the-Sea Town Hall	Town Hall	Low Susceptibility	No	No	High	2
7	Family Medicine Associates	Medical	Low Susceptibility	No	No	High	0
8	Brookwood Elementary School	School	Low Susceptibility	No	No	High	0
9	Manchester-by-the-Sea Memorial Elementary School	School	Low Susceptibility	No	No	High	0
10	Manchester-by-the-Sea Essex Regional Middle High School	School	Low Susceptibility	No	No	High	0
11	The Plains Seniors	Elderly Housing	Low	No	No	High	0

Table 5: Relationship of Critical Infrastructure to Hazard Areas

ID #	NAME	TYPE	Landslide	Within FEMA Flood Zone	Within Locally Identified Area of Flooding	Average Annual Snow Fall	Hurricane Surge Areas (Category#)
	Housing		Susceptibility				
12	Newport Park Seniors Housing	Elderly Housing	Low Susceptibility	No	No	High	0
13	Landmark School	School	Low Susceptibility	No	No	High	0
14	Manchester-by-the-Sea Public Library	Library	Low Susceptibility	No	No	High	3
15	First Baptist church	Place of Worship	Low Susceptibility	No	No	High	2
16	Manchester-by-the-Sea Water Treatment Plant	Water Treatment Plant	Low Susceptibility	No	No	High	0
17	Lincoln Street Well & Pumping Station	Water Pumping Station	Low Susceptibility	No	No	High	0
18	Manchester-by-the-Sea Water Tower (tank)	Water Pumping Station	Low Susceptibility	No	No	High	0
19	Manchester-by-the-Sea Wastewater Treatment	Waste Water Treatment Plant	Low Susceptibility	AE	SEWER TREATMENT PLANT	High	1
20	Manchester-by-the-Sea Harbor	Municipal	Low Susceptibility	No	No	High	2
21	Verizon- Switching Station	Communications	Low Susceptibility	No	No	High	0
22	National Grid	Sub Station	Low Susceptibility	No	No	High	4

Table 5: Relationship of Critical Infrastructure to Hazard Areas

ID #	NAME	TYPE	Landslide	Within FEMA Flood Zone	Within Locally Identified Area of Flooding	Average Annual Snow Fall	Hurricane Surge Areas (Category#)
23	Manchester-by-the-Sea Marina	Fuel Depot	Low Susceptibility	AE	No	High	1
24	DPW Garage	DPW	Low Susceptibility	No	No	High	0
25	School Street Bridge	Bridge	Low Susceptibility	No	SCHOOL STREET	High	3
26	Singing Beach	Beach	Low Susceptibility	No	No	High	1
27	Central Street Dam	Dam	No	A	CENTRAL MANCHESTER-BY-THE-SEA DRAINAGE SYSTEM	High	1
28	Sacred Heart Parish	Place of Worship	Low Susceptibility	No	No	High	0
29	Congregational Chapel	Place of Worship	Low Susceptibility	No	No	High	0
30	Manchester-by-the-Sea Athletic Club	Athletic Club	Low Susceptibility	No	No	High	0
31	Small Brook Dam	Dam	Low Susceptibility	No	BENNETT'S BROOK NEIGHBORHOOD	High	0
32	Forster Road Dam	Dam	Low Susceptibility	No	BENNETT'S BROOK NEIGHBORHOOD	High	0
33	Saw Mill Brook Dam	Dam	Low Susceptibility	No	No	High	0

Table 5: Relationship of Critical Infrastructure to Hazard Areas

ID #	NAME	TYPE	Landslide	Within FEMA Flood Zone	Within Locally Identified Area of Flooding	Average Annual Snow Fall	Hurricane Surge Areas (Category#)
34	Gorman Pond Dam	Dam	Low Susceptibility	No	No	High	0
35	EOC Town Hall	EOC	Low Susceptibility	No	No	High	2
36	Hornet's After School Program	Daycare	Low Susceptibility	No	No	High	0

Vulnerability Assessment

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

Introduction to HAZUS-MH

HAZUS- MH (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 nine communities that are a part of this study, it does not capture all relevant information. In fact, the HAZUS training manual notes that the default data is "subject to a great deal of uncertainty."

However, for the purposes of this plan, the analysis is useful. This plan is attempting to only generally indicate the possible extent of damages due to certain types of natural disasters and 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

According to the State Hazard Mitigation Plan, between 1858 and 2000, there were 15 hurricanes. 60% were Category 1, 33% were Category 2 and 7% were Category 3. For the purposes of this plan, a Category 2 and a Category 4 storm was chosen to illustrate damages. The reason is to present more of a "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 6
Estimated Damages from Hurricanes

	Category 2	Category 4[1]
Building Characteristics		
Estimated total number of buildings	1,941	1,941
Estimated total building replacement value (Year 2002 $) (Millions of Dollars)	$592	$592
Building Damages		
# of buildings sustaining minor damage	0	142
# of buildings sustaining moderate damage	0	9
# of buildings sustaining severe damage	0	0
# of buildings destroyed	0	0
Population Needs		
# of households displaced	0	5
# of people seeking public shelter	0	1
Debris		
Building debris generated (tons)	0	4,327
Tree debris generated (tons)	252	3,764
# of truckloads to clear building debris	0	22
Value of Damages (Thousands of dollars)		
Total property damage	$1.81	$4,043.21
Total losses due to business interruption	$0.07	$288.33

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

Estimated Damages from Earthquakes

Methodology Used

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

Table 7
Estimated Damages from Earthquakes

	Magnitude 5.0	**Magnitude 7.0**
Building Characteristics		
Estimated total number of buildings	1,941	1,941
Estimated total building replacement value (Year 2002 $)(Millions of dollars)	$592	$592
Building Damages		
# of buildings sustaining slight damage	97	640
# of buildings sustaining moderate damage	10	635
# of buildings sustaining extensive damage	2	225
# of buildings completely damaged	0	75
Population Needs		
# of households displaced	2	222
# of people seeking public shelter	0	46
Debris		
Building debris generated (tons)	Not available	Not available
# of truckloads to clear building debris		
Value of Damages (Millions of dollars)		
Total property damage	$13.03	$162.59
Total losses due to business interruption	$0.61	$25.95

Estimated Damages from Flooding

Methodology Used

MAPC did not use HAZUS-MH to estimate flood damages in Manchester-by-the-Sea. 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 Manchester-by-the-Sea, much of the flooding is due to deficiencies in the drainage system. In lieu of using HAZUS, MAPC developed a methodology to give a rough approximation of flood damages.

Manchester-by-the-Sea is 7.84 square miles or 5018 acres. Approximately 198 acres have been identified by local officials as areas of flooding. This amounts to 3.96 % of the land area in Manchester-by-the-Sea. The number of structures in each flood area was estimated by applying the percentage of the total land area to the number of structures (1,941) in Manchester-by-the-Sea; the same number of structures used by HAZUS for the hurricane and earthquake calculations. HAZUS uses a value of $304,997 per structure for the building replacement value. This was used to calculate the total building replacement value in each of the flood areas. The calculations were done for a low estimate of 10% building damages and a high estimate of 50% as suggested in the FEMA September 2002 publication, "State and Local Mitigation Planning how-to guides". (Page 4-13). The range of estimates for flood damages is $2,409,468 - $12,047,381. These calculations are not based solely on location within the floodplain or a particular type of storm (i.e. 100 year flood).

Table 8: Estimated Damages from Flooding							
ID	**Flood Hazard Area**	**Approximate Area in Acres**	**% of Total Land Area**	**# of Structures**	**Replacement Value**	**Low Estimate of Damages**	**High Estimate of Damages**
1	Central Manchester-by-the-Sea Drainage System	16.664	0.334	6	$1,829,982	$182,988	$914,991
2	Old Essex Road	0.530	0.011	1	$304,997	$30,500	$152,499
3	School Street	2.676	0.054	1	$304,997	$30,500	$152,499
4	Sewer Treatment Plant	1.360	0.027	1	$304,997	$30,500	$152,499
5	Blue Heron	0.634	0.013	1	$304,997	$30,500	$152,499
6	Bennett's Brook Neighborhood	166.579	3.337	65	$19,824,805	$1,982,480	$9,912,403
7	Raymond Street	2.952	0.059	1	$304,997	$30,500	$152,499
8	Ocean Street	3.342	0.067	1	$304,997	$30,500	$152,499
9	Magnolia Avenue	1.383	0.028	1	$304,997	$30,500	$152,499
10	Highland Avenue	1.575	0.032	1	$304,997	$30,500	$152,499
	Totals	**197.70**	**3.96**	**79**	**$24,094,763**	**$2,409,468**	**$12,047,381**

Future Development in Hazard Areas

The Town of Manchester-by-the-Sea has identified a parcel where development has been proposed, is underway or is expected to occur in the future. Table 9 shows the relationship of this parcel to two of the mapped hazards. This information is provided so that planners can ensure that development proposals meet all 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**
Coolidge Common	Low	No

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V. EXISTING MITIGATION MEASURES

Existing Flood Hazard Mitigation Measures

Participation in the National Flood Insurance Program (NFIP) – 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. FEMA maintains a database on flood insurance policies and claims. The reporting period covers through 3/31/2010). 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 Manchester-by-the-Sea:

Flood insurance policies in force (as of 3/31/2010)	111
Coverage amount of flood insurance policies	$ 28,960,300
Premiums paid	$134,831
Total losses (all losses submitted regardless of the status)	82
Closed losses (Losses that have been paid)	70
Open losses (Losses that have not been paid in full)	0
CWOP losses (Losses that have been closed without payment)	12
Total payments (Total amount paid on losses)	$1,039,601.93

Street sweeping – Every street gets swept once a year or as needed. Street sweeping is contracted out.

Catch basin cleaning – All of the town's approximately 635 catch basins are cleaned out once a year. This service is contracted out.

Roadway treatments – The town uses a 50/50 mixture of sand and salt.

Subdivision Rules and Regulation and Zoning– The subdivision rules and regulations and the zoning bylaw contain a number of requirements that address flood hazard mitigation. Some of these provisions also relate to other hazards.

Subdivision Rules and Regulations

7.05 Protection of Natural Features
1. All natural features, including, but not limited to, stone walls, trees, wooded areas, water courses, wetlands, scenic points, historic spots, shall be preserved to the maximum extent possible.

7.06 Lot Drainage

A. All subdivision proposals shall be reviewed to assure that such proposals minimize flood damage; all public utilities are located and constructed to minimize or eliminate flood damage, and adequate drainage is provided to reduce exposure to flood hazards.

B. Design Method

1. Lots shall be prepared and graded consistent with drainage into the subdivision and in such a manner that development of one shall not cause detrimental drainage onto another or on areas outside the subdivision, to the extent permitted by law.

3. To the maximum extent possible runoff exiting the overall subdivision area shall not be of greater volume after the completion of all improvements than existed prior to such improvements.

D. Street Location and Alignment

Streets shall be designed to facilitate the drainage objectives set forth in Section 7.10. Street grades shall conform as closely as practicable to the original topography and must be within the parameters listed below. Under no circumstances shall any street have a grade of more than three (3) percent within one hundred (100) feet of an intersection.

Maximum	Minimum
Lane	
9%	0.5%
Minor Street	
7%	0.5%
Collector	
6%	0.5%
Arterial	
5%	0.5%

E. Street Width

2. Reductions of width which are a part of an overall drainage plan to reduce the impervious surface in the subdivision and reduce runoff from the parcel shall be permitted if plans for safety, parking, pedestrian circulation and other factors are deemed superior by the Planning Board to accommodate the requested reductions.

G. Curbing

3. The need for curbing may be eliminated along certain roadways, when drainage is provided in swales, which are designed to reduce the rate of runoff, and restore or supply needed water to vegetation in the street right-of-way.

7.10 Drainage

A. General Approach

2. To the maximum extent feasible, storm water must be recharged utilizing structures designed to prevent water quality degradation, rather than piped to surface water. In areas identified as high yielding, aquifer and aquifer recharge areas, recharge is especially critical. Peak stream and channel flows and overland runoff at the boundaries of the

development in the Ten (10) and One Hundred (100) Year Frequency Storm shall be no higher following development than prior to development.
3. Where the water table is not too high and where the soil is reasonably permeable to adequate depths, drainage shall feature swales, detention/retention ponds and multi-use areas. Open drainage systems may be required for recharge of aquifers and recharge areas provided that runoff is not seriously polluted. Open drainage featuring grassed areas will be preferred as providing better filtration than pits and shafts.

E. Flood Hazard Avoidance
Any subdivision located partially or wholly within the Zone A of the
Flood Insurance Rate Maps prepared by the Federal Emergency Management Agency (FEMA) shall comply with the following:

1. Subdivision design shall be consistent with the need to minimize flood damage within the flood-prone area, through use of clustering, open space reservation, street profile design, and drainage.
2. All public utilities and facilities, such as sewer, gas, electrical, and water systems shall be located and constructed to minimize or eliminate flood damage.
3. Drainage systems shall be designed in consideration of possible flooding to the Base Flood Elevation.

Zoning Regulations

1.2 Purpose
The Purposes of the By-Law include the promotion and protection of the public health, safety, convenience, and general welfare of the inhabitants of the Town of Manchester-by-the-Sea-by-the-Sea. The By-Law specifically includes “reducing hazards from fire, flood, panic, and other dangers” as a specific purpose.

4.7 Flood Control District
The Flood Control District will consist of those areas designated as A1, A2 and B1 in Figure8 of a report prepared for the Town of Manchester-by-the-Sea-by-the-Sea by the consulting firm of Camp, Dresser and McKee entitled "Storm Drainage Improvements for the Bennett's Brook Drainage Area" dated October, 1971.

4.7.2 The purpose of the Flood Control District is to protect the public health and safety and property against the damages of flooding conditions caused by new development in areas with inadequate capacity of existing drainage systems, brook channels, and street culverts to accept storm runoff from the areas drained.

4.7.3 Any use otherwise permitted in the underlying district is permitted as a matter of right within the Flood Control District except those uses expressly regulated in this Section.

The following uses are hereby regulated:
4.7.3.1 Dumping, filling, or placing of soil or other substance as landfill or surfacing the land with any type of impervious materials; excavation, dredging, or removing of natural resource deposits.
4.7.3.2 Erection or construction of new buildings and enlargement or moving of existing structures.

4.8 Flood Plain
4.8.1 Flood Plain District:
The purposes of the Flood Plain District are to:

(a) Ensure public safety through reducing the threats to life and personal injury;
(b) (b) Eliminate new hazards to emergency response officials;
(c) Prevent the occurrence of public emergencies resulting from loss of water quality, contamination, and pollution due to flooding
(d) Avoid the loss of utility services which, if damaged by flooding, would disrupt or shut down the utility network and impact regions of the community beyond the site of flooding;
(e) Eliminate costs associated with the response and cleanup of flooding conditions;
(f) Reduce damage to public and private property resulting from flooding waters.

4.8.2 Flood Plain District Boundaries and Base Flood Elevation and Floodway Data

4.8.2.1 The Flood Plain District is herein established as an overlay district. Any use otherwise permitted in the underlying district is permitted as a matter of right in the Flood Plain District, provided the use meets the following additional requirements and those of the Massachusetts State Building Code dealing with construction in flood plains and coastal high hazard areas as applicable. The Flood Plain District includes all special flood hazard areas designated as Zones A, A1-30, V1-30, AO, AH and B on the Manchester-by-the-Sea-by-the-Sea, Massachusetts Flood Insurance Rate Map (FIRM), dated July 2, 1992 and September 4, 1986, which indicates the 100-year regulatory flood plain. The exact boundaries of the District shall be defined by the 100-year base flood elevations shown on the FIRM and shall be further defined by the Flood Insurance study booklet (FIS) dated July 4, 1986.

4.8.2.2 Base Flood Elevation and Floodway Data
(a) Base Flood Elevation Data is required for subdivision proposals or other developments greater than 50 lots or 5 acres, whichever is the lesser, within unnumbered A zones.

4.9. Ground and Surface Water Resource Overlay Protection Districts
4.9.1 Findings:
The Town of Manchester-by-the-Sea-by-the-Sea finds that:
(a) The groundwater underlying the Town is a major source of its existing and future water supply, including drinking water.

(b) The aquifer system supplying Manchester-by-the-Sea-by-the-Sea with its groundwater supply is integrally connected with numerous surface waters, lakes, and streams.
(c) The surface water supplies of Gravelly and Round Ponds supplement the Town's groundwater resource, and are similarly considered an indispensable natural resource.
(d) Accidental spills and discharges of toxic and hazardous materials have threatened the quality of such water supplies posing public health and safety hazards.
(e) Unless preventive measures are adopted to control the discharge and storage of toxic and hazardous materials within the Town, further spills and discharges of such materials will predictably occur and with greater frequency and degree of hazard by reason of increasing land development, population and vehicular traffic within Manchester-by-the-Sea-by-the-Sea.

4.9.2 Purpose:
The purpose of this section is to protect the public health, safety, and welfare through the preservation of the Town's water resources to ensure a future supply of safe and healthful drinking water for the residents and employees of the Town of Manchester-by-the-Sea by- the-Sea and the general public. The designation of the Ground and Surface Water Resource Overlay Protection Districts and careful regulation of development activities within these districts can reduce the potential for ground and surface water contamination.

4.9.5.1. Prohibited uses in Zone I, Zone II, and Zone III, and Zone A, Zone B, and Zone C include prohibitions on impervious surface areas as follows:

(p) Land uses that result in the rendering impervious of more than 15% or 2,500 square feet of any lot, whichever is greater, unless a system for artificial recharge of precipitation is provided, which is satisfactory to the Planning Board that will not result in the degradation of groundwater quality. A special permit for this land use may be granted by the Planning Board in all but Zone 1.

6.5 Site Plan Approval
6.5.1 Purpose:
The purpose of Site Plan Review is to ensure that the design and layout of certain developments permitted as a matter of right or by special permit will constitute suitable development and will not result in a detriment to the neighborhood or the environment. In considering a site plan the Planning Board shall assure:
(a) protection of adjacent areas against detrimental or offensive uses on the site by *provisions of adequate surface water drainage*, buffers against lighting, sight, sound, dust, vibration, and allowance of sun, light, and air;
(b) Convenience and safety of vehicular and pedestrian movement within the site and in relation to adjacent areas;
(c) Adequacy of facilities of handling and disposal of refuse and other production by-products;
(d) Protection of environmental features on the site and in adjacent areas;

(e) Promotion of appropriate arrangement of structures within the site and in relation to existing structures within the district and neighborhood;
(f) Coordination with and improvement of systems of vehicular and pedestrian access, *drainage*, water supply, sewage disposal, lighting, landscaping, wetlands, water courses, buildings and other features that support the neighborhood;
(g) Compliance with all applicable sections of the Zoning By-Laws.

6.5.2 Applicability:
Any new development, expansion, or change in use other than a single-family or two-family residence which would under the parking schedule "Off-Street Parking and Driveway/Curb Cut Regulations" of Section 6.2, require at least five (5) but less than ten (10) parking spaces.

The site plan must show all existing and proposed buildings, existing and proposed contour elevations, structures, parking spaces, driveway openings, driveways, service areas, facilities for sewage, refuse and other waste disposal *and for surface water drainage, wetlands, surface water, areas subject to the 100 year-flood*, and landscape features such as fences, walls, trees and planting areas.

The site plan must include material as may be required regarding measures proposed to prevent pollution of surface or ground water, soil erosion, increased runoff, changes in groundwater level, and flooding.

6.7 Open Space Planning Development
Open Space Planning developments are allowed by Special Permit in Residence Districts A, C, or E. A minimum lot size of 10 acres is required, frontage and setbacks are reduced and at least 30% of the development must be open land.

6.8 Planned Residential Development
Planned Residential Developments (PRD) are allowed on parcels of at least 50 acres by Special Permit in the Residential C and E Districts. The PRD seeks the conservation of open space and the lessening of land disturbance and excavation. Single Family and Multi Family residences are allowed with no minimum lot area required. The overall density is not to exceed the underlying zoning and 70% of the development must be preserved as common open space.

6.13 Residential Conservation Cluster
RCC is designed to save open space, preserve habitat and reduce stormwater runoff and flooding. For any development of at least 5 acres or 6 lots, the Planning Board may choose the RCC method of development rather than a conventional subdivision design. RCC allows for reduced frontage and setbacks and is allowed in all zoning districts that allow Single Family housing.

6.15 Stormwater Management Special Permit
Regulation of discharges to the municipal separate storm sewer system (MS4) is necessary for the protection of the Town of Manchester-by-the-Sea-by-the-Sea's water

bodies and groundwater, and to safeguard the public health, safety, welfare and the environment. Increased and contaminated stormwater runoff associated with developed land uses and the accompanying increase in impervious surface are major causes of impairment of water quality and flow and contamination of drinking water supplies, erosion of stream channels, alteration or destruction of aquatic and wildlife habitat, and flooding.

No person may undertake a construction activity, including clearing, grading and excavation that results in a land disturbance that will disturb equal to or greater than one acre of land or will disturb less than one acre of land but is part of a larger common plan of development that will ultimately disturb equal to or greater than one acre of land draining to the Town's municipal separate storm sewer system without a special permit from the Planning Board.

General Bylaws

Article XII Earth Removal
A permit from the Planning Board is required for the removal of more than 250 yards of earth from any Manchester-by-the-Sea-by-the-Sea parcel. Certain exemptions apply.

Article XVII General Wetlands Bylaw
A revised wetlands bylaw was adopted by the town in 2010. The new bylaw continues to provide jurisdiction over wetland resource areas and their 100-foot buffer zone but also adds more concise explanations of the underlying wetland regulations, definitions and restrictions for any wetland resource areas. The new bylaw also adds specific language regarding alterations within 200 feet of any riverfront area and allows the town the option to enforce wetlands violations by issuing citations rather than going to court.

The wetland regulations provide for "no-touch" and "no-build" policies within the 100 buffer zone.

Other Programs

Open Space Plan
The town is currently updating its 2004 Open Space and Recreation Plan.

Community Preservation Act
Manchester-by-the-Sea first adopted the Community Preservation Act in 2005 and again in 2010 when it voted for a higher local surcharge of 1.5% instead of 0.5%.

Existing Wind Hazard Mitigation Measures

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.

- *Tree-trimming program* – The town hires outside contractors on occasion to help with tree maintenance and also has its own tree chipper. The electrical utility company National Grid does a full tree inspection of its power line corridors every three years and takes down problem trees as needed. The town feels that this is not entirely effective as the more difficult hazardous trees are not always dealt with. The town would like to purchase a bucket truck and tub grinder to help with tree maintenance.

Existing Winter Hazard Mitigation Measures

Snow disposal –The town conducts general snow removal operations with its own equipment and hires outside contractors as needed. The Mass Department of Transportation (MA DOT) handles snow removal for portions of State Highway Routes 128 and all of Route 127 except for the downtown in Manchester-by-the-Sea.

Existing Fire Hazard Mitigation Measures

Permits Required for Outdoor Burning – The Fire Department requires a written permit for outdoor burning, which is permitted only between January 1 and April 30.

Subdivision Review – The Fire Department is involved in reviewing all subdivision plans.

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 Multi-Hazard Mitigation Measures

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

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

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

Participation in the Local Emergency Management Planning Committee **(LEPC)** Manchester-by-the-Sea has its own Local Emergency Planning Committee**.**

Table 10: Manchester-by-the-Sea Existing Natural Hazard Mitigation Measures

Hazard	Area	Mitigation Measure
Flood –Related	Town-Wide	A) The town participates in the National Flood Insurance Program and adopted the FIRM maps. There are 111 policies in force. The town actively enforces floodplain regulations. B) All streets and catch basins (635) are cleaned annually. C) 50/50 sand/salt mix is used for winter road treatments. D) Drainage infrastructure and maintenance performed using MA Chapter 90 funds. E) Subdivision Rules for drainage F) Flood Control and Flood Plain Overlay Districts G) Site Plan Review for stormwater and erosion H) Residential Conservation Cluster for developments over 5 acres or 6 lots

Hazard	Area	Mitigation Measure
		I) Open Space and Planned Residential Developments allowed J) Ground/Surface Water Resource Districts K) Stormwater Management Bylaw L) 2004 Open Space Plan being revised M) Community Preservation Act adopted in 2005 and re-adopted at 1.5% in 2010 N) Revised Wetlands Bylaw adopted in 2010
Dams	**Town-Wide**	A) DCR Dam Safety Regulations B) State permits required for dam construction. C) Comprehensive Emergency Management Plan addresses dam safety and is up to date.
Wind-Related	**Town-Wide**	A) Outside contract for tree trimming. National Grid maintains trees within its power line corridors**.** B) The town enforces the MA State Building Code.
Winter-Related	**Town-Wide**	A) Standard snow operations with 50/50 salt/sand mix.
Brush Fire-Related	**Town-Wide**	A) The Fire Department requires a written permit for outdoor burning. B) The Fire Department reviews all subdivision development plans.
Geologic - *Earthquake*	**Town-Wide**	A) The town enforces the MA State Building Code. B) Evacuation plans in CEMP C) Shelters and backup facilities available
Geologic- *Landslide*	**Town-Wide**	A) Maximum slope for subdivision roads B) Earth Removal Bylaw
Multi-Hazard	**Town-Wide**	A) The town enforces the MA State Building Code. B) Comprehensive Emergency Plan C) Town utilizes the MA Emergency Incident Command Unit. D) Town has Code Red, a form of Reverse 911.

Hazard	Area	Mitigation Measure
		E) Manchester-by-the-Sea is a member of the Region One Boston Network (BAPERN). F) The town has its own Local Emergency Planning Committee. G) Fire Station has a fixed, diesel generator. Police Station has a fixed, diesel generator. H) Multi department review of all developments.

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VI. HAZARD MITIGATION GOALS AND OBJECTIVES

The Manchester-by-the-Sea Local Multiple Hazard Community Planning Team met on March 19, 2010. At that meeting, the team reviewed and discussed a draft set of goals and objectives for the town of Manchester-by-the-Sea. The following eight goals were endorsed by the team for the Manchester-by-the-Sea Plan to the Metro Boston North Shore Hazard Mitigation Plan:

1. Prevent and reduce the loss of life, injury, public health impacts and property damages resulting from all major natural hazards.

2. Identify and seek funding for measures to mitigate or eliminate each known significant flood hazard area.

3. Integrate hazard mitigation planning as an integral factor in all relevant municipal departments, committees and boards.

4. Prevent and reduce the damage to public infrastructure resulting from all hazards.

5. Encourage the business community, major institutions and non-profits to work with the Town to develop, review and implement the hazard mitigation plan.

6. Work with surrounding communities, state, regional and federal agencies to ensure regional cooperation and solutions for hazards affecting multiple communities.

7. Ensure that future development meets federal, state and local standards for preventing and reducing the impacts of natural hazards.

8. Take maximum advantage of resources from FEMA and MEMA to educate Town staff and the public about hazard mitigation.

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VII. POTENTIAL MITIGATION MEASURES

What is hazard mitigation?

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

Process for Setting Priorities and Prioritization for Mitigation Measures

The decision on priorities was made at a meeting of the local committee. Priority setting was based on local knowledge of the hazard areas, cost information and an assessment of benefits.

MAPC staff attended the FEMA Benefit-Cost Analysis Training Course on October 31-November 1, 2005 and on October 24- 25, 2007. Information from this training was shared with local officials in order to help them understand the role of a benefit/cost analysis in developing and evaluating potential mitigation projects.

Based on information gained from the Benefit-Cost Analysis trainings and a review of the STAPLEE criteria (a checklist for evaluating social, technical, administrative, political, legal, economic and environmental issues) 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 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 breakdown of high, medium and lower priority measures, along with measures to ensure ongoing compliance with NFIP and other possible measures is provided in the discussions below and summarized in Table 11.

High Priority Mitigation Measures (not listed in order of priority)

Flooding, Drainage Infrastructure

Central Manchester-by-the-Sea Drainage System: Mitigation to the Central Manchester-by-the-Sea Drainage System is a high priority for the town of Manchester-by-the-Sea. The town would like to develop an overall feasibility, implementation and action plan for the downtown areas affected, followed by actions to improve drainage and safety. Immediate mitigation would include replacement of the Sawmill Brook culvert and the Central Street bridge deck to increase drainage capacity.

Old Essex Road: This area should be included in the overall Manchester-by-the-Sea Drainage Study. Direct mitigation could include replacement of the Sawmill Brook culvert and the Central Street bridge deck to increase drainage capacity.

School Street: This area should also be included in the overall downtown drainage action plan. Drainage improvements to Sawmill Brook and improving stormwater infiltration inflow may potentially mitigate this problem. Direct mitigation could include putting in a sewer cutoff at the School Street and Brook Street intersection which would prevent infiltration inflow from going down School Street. The Local Committee estimates this project to cost approximately $350,000.

Sewage Treatment Plant: is an area of concern for the town and needs to be incorporated into the drainage study plan as well. For immediate mitigation, the town has proposed diverting stormwater away from the Plant by improving the Sawmill Brook drainage system.

Blue Heron Lane: This area should be included in the downtown area drainage plan and drainage upgraded as needed.

Bennett's Brook Neighborhood: A comprehensive drainage study could serve as a prelude for determining potential mitigation measures. Mitigation to the Bennett Brook Neighborhood is a high priority.

Find more resources for more frequent maintenance of town-owned drainage infrastructure, particularly as federal Clean Water Act mandates are increasing.

The Fire and Water Departments both need additional portable pumps for basement pump-outs

Dams

The Town is will include study of the enlargement or replacement of the town-owned Saw Mill Brook/ Central Street Dam as part of conducting the Central Manchester-by-the-Sea Drainage System Study.

Land Protection and Flooding

The town's top land protection priority is the protection of wetland areas buffering the water supply north of Rte 128 on Upper Pine Street, which are currently owned by Gordon College.

Complete update of Manchester-by-the-Sea Open Space and Recreation Plan.

Winter Storms

Purchase two snow blowers and one sidewalk plow to clear snow downtown and provided emergency access.

Brush Fires

Purchase two new pumper trucks and 6,000 feet of new 4-inch fire hose.

Purchase new forest fire pumper truck: 2-ton, 4 x 4, with 400 gallon/minute pumping capacity.

Purchase new forest fighting equipment: Hand tools, water cans, floating and portable pumps, nozzles, Y-adapters, 5,000 feet of 1.5 inch hose, 10,000 feet of 1.25 inch hose.

High Winds

Purchase new bucket truck and tub grinder to increase tree maintenance capacity.

Multi-hazard: power outage and communications

Install fixed, multi-fuel generator at Memorial School.

Install fixed, multi-fuel generator at DPW facility.

Upgrade current fixed, diesel Police Station generator with fixed, multi-fuel generator to serve both adjacent Town Hall and Police Station.

Upgrade fixed, diesel generator at Fire Station with fixed, multi-fuel generator.

Install 480-phase backup generators at sewage pump station.

Acquire one, trailer-mounted, single-phase, 10 Kw generators for the Fire Department.

Acquire four, 3-5 Kw, trailer mounted generators.

Develop interoperable radio system between Police, Fire and DPW Departments.

Medium Priority Mitigation Measures

Flooding and Drainage Infrastructure

Increase preventive maintenance practices on town drainage infrastructure and investigate funding options such as a stormwater utility.

Raymond Street: Improve drainage infrastructure and investigate the possibility of connecting the neighborhood Title V systems into the Gloucester sewage treatment system.

Ocean Street: Determine options for preventing street washout by ocean surge and tidal flooding.

Magnolia Avenue: Replace existing Wolf Brook culvert with new 4x4, reinforced concrete culvert.

Highland Avenue: Install roadside berms and additional catch basins.

The town can distribute information on the National Flood Insurance Program including information on insurance and building code requirements through explanatory pamphlets, booklets and on-line resources.

Update town Flood Information Rate Maps (FIRM) maps and update town bylaw as needed'

Lower Priority Mitigation Measures

Earthquakes

Investigate options to make all public safety buildings earthquake resistant.

Multi-hazards

Ensure that emergency plans for hazardous facilities within Manchester-by-the-Sea are up to date and mapped.

Introduction to Potential Mitigation Measures (Table 11)

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

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

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/stream bank 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 fire fighting needs. See the link below for some example.

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

Abbreviations Used in Table 11

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

ACOE = Army Corps of Engineers.

MA DOT Highway Division = Massachusetts Department of Transportation

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 11 Manchester-by-the-Sea Potential Mitigation Measures						
Hazard Area	**Mitigation Measure**	**Priority**	**Implementation Responsibility**	**Time Frame**	**Estimated Cost**	**Potential Funding Sources**
High Priority						
Flooding/Drainage *Central Manchester Drainage Plan*	Survey, design and implement comprehensive downtown/central Manchester-by-the-Sea drainage and stormwater action plan.	High & NFIP	DPW/MA DOT	2010 -2012	$250,000	Manchester-by-the-Sea/FEMA
Dams	Include the enlargement or replacement of the Sawmill Brook Dam as part of the overall downtown drainage plan.	High	DPW	2010- 2013	Part of $250,000 downtown drainage plan cost.	Manchester-by-the Sea/FEMA
Old Essex Road	Include in overall downtown drainage plan.	High	DPW	2010 -2012	$250,000	Manchester-by-the-Sea/FEMA
Old Essex Road: alternative mitigation	Replace Sawmill Brook culvert and bridge deck	High	DPW	2011- 2012	Culvert: $100,000 Bridge Deck; $1.5 million	Manchester-by-the-Sea/FEMA
School Street	Include in overall downtown drainage plan.	High	DPW /MA DOT	2011 - 2012	$250,000	Manchester-by-the-Sea/MA

Table 11
Manchester-by-the-Sea Potential Mitigation Measures

Hazard Area	Mitigation Measure	Priority	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
						DOT/FEMA
School Street: alternative mitigation	Install sewer cut-off at intersection of School and Brooks Street	High	DPW /MA DOT	2011 - 2012	$350,000	Manchester-by-the-Sea/FEMA
Sewage Treatment Plant	Include in overall downtown drainage plan.	High	DPW /MA DOT	2011 - 2013	$250,000	Manchester-by-the-Sea/MA DOT/FEMA
Sewage Treatment Plant: alternative mitigation	Make improvements to Sawmill Brook drainage system	High/ NFIP	DPW	2011- 2013	$250.000	Manchester-by-the-Sea/MA DOT/FEMA
Blue Heron Lane	Include in overall downtown drainage plan.	High	DPW/MA DOT	2011 -2013	$250,000	Manchester-by-the-Sea/FEMA
Bennett's Brook Neighborhood	Survey, design and implement comprehensive downtown/central Bennett's Brook watershed drainage and stormwater action plan.	High / NFIP	DPW	2011-2013	TBD	Manchester-by-the-Sea/FEMA

Table 11
Manchester-by-the-Sea Potential Mitigation Measures

Hazard Area	Mitigation Measure	Priority	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
Flooding Assistance	Purchase six additional portable water pumps for the Fire and DPW Departments: (1) 6-inch, (1) 4-inch, (3) 1.5-inch, (1) 2.5-inch	High	Fire Department	2011 - 2012	TBD	Manchester-by-the-Sea/FEMA
Land Protection	Complete update of Manchester-by-the-Sea Open Space and Recreation Plan.	High	Conservation Commission	2011	Ongoing	Manchester-by-the-Sea
Land Protection	Acquire priority open space parcels.	High / NFIP	Community Preservation Committee/ Conservation Commission	2011 - 2015	TBD	CPA Fund/ MA DCR/ Manchester-by-the-Sea
Winter Storms	Purchase two snow blowers and one sidewalk plow.	High	DPW	2011- 2013	TBD	Manchester-by-the-Sea/ FEMA
Brush Fires	Purchase two new pumper trucks and 6,000 feet of new 4-inch hose.	High	Fire Department	2011-2013	TBD	Manchester-by-the-Sea/ FEMA
High Winds	Purchase new bucket truck	High	DPW	2011- 2013	Bucket truck:	Manchester-by-

Table 11
Manchester-by-the-Sea Potential Mitigation Measures

Hazard Area	Mitigation Measure	Priority	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
	and tub grinder for tree maintenance.				$98,000 Tub grinder: $150,000	the-Sea/ FEMA
Brush Fires	Purchase new forest fire pumper truck, tools, pumps, and hose.	High	Fire Department	2011- 2013	TBD	Manchester-by-the-Sea/ FEMA
Multi-hazard: power outage and communications	Purchase and install fixed, multi-fuel generators for backup power at Memorial School, and DPW building. Upgrade Police Station generator to serve both Police and Town Hall. Upgrade Fire Station generator.	High	Fire Department/ DPW/Police Department	2011 - 2013	$40,000/ generator	Manchester-by-the-Sea/ FEMA
Multi-hazard: power outage and communications	Install 480-phase backup generators at sewage pump station.	High	DPW	2011 - 2013	$75,000	Manchester-by-the-Sea/ FEMA
Multi-hazard: power outage and communications	Acquire one, trailer-mounted, single-phase, 10 Kw generators for the Fire Department. Acquire four, 3-5 Kw,	High	Fire Department	2011- 2013	TBD	Manchester-by-the-Sea/ FEMA

Table 11
Manchester-by-the-Sea Potential Mitigation Measures

Hazard Area	Mitigation Measure	Priority	Implementation Responsibility	Time Frame	Estimated Cost	Potential Funding Sources
	trailer mounted generators.					
Multi-hazard: power outage and communications	Develop interoperable radio system between Police, Fire and DPW Departments.	High	Police/Fire and DPW	2011 – 2014	TBD	Manchester-by-the-Sea/ FEMA
Medium Priority						
Drainage Infrastructure Maintenance	Create more resources for more frequent maintenance of town-owned drainage facilities such as more frequent catch basin cleaning and replacement, culvert replacement, stormwater attenuation and treatment	Medium	DPW	2011 - 2015	TBD	Manchester-by-the-Sea
Raymond Street	Improve drainage infrastructure and investigate the possibility of connecting the neighborhood Title V systems into the Gloucester sewage treatment system.	Medium	DPW	2011 - 2015	TBD	Manchester-by-the-Sea

Table 11 Manchester-by-the-Sea Potential Mitigation Measures						
Hazard Area	**Mitigation Measure**	**Priority**	**Implementation Responsibility**	**Time Frame**	**Estimated Cost**	**Potential Funding Sources**
Ocean Street	Determine options for preventing street washout by ocean surge and tidal flooding.	Medium	DPW	2011 - 2015	TBD	Manchester-by-the-Sea
Highland Avenue	Install roadside berms and additional catch basins.	Medium	DPW	2013 – 2015	TBD	Manchester-by-the-Sea
Town wide	Provide Public Information on NFIP Compliance	Medium / NFIP	DPW	Ongoing	Staff time and materials	Manchester-by-the-Sea
Town wide	Update town Flood Information Rate Maps (FIRM) maps and update town bylaw as needed	Medium / NFIP	Planning	2011-2012	Staff time	Manchester-by-the-Sea
Lower Priority						
Earthquakes	Investigate options to make all public safety buildings earthquake resistant.	Lower	Fire Department	2010- 2015	TBD	Manchester-by-the-Sea

VIII. 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. There is a third level of mitigation which is regional; involving a state, regional or federal agency or an issue that involves three or more municipalities.

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 Manchester-by-the-Sea, the Department of Conservation and Recreation (DCR), the Massachusetts Water Resources Authority (MWRA), Massachusetts Department of Transportation (MA DOT) and the Massachusetts Bay Transportation Authority (MBTA). The planning, construction, operations and maintenance of these structures are integral to the flood hazard mitigation efforts of communities. These agencies must be considered the communities regional partners in hazard mitigation. These agencies also operate under the same constraints as communities do including budgetary and staffing constraints and numerous competing priorities. In the sections that follow, the plan includes recommendations for activities to be undertaken by these other agencies. Implementation of these recommendations will require that all parties work together to develop solutions.

Inter-Community Considerations

Beaver management continues to be a persistent problem for Manchester-by-the-Sea and its neighboring communities, especially in Essex, Hamilton and Wenham. Wenham and Hamilton are both members of the Miles River Task Force and beaver dams are a major contributing factor to chronic flooding and backups in the Miles River watershed, indirectly impacting and contributing to Manchester-by-the-Sea's own beaver issues in the North Coastal watershed.

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IX. PLAN ADOPTION AND MAINTENANCE

Plan Adoption and FEMA Approval

The Manchester-by-the-Sea Hazard Mitigation Plan was adopted by the Board of Selectmen on August 6, 2012. The plan was approved by FEMA on October 18, 2012 for a five-year period that will expire on October 18, 2017. See Appendix D for documentation.

Plan Maintenance

MAPC worked with the Manchester-by-the-Sea 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 Team, 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 Local 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 team 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 Manchester-by-the-Sea Hazard Mitigation Plan. The Local Hazard Mitigation Implementation Team will have primary responsibility for tracking progress and updating the plan.

Develop a Year Four Update – At the beginning of the fourth year after plan adoption, the coordinator of the Local 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 the town's 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 prepared and approved in order to maintain the town's approved plan status and its eligibility for FEMA mitigation grants. Because of the lead 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 at the beginning of Year 4. 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 Local 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 Manchester-by-the-Sea 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 Manchester-by-the-Sea 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:

The membership of the Regional Implementation Group and local committees.
Issues related to integration of the plans with local and regional plans and procedures.
An analysis of the relevance of the hazard mitigation goals.
The successfulness of the plan in accomplishing mitigations measures.

Prepare and Adopt New Community Planes and Regional Plan – However the Regional Implementation Group decides to update the plan, the group will need to review the current disaster mitigation plan guidelines for any changes. The plan update subcommittee will present the full Regional Implementation Group with an update of the Planes to the Regional Plan. The updates of the Planes and Regional Plan are forwarded to MEMA and DCR for review and to FEMA for approval.

Integration of the Plans with other Planning Initiatives

Upon approval of the Manchester-by-the-Sea Hazard Mitigation Plan by FEMA, the 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.

In addition, the plan will be made available for review by state agencies such as MEMA, DCR, and DOT.

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X. 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 Manchester-by-the-Sea Zoning and General Bylaws

Town of Manchester-by-the-Sea Subdivision Rules and Regulations

Town of Manchester-by-the-Sea Open Space and Recreation Plan, 2004

Flood Insurance Study, Town of Manchester-by-the-Sea, MA Federal Emergency Management Agency, Revised August 19, 1991

Commonwealth of Massachusetts, MacConnell Land Use Statistics, 1999

Federal Emergency Management Agency, Flood Insurance Rate Maps for Manchester-by-the-Sea, MA, 2007

MA Executive Office of Environmental Affairs, Build Out Analysis for Manchester-by-the-Sea, MA 2000

Metropolitan Area Planning Council, Geographic Information Systems Lab

Metropolitan Area Planning Council, Regional Plans and Data

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APPENDIX A
MEETING AGENDAS

Don Boyce
DIRECTOR

Richard Sullivan
COMMISSIONER

Marc D. Draisen
EXECUTIVE DIRECTOR

GREATER BOSTON PRE-DISASTER MTITGATION PLAN

UPPER NORTH SHORE REGIONAL HAZARD MITIGATION TEAM
Danvers
Essex
Gloucester
Hamilton
Ipswich
Manchester
Middleton
Rockport
Wenham

INNER CORE-WEST REGIONAL HAZARD MITIGATION TEAM
Arlington
Belmont
Newton
Waltham
Watertown
Wellesley

SOUTH SHORE REGIONAL HAZARD MITIGATION TEAM
Duxbury
Norwell

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

Hazard Mitigation Community Planning Team
Greater Boston / Upper North Shore

First Meeting

Tuesday, April 15, 10:00 AM
Hamilton Public Safety Building
265 Bay Road (Rt. 1A), Hamilton

AGENDA

10:00 WELCOME & INTRODUCTIONS *(Please sign contact sheet)*

10:10 OVERVIEW OF FEDERAL DISASTER MITIGATION ACT & PRE-DISASTER MITIGATION PLANNING

- Presentation, Questions & Discussion
  --Martin Pillsbury, Manager of Regional Planning, MAPC

10:30 GETTING STARTED: THE HAZARD MITIGATION PLAN FOR THE UPPER NORTH SHORE COMMUNTIES

- Review of Scope of Work & Schedule
- Questions & Discussion - Local Issues & Priorities

10:50 PREVIEW OF MAPPING AND DATABASES FOR THE PLAN

- Examples from the North Shore & Metro Boston PDM Plans
  --Alan Bishop, GIS Manager, MAPC

11:20 NEXT STEPS / MEETING SCHEDULE

11:30 ADJOURN

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

Don Boyce
DIRECTOR

Richard Sullivan
COMMISSIONER

Marc D. Draisen
EXECUTIVE DIRECTOR

GREATER BOSTON PRE-DISASTER MITIGATION PLAN

UPPER NORTH SHORE REGIONAL HAZARD MITIGATION TEAM
Danvers
Essex
Gloucester
Hamilton
Ipswich
Manchester
Middleton
Rockport
Wenham

INNER CORE-WEST REGIONAL HAZARD MITIGATION TEAM
Arlington
Belmont
Newton
Waltham
Watertown
Wellesley

SOUTH SHORE REGIONAL HAZARD MITIGATION TEAM
Duxbury
Norwell

THE COMMONWEALTH OF MASSACHUSETTS
Deval Patrick, Governor

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

Hazard Mitigation Community Planning Team
Upper North Shore

Second Meeting

Tuesday, September 30, 10:00 AM
Hamilton Public Safety Building
265 Bay Road (Rt. 1A), Hamilton

AGENDA

10:00 WELCOME, INTRODUCTIONS & OVERVIEW OF AGENDA
- *Martin Pillsbury, Project Manager*

10:05 REVIEW OF HAZARD MAPPING AND CRITICAL INFRASTRUCTURE DATA COLLECTION
- *Allan Bishop, GIS Manager, will present an overview of the draft Critical Facilities database and community hazard maps*

10:45 UPDATE ON LOCAL PLANS
- *Sam Cleaves and Brad Stoler will review progress and next steps for developing the local PDM Plan Annexes for each community*

11:00 SETTING GOALS AND OBJECTIVES FOR THE REGIONAL PDM PLAN
- *Martin Pillsbury will in review goals and objectives and ask the team to discuss priorities for the North Shore communities (see attachment)*

11:20 NEXT STEPS / MEETING SCHEDULE

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

Manchester-by-the-Sea Predisaster Mitigation Planning Meeting
Information Gathering Meeting
August 14, 2008
Manchester-by-the-Sea Town Hall
9:30 – 11:00

Agenda

1. Welcome and Introductions

2. Project Overview

3. Survey Handout and Ortho Map Markup of Hazardous Areas/ Conversation:

    - What floods? How often? Any mitigation studies done? What mitigation measures have been done or planned for? High or low priority?

    - Other hazards: Brush fires, dams, earthquake, high winds? What areas? Dam studies available?

    - Map known future development areas? Type, size, status of permitting

    4. Next Steps: Follow up with individuals as needed, continue information gathering, set local group Goals and Objectives meeting and check information to date

The Metro Boston Upper North Shore
Multi-Hazard Mitigation Plan
Second Local Committee Meeting

Manchester Pre-Disaster Mitigation Meeting Agenda
September 30, 2008

1. Welcome and introductions

2. Review of scope of work and progress to date

3. Review aerial maps of critical natural hazards and potential development and discuss:
    a. Severity and frequency
    b. Existing and potential mitigation measures
    c. Costs & funding
    d. Timeframes
    e. Priorities

4. Develop goals and objectives

5. Next steps

Manchester-by-the-Sea Predisaster Mitigation Planning Meeting
Local Work Group Meeting
March 5, 2010
Manchester-by-the-Sea Town Hall
8 – 9:45 am

Agenda

1. Welcome, Introductions

2. Complete mitigation matrix, set priority projects/ timeline/ estimate costs

3. Check digitized ortho photo showing Areas of Concern—check for accuracy and edit as needed

4. Review draft goals for Hazard Mitigation Plan and introduce STAPLEE Criteria

5. Next steps: 1) submit draft plan to Work Group for comment; 2) public meeting with BOS to give overview and get public comment; 3) submit draft plan to MEMA for review—they send on to FEMA

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.	Recent and 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 recent and potential future developments, and critical infrastructure sites. MAPC consulted with town staff to determine areas that were likely to be developed or redeveloped in the future.

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

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

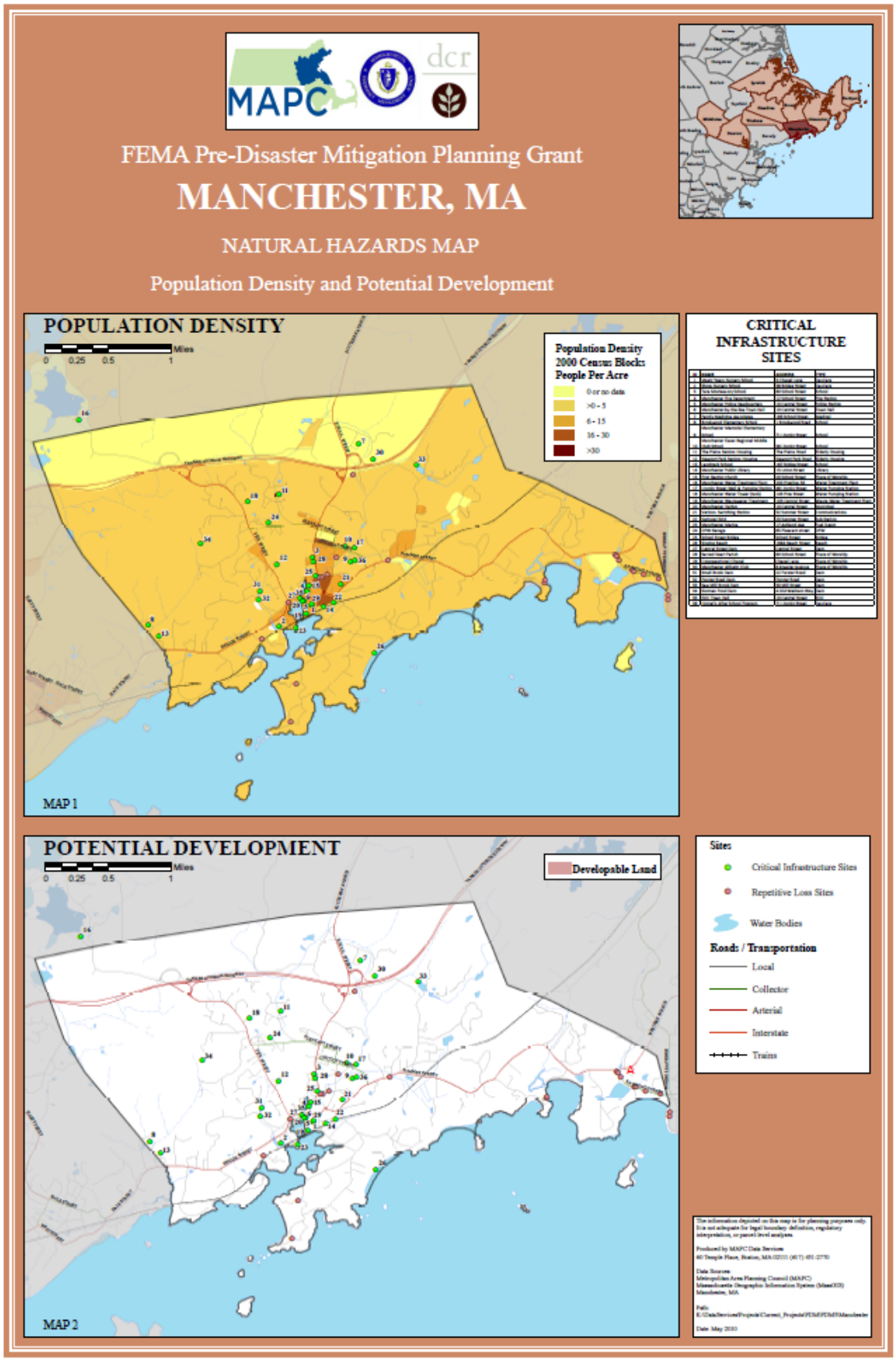
The landslide information shows areas with either a low susceptibility or a moderate susceptibility to landslides based on mapping of geological formations. This mapping is highly general in nature. For more information on how landslide susceptibility was mapped, refer to http://pubs.usgs.gov/pp/p1183/pp1183.html.

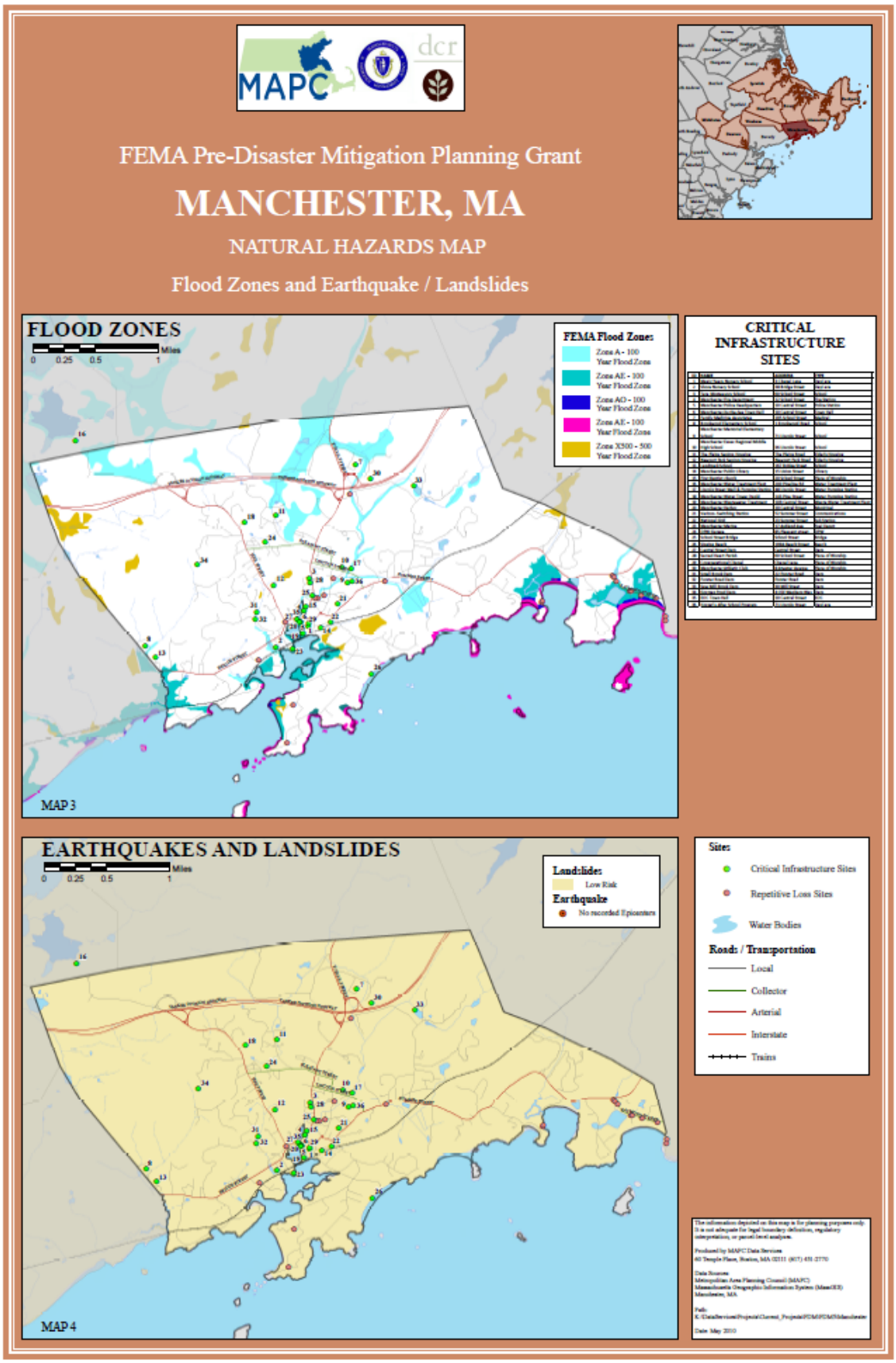
Map 5: Hurricanes and Tornadoes – This map shows a number of different items. The map includes the storm tracks for both hurricanes and tropical storms. This information must be viewed in context. A storm track only shows where the eye of the storm passed through. In most cases, the effects of the wind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

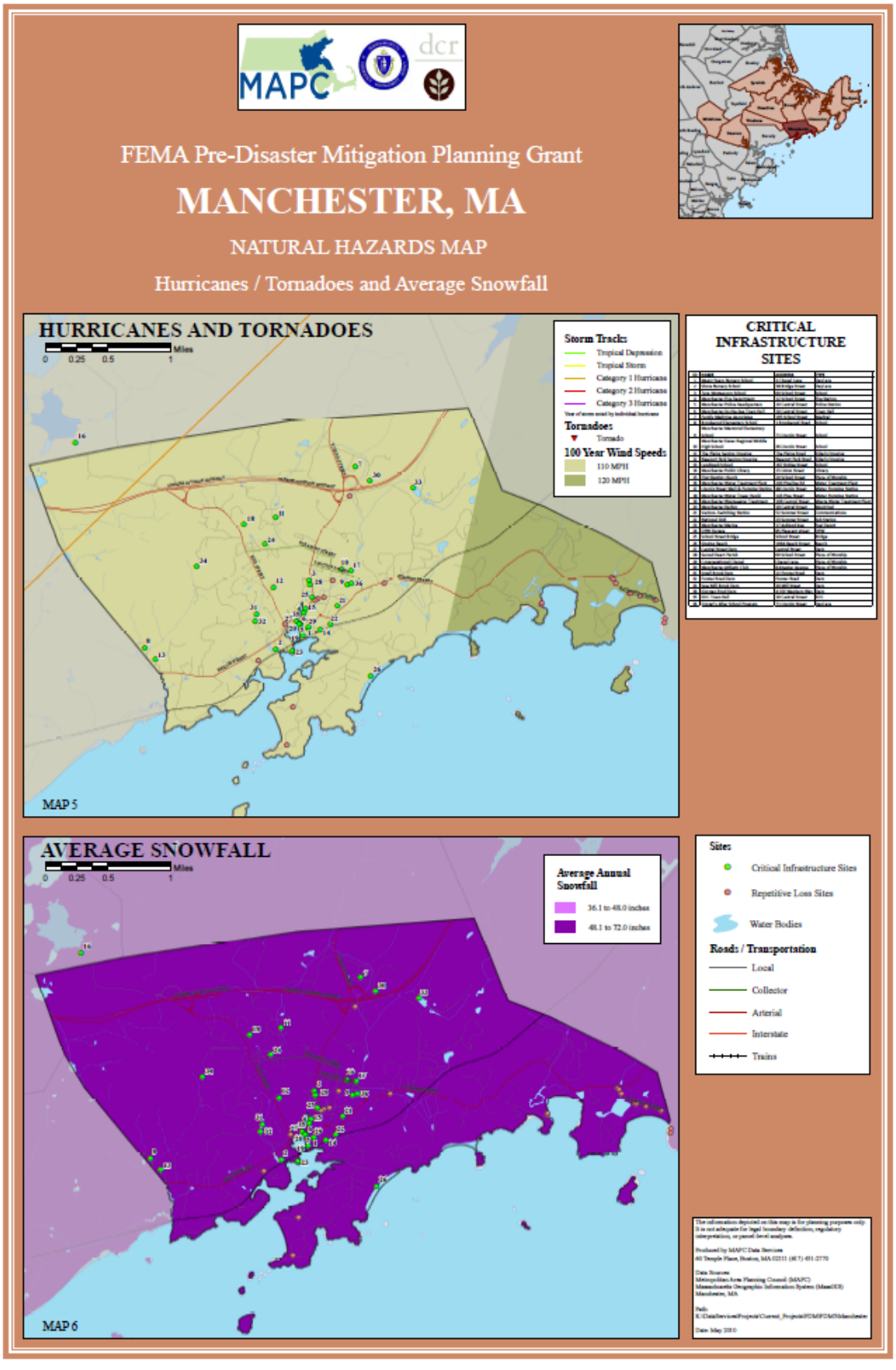
Map 6: Average Snowfall - - This map shows the average snowfall, repetitive loss structures and open space. It also shows storm tracks for nor'easters, if any storms tracked through the community.

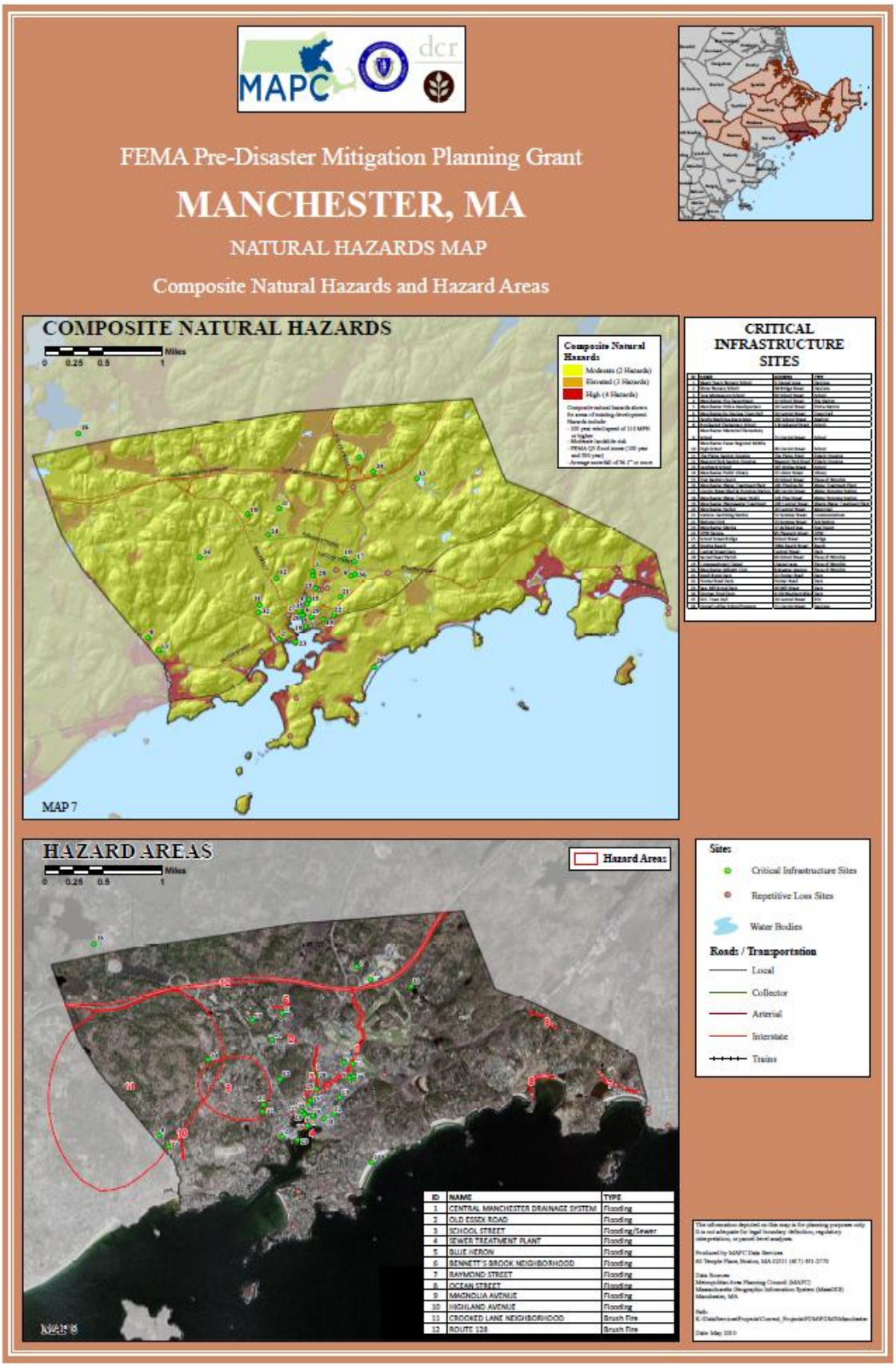
Map 7: Composite Natural Hazards - This map shows four categories of composite natural hazards for areas of existing development. The hazards included in this map are 100 year wind speeds of 110 mph or higher, low and moderate landslide risk, FEMA Q3 flood zones (100 year and 500 year) and hurricane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

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


MAPC
dcr
FEMA Pre-Disaster Mitigation Planning Grant
MANCHESTER, MA
NATURAL HAZARDS MAP
Population Density and Potential Development
POPULATION DENSITY
Miles
0 0.25 0.5 1
Population Density
2000 Census Blocks
People Per Acre
0 or no data
>0 - 5
6 - 15
16 - 30
>30
CRITICAL INFRASTRUCTURE SITES
MAP 1
POTENTIAL DEVELOPMENT
Miles
0 0.25 0.5 1
Developable Land
Sites
Critical Infrastructure Sites
Repetitive Loss Sites
Water Bodies
Roads / Transportation
Local
Collector
Arterial
Interstate
Trains
MAP 2


MAPC
dcr
FEMA Pre-Disaster Mitigation Planning Grant
MANCHESTER, MA
NATURAL HAZARDS MAP
Flood Zones and Earthquake / Landslides
FLOOD ZONES
FEMA Flood Zones
Zone A - 100 Year Flood Zone
Zone AE - 100 Year Flood Zone
Zone AO - 100 Year Flood Zone
Zone AE - 100 Year Flood Zone
Zone X500 - 500 Year Flood Zone
CRITICAL INFRASTRUCTURE SITES
MAP 3
EARTHQUAKES AND LANDSLIDES
Landslides
Low Risk
Earthquake
No recorded Epicenters
Sites
Critical Infrastructure Sites
Repetitive Loss Sites
Water Bodies
Roads / Transportation
Local
Collector
Arterial
Interstate
Trains
MAP 4


MAPC
dcr
FEMA Pre-Disaster Mitigation Planning Grant
MANCHESTER, MA
NATURAL HAZARDS MAP
Hurricanes / Tornadoes and Average Snowfall
HURRICANES AND TORNADOES
Miles
0 0.25 0.5 1
Storm Tracks
Tropical Depression
Tropical Storm
Category 1 Hurricane
Category 2 Hurricane
Category 3 Hurricane
Tornadoes
Tornado
100 Year Wind Speeds
110 MPH
120 MPH
MAP 5
CRITICAL INFRASTRUCTURE SITES
AVERAGE SNOWFALL
Miles
0 0.25 0.5 1
Average Annual Snowfall
36.1 to 48.0 inches
48.1 to 72.0 inches
MAP 6
Sites
Critical Infrastructure Sites
Repetitive Loss Sites
Water Bodies
Roads / Transportation
Local
Collector
Arterial
Interstate
Trains


MAPC
dcr
FEMA Pre-Disaster Mitigation Planning Grant
MANCHESTER, MA
NATURAL HAZARDS MAP
Composite Natural Hazards and Hazard Areas
COMPOSITE NATURAL HAZARDS
Miles
0 0.25 0.5 1
Composite Natural Hazards
Moderate (2 Hazards)
Elevated (3 Hazards)
High (4 Hazards)
MAP 7
CRITICAL INFRASTRUCTURE SITES
HAZARD AREAS
Hazard Areas
Sites
Critical Infrastructure Sites
Repetitive Loss Sites
Water Bodies
Roads / Transportation
Local
Collector
Arterial
Interstate
Trains
ID NAME TYPE
1 CENTRAL MANCHESTER DRAINAGE SYSTEM Flooding
2 OLD ESSEX ROAD Flooding
3 SCHOOL STREET Flooding/Sewer
4 SEWER TREATMENT PLANT Flooding
5 BLUE HERON Flooding
6 BENNETT'S BROOK NEIGHBORHOOD Flooding
7 RAYMOND STREET Flooding
8 OCEAN STREET Flooding
9 MAGNOLIA AVENUE Flooding
10 HIGHLAND AVENUE Flooding
11 CROOKED LANE NEIGHBORHOOD Brush Fire
12 ROUTE 128 Brush Fire

APPENDIX C
DOCUMENTATION OF THE PUBLIC MEETING

MANCHESTER-BY-THE-SEA

BOARD OF SELECTMEN • TOWN HALL
Manchester-by-the-Sea, Massachusetts 01944-1399
Telephone (978) 526-2000 FAX (978) 526-2001

MEETING: BOARD OF SELECTMEN
DATE: MONDAY, JULY 19, 2010
TIME 6:30 P.M.
LOCATION: TOWN HALL

AGENDA

1. **Public Hearing – Personnel Regulations** 6:30 p.m.
2. **Discussion - Pre-Disaster Mitigation Plan** 7:00 p.m.
3. **Ben Rossi – request for the Board's Support of Application to BOH for Permit For Horse Paddocks That Will Encroach on Setbacks to Town Property** 7:30 p.m.
4. **Historic District Commission Appointments**
5. **Correspondence**
6. **Minutes: July 6, 2010**
7. **Other Business**
   - **Transfer Requests**
8. **Executive Session (if necessary)** 9:00 p.m.

Up-Coming Meetings:
Monday, August 2, 2010 @ 6:30 p.m. – Regular Selectmen's Meeting
Monday, August 16, 2010 @ 7:30 p.m. – Harbor Advisory Committee Report
Monday, August 23, 2010 @ 6:30 p.m. – Regular Selectmen's Meeting

MEETING LOCATION: Town Hall **ROOM: 5**

Received by the Town Clerk

Date: _____at _____

Signature **Clerk/Bd. Member**

APPENDIX D
DOCUMENTATION OF PLAN ADOPTION AND FEMA APPROVAL

MANCHESTER-BY-THE-SEA

BOARD OF SELECTMEN • TOWN HALL
Manchester-by-the-Sea, Massachusetts 01944-1399

CERTIFICATE OF ADOPTION
BOARD OF SELECTMEN

TOWN OF MANCHESTER-BY-THE-SEA, MASSACHUSETTS

A RESOLUTION ADOPTING THE TOWN OF MANCHESTER-BY-THE-SEA HAZARD MITIGATION PLAN

WHEREAS, the Town of Manchester-by-the-Sea established a Committee to prepare the Hazard Mitigation plan; and

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

WHEREAS, a duly-noticed public meeting was held by the BOARD OF SELECTMEN on February 9, 2010, and

WHEREAS, the Town of Manchester-by-the-Sea authorizes responsible departments and/or agencies to execute their responsibilities demonstrated in the plan, and

NOW, THEREFORE BE IT RESOLVED that the Town of Manchester-by-the-Sea 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 Manchester-by-the-Sea.

ADOPTED AND SIGNED this Date. August 6, 2012

Board of Selectmen

Susan W. Thorne

Thomas P. Kehoe

Mary M. Hardwick

Paul M. Barclay

Margaret F. Driscoll

U.S. Department of Homeland Security
99 High Street, 6th Floor
Boston, MA 02110-2320

FEMA

October 25, 2012

Susan W. Thorne, Chair
Manchester-By- The-Sea Town Hall
10 Central Street
Manchester, MA 01944

Dear Ms. Thorne:

Thank you for the opportunity to review the Town of Manchester-By-The-Sea, 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 for Mitigation grants administered by FEMA. Requests for mitigation funding will be evaluated individually according to the specific eligibility and requirements of each of these programs. Furthermore, 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 for FEMA funding under the programs referenced above.

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 October 18, 2012** in order to maintain eligibility as an applicant for mitigation grants. Over the next five years, we encourage the City 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,

ACTING DRA 10/26/12

Paul F. Ford
Acting Regional Administrator

PFF: mh

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