TOWN OF NEW CASTLE, NH

HAZARD MITIGATION PLAN 2006

Approved by the

NEW CASTLE BOARD OF SELECTMEN

And adopted as an official appendix to the New Castle Emergency Operations Plan

_____, 2006

Rockingham Planning Commission

This project was partially funded by

NEW HAMPSHIRE BUREAU OF EMERGENCY MANAGEMENT

New Castle Hazard Mitigation Plan

This Plan serves a dual role as a stand alone document approved by the New Castle Board of Selectmen on _____, 2007. This document also serves as an official annex to the New Castle Emergency Operations Plan.

Approved by the New Castle Board of Selectmen:

_____, Chair

_____

_____

Date _____, 2007

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

EXECUTIVE SUMMARY

The New Castle Hazard Mitigation Plan (herein after, the *Plan*) was compiled to assist the Town of New Castle in reducing and mitigating future losses from natural hazard events. The *Plan* was developed by the Rockingham Planning Commission and participants from the Town of New Castle and contains the tools necessary to identify specific hazards and aspects of existing and future mitigation efforts.

The following hazards are addressed:

- Flooding
- Hurricane – High Wind Event
- Severe Winter Weather
- Wildfire
- Earthquake
- Coastal Storm

The Critical Facilities include:

- Emergency Response Facilities
- Critical Infrastructure
- Vulnerable Populations
- Historic Landmarks
- Transportation Infrastructure
- Possible Resources during a Hazard Event

The *Plan* is considered a work in progress and should be revisited frequently to assess whether the existing and suggested mitigation strategies are successful. Copies have been distributed to the Town of New Castle, and a copy will remain on file at the Rockingham Planning Commission. A copy of this Plan is also on file at the New Hampshire Bureau of Emergency Management (NH BEM) and the Federal Emergency Management Agency (FEMA). This *Plan* was approved by both agencies prior its adoption at the local level.

CHAPTER 1 – INTRODUCTION

BACKGROUND

The New Hampshire Bureau of Emergency Management (NH BEM) has a goal for all communities within the State to establish local hazard mitigation plans as a means to reduce and mitigate future losses from natural hazard events. The NH BEM outlined a process whereby communities throughout the State may be eligible for grants and other assistance upon completion of a local hazard mitigation plan. A handbook entitled Hazard Mitigation Planning for New Hampshire Communities was created by NH BEM to assist communities in developing local plans. The State's Regional Planning Commissions are charged with providing assistance to selected communities to develop local plans.

The Plan was prepared by Rockingham Planning Commission (RPC) with the assistance of participants from the Town of New Castle, under contract with the New Hampshire Bureau of Emergency Management (BEM) operating under the guidance of Section 206.405 of 44 CFR Chapter 1 (10-1-97 Edition). The Plan serves as a strategic planning tool for use by the Town of New Castle in its efforts to identify and mitigate the future impacts of natural and/or man-made hazard events. Upon adoption of this Plan by the New Castle Board of Selectmen, it will become an official appendix to the New Castle Emergency Operations Plan.

METHODOLOGY

In 2005, the Rockingham Planning Commission (RPC) organized the first meeting with emergency management officials from the Town of New Castle to begin the initial planning stages of the *Plan.* RPC and participants from the Town developed the content of the *Plan* using the ten-step process set forth in the *Hazard Mitigation Planning for New Hampshire Communities*. The following is a summary of the ten-step process conducted to compile the *Plan.*

Step 1 – Map the Hazards

Areas were identified where damage from historic natural disasters has occurred and areas where critical man-made facilities and other features may be at risk in the future for loss of life, property damage, environmental pollution and other risk factors. RPC generated a set of base maps with GIS (Geographic Information Systems) that were used in the process of identifying past and future hazards.

Step 2 – Identify the Critical Facilities

Critical Facilities were identified. These included buildings and areas that were considered to be important to the Town for emergency management purposes, were identified for provision of utilities and community services, evacuation routes, and for recreational and social value. Using a Global Positioning System, RPC plotted the exact location of these sites on a map.

Step 3 – Identify Existing Mitigation Actions or Strategies

After collecting information on each critical facility in New Castle, RPC staff identified existing mitigation strategies relative to hazards that may affect the Town.

Step 4 – Identify Gaps in Existing Mitigation Actions or Strategies

The existing strategies were then reviewed by the RPC for coverage and effectiveness, as well as the need for improvement.

Step 5 – Identify Potential Mitigation Actions or Strategies

A list was developed of additional hazard mitigation actions and strategies for the Town of New Castle. Potential actions include investigating changes to Zoning and Building Codes to reduce damage susceptibility, and structural projects to reinforce the causeway on and install culverts on Route 1B.

Step 6 – Prioritize and Develop Action Plan

The proposed hazard mitigation actions and strategies were reviewed and each strategy was rated (good, average, or poor) for its effectiveness according to several factors (*e.g.*, technical and administrative applicability, political and social acceptability, legal authority, environmental impact, financial feasibility). Each factor was then scored and all scores were totaled for each strategy. Strategies were ranked by overall score for preliminary prioritization then reviewed again under Step 7.

Step 7 – Determine Priorities

The preliminary prioritization list was reviewed in order to make changes and determine a final prioritization for new hazard mitigation actions and existing protection strategy improvements identified in previous steps. RPC also presented recommendations to be reviewed and prioritized by emergency management officials.

Step 8 – Develop Implementation Strategy

An implementation strategy was developed for the Action Plan which included person(s) responsible for implementation (who), a timeline for completion (when), and a funding source and/or technical assistance source (how) for each identified hazard mitigation actions.

Step 9 – Adopt and Monitor the Plan

RPC staff compiled the results of Steps 1 to 8 in a draft document. This draft *Plan* was reviewed by members of the *Committee* and by staff members at the RPC. The draft *Plan* was also placed on the RPC website for review by the public, neighboring communities, agencies, businesses, and other interested parties to review and make comments via email. A letter was sent to the abutting New Hampshire communities of Portsmouth, Rye and Kittery, ME, to insure their opportunity to review the *Plan* prior to finalization (see Appendix F). A duly noticed public hearing was held by the New Castle Board of Selectmen (_____, 2006). This meeting allowed the community to provide comments and suggestions for the *Plan* in person, prior to the document being finalized. The draft was revised to incorporate comment from the Board of Selectmen and general public; then submitted to the NHBEM and FEMA Region I for their review and comments (_____, 2006). Any changes required by NHBEM and FEMA were made and a revised draft document was then submitted to the New Castle Board of Selectmen for their final review on _____, 2006. A second public hearing was then held by the New Castle Board of Selectmen on _____, 2006. At this public hearing the *Plan* was approved by the Board of Selectmen, and adopted as an appendix to the New Castle Emergency Operations Plan.

HAZARD MITIGATION GOALS AND OBJECTIVES OF THE STATE OF NEW HAMPSHIRE

The *State of New Hampshire Natural Hazards Mitigation Plan*, which was prepared and is maintained by the New Hampshire Bureau of Emergency Management (NH BEM), sets forth the following related to overall hazard mitigation goals and objectives for the State of New Hampshire:

1. To improve upon the protection of the general population, the citizens of the State and guests, from all natural and man-made hazards.
2. To reduce the potential impact of natural and man-made disasters on the State's Critical Support Services.
3. To reduce the potential impact of natural and man-made disasters on Critical Facilities in the State.
4. To reduce the potential impact of natural and man-made disasters on the State's infrastructure.
5. To improve Emergency Preparedness.
6. Improve the State's Disaster Response and Recovery Capability.
7. To reduce the potential impact of natural and man-made disasters on private property.
8. To reduce the potential impact of natural and man-made disasters on the State's economy.
9. To reduce the potential impact of natural and man-made disasters on the State's natural environment.
10. To reduce the State's liability with respect to natural and man-made hazards generally.
11. To reduce the potential impact of natural and man-made disasters on the State's specific historic treasures and interests as well as other tangible and intangible characteristics which add to the quality of life of the citizens and guests of the State.
12. To identify, introduce and implement cost effective Hazard Mitigation measures so as to accomplish the State's Goals and Objectives and to raise the awareness of, and acceptance of Hazard Mitigation generally.

Through the adoption of this Plan the Town of New Castle concurs and adopts these goals and objectives.

ACKNOWLEDGEMENTS

The Town of New Castle offers thanks to the **New Hampshire Bureau of Emergency Management** (www.nhBEM.state.nh.us), which provided the model and funding for this document. In addition, thanks are extended to the staff of the Rockingham Planning Commission for professional services, process facilitation and preparation of this document.

CHAPTER II – COMMUNITY PROFILE

NATURAL FEATURES

The Town of New Castle is located at the mouth of the Piscataqua River, which divides New Hampshire for Maine. New Castle is made up entirely of Islands and is only connected to the mainland by bridges. The islands total 0.8 square miles of land and 7.5 miles of coastline. Natural features in the Town include beaches, marine grasses, salt marshes, and wetlands

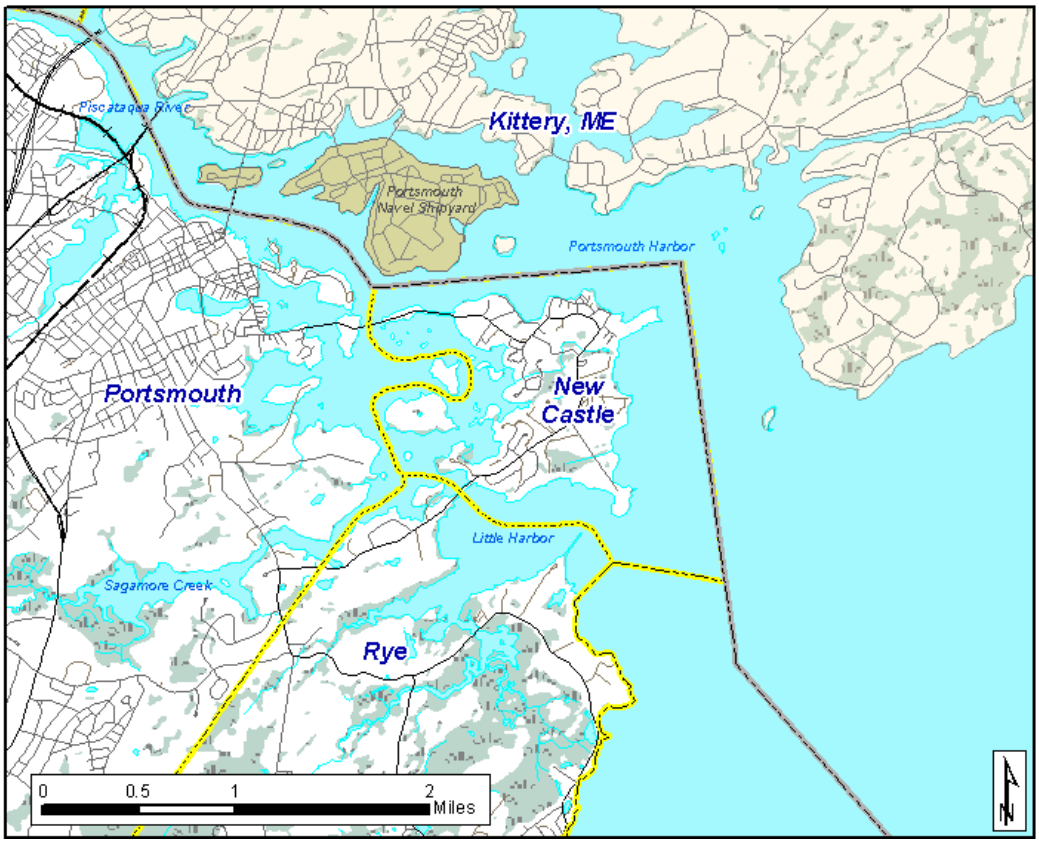

Figure 1: Location Map of New Castle, New Hampshire

LAND USE AND DEVELOPMENT

New Castle has a high population density due to its small size and the municipal water and sewer. The population was estimated to be 1,038 in 2004. The total housing units in 2003 were 510 with little opportunity for increased development. Much of the open land that is remaining in Town is either Town, State or federally owned, under conservation easement, or has recently been zoned as low density residential (2 acre minimum). Due to the lack of available land and the high demand for land in Town, the majority of development is redevelopment of existing lots.

A land use map was prepared for this *Plan* using data from GRANIT (The New Hampshire Geographically Referenced Analysis and Information Transfer System). The land use data was created for Rockingham County in 1998. The data was developed through interpretation of 1:12,000 scale black and white digital orthophoto quadangles from the United States Geologic Survey. For more information on this data layer please visit http://granit.sr.unh.edu. This data is presented in Map 1: New Castle Land Use.

CHAPTER III – NATURAL HAZARDS IN THE TOWN OF NEW CASTLE

WHAT ARE THE HAZARDS?

The first step in planning for natural hazard mitigation is to identify hazards that may affect the Town. Some communities are more susceptible to certain hazards (i.e., flooding near rivers, hurricanes on the seacoast, etc.). The Town of New Castle is prone to several types of natural hazards. These hazards include: flooding, hurricanes or other high-wind events, severe winter weather, wildfires, earthquakes, and coastal storms. Coastal storms are not defined separately in the next section (definition of natural hazards) because of their diverse affects they are defined under multiple hazards (flooding, hurricanes-high wind events, and severe winter weather). Other natural hazards can and do affect the Town of New Castle, but these were the hazards prioritized by the Committee for mitigation planning. These were the hazards that were considered to occur with regularity and/or were considered to have high damage potential, and are discussed below.

Natural hazards that are included in the State's Hazard Mitigation Plan that are not included in the *Plan* include: drought, extreme heat, landslide, subsidence, radon and avalanche. Subsidence and avalanche are rated by the State as having Low and No risk in Rockingham County, respectively; due to this they were left out of the *Plan*. New Castle has no record of landslides and little chance of one occurring; so landslides were not included in this *Plan*. The State's Plan indicates that Rockingham County is at Moderate risk to drought, extreme heat, and radon; these hazards were not included in the *Plan*. When compared potentially devastating natural hazards (earthquakes or hurricanes) or natural hazards that occur with regularity (flooding or severe winter weather) it was not considered an effective us of the Committee time to include drought, extreme heat, and radon in the *Plan* at this time. When the *Plan* is revised and updated in the future, possible inclusion of these hazards will be reevaluated.

HAZARD DEFINITIONS

Flooding

Floods are defined as a temporary overflow of water onto lands that are not normally covered by water. Flooding results from the overflow of major rivers and tributaries, storm surges, and/ or inadequate local drainage. Floods can cause loss of life, property damage, crop/livestock damage, and water supply contamination. Floods can also disrupt travel routes on roads and bridges.

Inland floods are most likely to occur in the spring due to the increase in rainfall and melting of snow; however, floods can occur at any time of the year. A sudden thaw in the winter or a major downpour in the summer can cause flooding because there is suddenly a lot of water in one place with nowhere to go. Coastal flooding can be caused by storm surge associated with high wind events hurricanes or from tsunami.

100-year Floodplain Events

Floodplains are usually located in lowlands near rivers, and flood on a regular basis. The term 100 year flood does not mean that flood will occur once every 100 years. It is a statement of probability that scientists and engineers use to describe how one flood

compares to others that are likely to occur. It is more accurate to use the phrase "1% annual chance flood". What this means is that there is a 1% chance of a flood of that size happening in any year. The flood hazard areas that are identified in New Castle are defined as follows.[1]

Zone AE is the flood insurance rate zones that correspond to the 100-year floodplains that are determined in the Flood Insurance Study by detailed methods. In most instances, Base Flood Elevations (BFEs) derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.

Zone VE is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.

Zone X is the flood insurance rate zones that correspond to areas outside the 100-year floodplains, areas of 100-year sheet flow flooding where average depths are less than 1 foot, areas of 100-year stream flooding where the contributing drainage area is less than 1 square mile, or areas protected from the 100-year flood by levees. No BFEs or depths are shown within this zone.

Rapid Snow Pack Melt
Warm temperatures and heavy rains cause rapid snowmelt. Quickly melting snow coupled with moderate to heavy rains are prime conditions for flooding.

River Ice Jams
Rising waters in early spring often breaks ice into chunks, which float downstream and often pile up, causing flooding. Small rivers and streams pose special flooding risks because they are easily blocked by jams. Ice collecting in river bends and against structures presents significant flooding threats to bridges, roads, and the surrounding lands.

Tsunami
The National Tsunami Hazard mitigation Program (http://www.pmel.noaa.gov/tsunami-hazard/terms.html) defines a Tsunami as Japanese term derived from the characters "tsu" meaning harbor and "nami" meaning wave. Generally accepted by the international scientific community to describe a series of traveling waves in water produced by the displacement of the sea floor associated with submarine earthquakes, volcanic eruptions, or landslides.

Hurricane - High Wind Event
Significantly high winds occur especially during hurricanes, tornadoes, winter storms and thunderstorms. Falling objects and downed power lines are dangerous risks associated with high winds. In addition, property damage and downed trees are common during high wind occurrences.

[1] FEMA's website: http://www.fema.gov/fhm/fq_term.shtm

Hurricanes

A hurricane is a tropical cyclone in which winds reach speeds of 74 miles per hour or more and blow in a large spiral around a relatively calm center (see Appendix C). The eye of the storm is usually 20-30 miles wide and may extend over 400 miles. High winds are a primary cause of hurricane-inflicted loss of life and property damage.

Tornadoes

A tornado is a violent windstorm characterized by a twisting, funnel shaped cloud. They develop when cool air overrides a layer of warm air, causing the warm air to rise rapidly. The atmospheric conditions required for the formation of a tornado include great thermal instability, high humidity and the convergence of warm, moist air at low levels with cooler, drier air aloft. Most tornadoes remain suspended in the atmosphere, but if they touch down they become a force of destruction.

Tornadoes produce the most violent winds on earth, at speeds of 280 mph or more. In addition, tornadoes can travel at a forward speed of up to 70 mph. Damage paths can be in excess of one mile wide and 50 miles long. Violent winds and debris slamming into buildings cause the most structural damage.

The Fujita Scale is the standard scale for rating the severity of a tornado as measured by the damage it causes (see Appendix D). A tornado is usually accompanied by thunder, lightning, heavy rain, and a loud "freight train" noise. In comparison with a hurricane, a tornado covers a much smaller area but can be more violent and destructive.

Severe Thunderstorms

All thunderstorms contain lightning. During a lightning discharge, the sudden heating of the air causes it to expand rapidly. After the discharge, the air contracts quickly as it cools back to ambient temperatures. This rapid expansion and contraction of the air causes a shock wave that we hear as thunder, which can damage building walls and break glass.

Lightning

Lightning is a giant spark of electricity that occurs within the atmosphere or between the atmosphere and the ground. As lightning passes through air, it heats the air to a temperature of about 50,000 degrees Fahrenheit, considerably hotter than the surface of the sun. Lightning strikes can cause death, injury and property damage.

Hail

Hailstones are balls of ice that grow as they're held up by winds, known as updrafts, which blow upwards in thunderstorms. The updrafts carry droplets of supercooled water – water at a below freezing temperature – but not yet ice. The supercooled water droplets hit the balls of ice and freeze instantly, making the hailstones grow. The faster the updraft, the bigger the stones can grow. Most hailstones are smaller in diameter than a dime, but stones weighing more than a pound have been recorded. Details of how hailstones grow are complicated, but the results are irregular balls of ice that can be as

large as baseballs, sometimes even bigger. While crops are the major victims, hail is also a hazard to vehicles and windows.

Severe Winter Weather

Ice and snow events typically occur during the winter months and can cause loss of life, property damage and tree damage.

Heavy Snow Storms

A winter storm can range from moderate snow to blizzard conditions. Blizzard conditions are considered blinding, wind-driven snow over 35 mph that lasts several days. A severe winter storm deposits four or more inches of snow during a 12-hour period or six inches of snow during a 24-hour period.

Ice Storms

An ice storm involves rain, which freezes upon impact. Ice coating at least one-fourth inch in thickness is heavy enough to damage trees, overhead wires and similar objects. Ice storms often produce widespread power outages.

Nor'easter

A Nor'easter is large weather system traveling from South to North passing along or near the seacoast. As the storm approaches New England and its intensity becomes increasingly apparent, the resulting counterclockwise cyclonic winds impact the coast and inland areas form a Northeasterly direction. The sustained winds may meet or exceed hurricane force, with larger bursts, and may exceed hurricane events by many hours (or days) in terms of duration[2].

Wildfire

Wildfire is defined as an uncontrolled and rapidly spreading fire.

Forest Fires and Grass Fires

A forest fire is an uncontrolled fire in a woody area. They often occur during drought and when woody debris on the forest floor is readily available to fuel the fire. Grass fires are uncontrolled fires in grassy areas.

Earthquakes

Geologic events are often associated with California, but New England is considered a moderate risk earthquake zone. An earthquake is a rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. Earthquakes can cause buildings and bridges to collapse, disrupt gas, electric and phone lines, and often cause landslides, flash floods, fires, and avalanches. Larger earthquakes usually begin with slight tremors but rapidly take the form of one or more violent shocks, and end in vibrations of gradually diminishing force called aftershocks. The underground point of origin of an earthquake is called its focus; the point on the surface directly above the focus is the epicenter. The magnitude and intensity of an earthquake is determined by the use of scales such as the Richter scale[3] and Mercalli scale.

[2] Definition of Nor'easter taken from NH State Natural Hazards Mitigation Plan October 2000 Edition.
[3] A copy of the Richter scale is displayed in Appendix E.

PROFILE OF PAST AND POTENTIAL HAZARDS

As discussed above the natural hazards that were identified for mitigation in this Plan include: flooding, hurricanes-high wind events, severe winter weather, wildfire and earthquakes. Some of the natural hazards could be included under more than one type of hazard. For example a hurricane could be considered a high wind event or a flooding event depending on the storm's consequences.

The hazard profiles below include: a description of the events included as part of the natural hazard, the geographic location of each natural hazard (if applicable), the extent of the natural hazard (e.g. magnitude or severity), probability, past occurrences, and community vulnerability. Past occurrences of natural hazards were mapped if possible (Map 2: Past and Future Hazards). Some of the natural hazards have not occurred within the Town of New Castle (within written memory), for these hazards the plan refers to a table of hazards that have occurred regionally and statewide (Table 3). Community vulnerability identifies the specific areas, general type of structures, specific structures, or general vulnerability of the Town of New Castle to each natural hazard.

Flooding

Description: Flooding events can include hurricanes, 100-year floods, 500-year floods, debris-impacted infrastructure, erosion, mudslides, rapid snow pack melt, river ice jams, dam breach and/or failure, coastal storm surge, and tsunami.

Location: New Castle is vulnerable to flooding in several locations. Generally, the Town is at risk within the Flood Zones identified by FEMA on Digital Flood Insurance Rate Maps (DFIRM). The flood zones are depicted on the DFIRM's numbering 0286E, 0287E, 0278E and 0279E, all from Rockingham County. New Castle has three major flood zones: VE, AE and X. These flood zones correspond to the Special Flood Hazard Areas and the 500-year flood zone. There are also several locally-identified areas susceptible to that are described below and displayed on Map 2: Past and Future Hazards.

Extent: The extent of the flood zones can be seen in Map 2: Past and Future Hazards. This area includes FIRM Zones that have been identified in New Castle, as well as, areas of locally chronic flood problems. Map 2 also shows the potential storm surge inundation zone for categories 1 though 4. The data was developed by the National Hurricane Center and Provide by the US Army Corps of Engineers.

Probability: **HIGH**

Table 1: Probability of Flooding based on return interval

Flood Return Interval	Chance of Occurrence in Any Given Year
10-year	10%
50-year	2%
100-year	1%
500-year	0.2%

Past Occurrence: Flooding is a common hazard for the Town of New Castle. Several locations were identified as areas of chronic reoccurring flooding or high potential for future flooding. These areas are listed below. Larger flood events are listed in Table3.

Community Vulnerability: Flooding is most likely to occur in the 100-year flood zones, especially along the Atlantic coastline. The coastline is vulnerable to both coastal flooding from storm surge, and flooding from other causes including heavy rain. The community has several structures that currently exist in the flood zones. As of January, 2006, New Castle had 16 Flood insurance policies in force (Community Information System: https://Portal.fema.gov/cis/insurenceview.jsp). These policies total $4,116,500 of insurance coverage. The number of paid losses in New Castle is 3 for a total of $5,742 of damage. New Castle has no structures identified as repetitive loss structures. Other areas of vulnerability would include any roadways or infrastructure within the flood zones.

- Structures located in the flood zone
- Culverts
- Basements
- Erodable soils
- Locally-identified flood areas (Map 2: Past and Future Hazards)

Hurricane - High Wind Event

Description: High wind events can include hurricanes, tornadoes, "Nor'-Easters," downbursts and lightning/thunderstorm events.

Location: Hurricane events are more potentially damaging with increasing proximity to the coast. For this *Plan*, high-wind events were considered to have an equal chance of affecting any part of the Town of New Castle.

Extent: New Castle is located within a Zone II hurricane-susceptible region (indicating a design wind speed of 160 mph)[4]. Between 1900 and 1996 2 hurricanes have made landfall in New Hampshire, a category 1 and a category 2. In Maine, 5 hurricanes have made landfall (all category 1). In Massachusetts, 6 hurricanes have made landfall (2 category 1, 2 category 2 and 2 category 3). From this information it can be extrapolated that New Castle is a high risk to a hurricane event, with variable wind speeds between 74 – 130 mph (category 1-3).

From 1950 to 1995 Rockingham County was subject to 9 recorded tornado events, these included 2 type F0 (Gale Tornado, 40-72 mph), 2 type F1 (Moderate Tornado, 73-112 mph), 4 type F2 (Significant Tornado, 113-157 mph) and 1 type F3 (Severe Tornado, 158-206 mph)[5]. Type 3 tornados can cause severe damage including tearing the roofs and walls from well-constructed homes, trees can be uprooted, trains over-turned, and cars lifted off the ground and thrown[6].

[4] "Understanding Your Risks, Identifying Hazards and Estimating Losses", FEMA, page
[5] The tornado project .com
[6] "Understanding Your Risks, Identifying Hazards and Estimating Losses", FEMA, page

Probability: **HIGH**. The State of New Hampshire's Natural Hazards Mitigation Plan rates Rockingham County with high likelihood of hurricane, tornado and "Nor'-Easters" events. Also, it rates the risk of downbursts, lightning and hail events as moderate.

Past Occurrence: Between 1635 and 1991, 10 hurricanes have impacted the State of New Hampshire. The worst of these occurred on September 21, 1938, with wind speeds of up to 186 mph in MA and 138mph elsewhere. Thirteen of 494 people killed by this storm were residents of New Hampshire. The Storm caused $12,337,643 in damages (1938 dollars), timber not included.

Rockingham County tornado history is as follows: Category F0 tornados occurred on Oct. 03, 1970 and June 09, 1978. Category F1 tornados occurred on July 31, 1954 and July 26, 1966. Category F2 tornados occurred on Aug. 21, 1951, June 19, 1957, July 02, 1961 and June 09, 1963. The category F3 tornado occurred on June 09, 1953.

Community Vulnerability:

- Power lines,
- Shingled roofs,
- Chimneys, and
- Trees

Severe Winter Weather

Description: There are three types of winter events**:** blizzards, ice storms and extreme cold. All of these events are a threat to the community with subzero temperatures from extreme wind chill and storms causing low visibility for commuters. Snow storms have been known to collapse buildings. Ice storms disrupt power and communication services. Extreme cold affects the elderly.

Location: Severe winter weather events have and equal chance of affecting any part of the Town of New Castle.

Extent: Large snow events in Southeastern New Hampshire can produce 30 inches of snow, or more. Portions of central New Hampshire recorded snowfalls of 98" during one slow moving storm in February of 1969. Ice storms occur with regularity in New England. Seven severe ice storms have been recorded that affected New Hampshire since 1929. These events caused disruption of transportation, loss of power and millions of dollars in damage.

Probability: **HIGH**. The State of New Hampshire's Natural Hazards Mitigation Plan rates Rockingham County with high likelihood of heavy snows and ice storms.

Past Occurrence: A list of past winter storm events is displayed below, in Table 3.

Community Vulnerability:

- Power lines
- Trees
- Elderly Populations

Wildfire

Description: Wildfires include grass fires and forest fires.

Location: The Committee identified no particular areas of New Castle as having higher risk of wildfire than any other.

Extent: A wildfire in the Town of New Castle is unlikely, but if a crown fire were to occur it could be very damaging to structures abutting wooded areas of Town.

Probability: **MODERATE**. The State of New Hampshire's Natural Hazards Mitigation Plan rates Rockingham County with moderate risk to wildfires. Because New Castle is so small and densely developed, there are few large undeveloped tracts of land. The Committee felt this reduced the Towns' risk to wildfire. In addition, the entire Town is serviced by municipal water; no area of Town is a large distance from a fire hydrant.

Past Occurrence: There is no record of large wildfires in New Castle in recent memory.

Community Vulnerability:

- Structures located near large open vegetated areas prone to lightning strike
- Vulnerability increases during drought events

Earthquake

Description: Seismic activity including landslides and other geologic hazards.

Location: An earthquake has an equal chance of affecting all areas in the Town of New Castle.

Extent: New England is particularly vulnerable to the injury of its inhabitants and structural damage because of our built environment. Few New England States currently include seismic design in their building codes. Massachusetts introduced earthquake design requirements into their building code in 1975 and Connecticut very recently did so. However, these specifications are for new buildings, or very significantly modified existing buildings only. Existing buildings, bridges, water supply lines, electrical power lines and facilities, etc. have rarely been designed for earthquake forces (New Hampshire has no such code specifications).

Probability: **MODERATE**. The State of New Hampshire's Natural Hazard Mitigation Plan ranks all of the Counties in the State with at moderate risk to earthquakes. The Town of New Castle's Peak Ground Acceleration (PGA) values range between 6.1 and 21.0[7]. These numbers are associated with how much an earthquake is felt and how much damage it may cause (Table 2).

[7] http://geohazards.cr.usgs.gov/eq/pubmaps/us.pga.050.map.gif

Table 2: Peak Ground acceleration (PGA) values for New Castle (information from State and Local Mitigation Planning, FEMA).

PGA	Chance of being exceeded in the next 50 years	Perceived Shaking	Potential Damage
6.1	10%	Moderate	Very Light
10.6	5%	Strong	Light
21.0	2%	Very Strong	Moderate

Past Occurrence: Large earthquakes have not affected the Town of New Castle within recent memory. A list of earthquakes that have affected the region is displayed in Table 3.

Community Vulnerability:

- Bridges,
- Brick Structures,
- Infrastructure,
- Water and Sewer lines, and
- Secondary hazards such as fire, power outages, or hazardous material leak or spill.

Coastal Storm

Description: The State's Atlantic seacoast and estuaries are vulnerable to extremes of storm water runoff and storm surge from coastal storms and hurricanes. A storm surge, especially when coupled with astronomical high tides, presents a threat to all land areas adjacent to the marine environment.

Location: The potential size of a storm surge is variable and sources also differ on the potential maximum size of a storm surge in the area of New Castle, NH. The location of potential storm surge has been mapped by the Hurricane Research Center and the Army Corps. of Engineers, these areas are depicted on Map 2: Past and Future Hazards.

Extent: Coastal storms could affect much of New Castle, due to the Town's low elevation. Assuming that the Town is vulnerable to category 4 hurricanes, the potential storm surge related to such a wind event could reach several feet above normal sea level[8]. A storm surge would affect many of the structures located near and adjacent to the waterline. Map 2: past and future hazards, depicts the possible storm surge inundation zones for category 1 through 4 hurricanes.

Probability: **HIGH**. The State of New Hampshire's Natural Hazards Mitigation Plan rates Rockingham County with high likelihood of storm surge and hurricane events. The probability of this maximum storm surge event is **Very Low**. Figure 3 below show the chance of a "named storm" affecting the areas as a percentage per year. From this map it can be interpolated that New Hampshire has between 18% and 24% of being affected by a named storm each year.

[8] "Understanding Your Risks, Identifying Hazards and Estimating Losses", FEMA, page

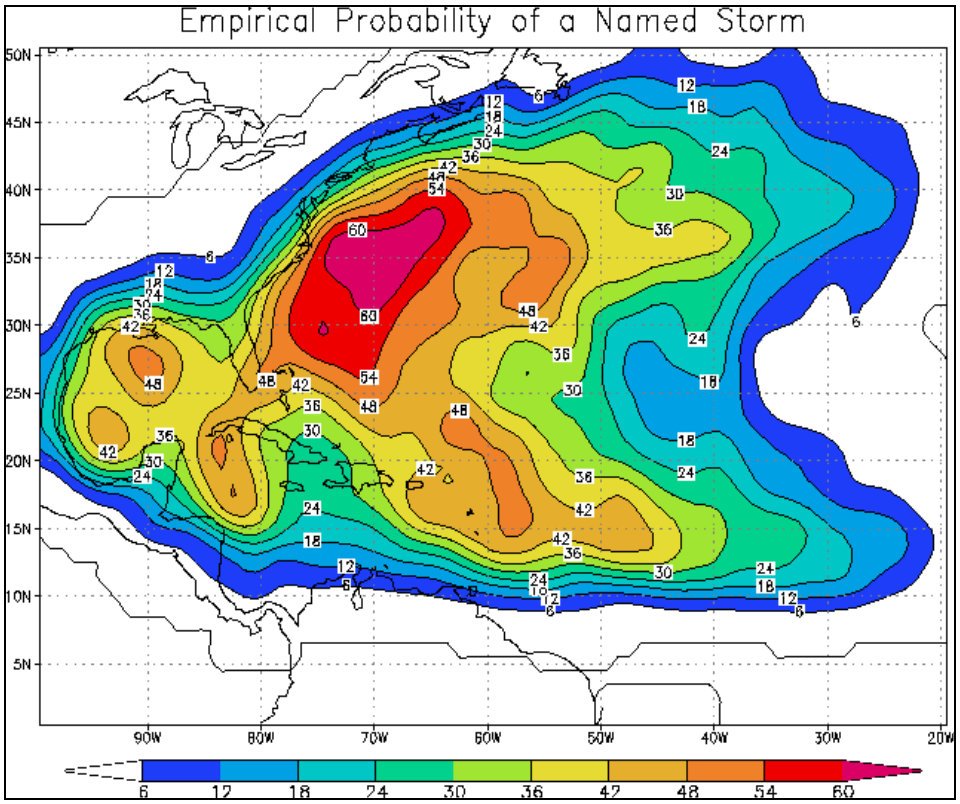

Figure 2: Coastal Storm Probability, per year. Source NOAA www.aoml.noaa.gov/hrd/tcfaq/tcfaqG.htm1#G12

Past Occurrence: A list of hurricanes and Nor'easters that have affected the region are displayed below in Table 3.

Community Vulnerability: The Storm surge inundation zones on Map 2, show that a category 2 or 3 hurricane storm surge could divide the main island into two parts during the flooding event. A storm surge of this size would likely damage the causeway (figure 3) that is the northern exit from New Castle to Portsmouth. The storm surge may not damage the bridge to the South, but the same storm surge data shows that Route 1B is susceptible to flooding in Rye from a category 3 hurricane. The worry of the committee is that a large storm surge would not only divide the island into two parts because of a road wash out on 1B near Pit Lane (figure 4), but also cut off both avenues for evacuation. This would also leave the south side of the island separated from the emergency response facilities. Other areas of community vulnerability include:

- Structures near the shoreline
- Boats and docks
- Shoreline erosion
- Utilities near the shoreline

Figure 3: Causeway on Route 1B, Road surface erosion can be seen here and in other locations. This is caused by wind driven waves from the river-side of the causeway.

Figure 4: Route 1B near Pit Lane. Low section of road could be flooded and damaged during and storm surge event.

Table 3: Past Hazard Events in New Castle and Rockingham County

Hazard	Date	Location	Critical Facility or Area Impacted	Remarks/Description
Flood	March 11-21, 1936	Statewide	$133,000,000 in damage throughout New England, 77,000 homeless.	Double Flood; snowmelt/heavy rain.
Flood	September 21, 1938	Statewide	Unknown	Hurricane; stream stage similar to March 1936
Flood	July 1986 – August 10, 1986	Statewide	Unknown	**FEMA DR-771-NH**: Severe storms; heavy rain, tornadoes , flash flood, severe wind
Flood	August 7-11 1990	Statewide	Road Network	**FEMA DR-876-NH**: A series of storms with moderate to heavy rains; widespread flooding.
Flood	August 19, 1991	Statewide, Primarily Rockingham and Strafford Counties	Road Network	**FEMA DR-917-NH:** Hurricane Bob; effects felt statewide; counties to east hardest hit.
Flood	October 28, 1996	Rockingham County	Unknown - Typically structures and infrastructure in the floodplain	North and west regions; severe storms.
Flood	June – July 1998	Rockingham County	Heavy damage to secondary roads occurred	**FEMA DR-1231-NH:** A series of rainfall events
Hurricane	October 18,19 1778	Portions of State	Unknown	40-75 mph winds
Hurricane	1804	Portions of State	Unknown	
Hurricane	September 8, 1869	Portions of State	Unknown	> 50 mph winds
Great Hurricane Of 1938	September 21, 1938	All of Southern New England	2 billion board feet of timber destroyed; electric and telephone disrupted, structures damaged, flooding; statewide 1,363 families received assistance.	Max. wind speed of 186 mph in MA and 138mph max. elsewhere 13 of 494 dead in NH; $12,337,643 total storm losses (1938 dollars), timber not included.
Hurricane Carol	August 31, 1954	Southern New England	Extensive tree and crop damage in state.	SAFFIR/SIMPSON HURRICANE SCALE[9] - Category 3, winds 111-130 mph
Hurricane Donna	September 12, 1960	Southern and Central NH	Unknown	Category 3 Heavy Flooding
Hurricane Belle	August 10,	Southern New	Unknown	Category 1, winds 74-95

[9] For a complete description of the Saffir/Simpson Hurricane Scale see Appendix C.

Hazard	Date	Location	Critical Facility or Area Impacted	Remarks/Description
	1976	England		mph Rain and flooding in NH
Hurricane Gloria	September 27, 1985	Southern New England	Unknown	Category 2, winds 96-110 mph >70 mph winds; minor wind damage and
Tropical Storm Floyd	September 16-18 1999	Statewide	Unknown	
Ice Jam	Feb 29, 2000	Brentwood, NH Exeter River	Unknown	Discharge 570 cfs
Ice Jam	Mar 29, 1993	Epping, NH Lamprey River	Road flooding	
Tornado	May 21, 1814	Rockingham County	Unknown	F2[10]
Tornado	May 16, 1890	Rockingham County	Unknown	F2
Tornado	August 21, 1951	Rockingham County	Unknown	F2
Tornado	June 9, 1953	Rockingham County	Unknown	F3
Tornado	June 19, 1957	Rockingham County	Unknown	F2
Tornado	July 2, 1961	Rockingham County	Unknown	F2
Tornado	June 9, 1963	Rockingham County	Unknown	F2
Downburst	July 6, 1999	Stratham, NH	Five fatalities and eleven injuries. Major tree damage, power outages	Microburst $2,498,974 in damages
Ice Storm	December 17-20 1929	NH	Telephone, telegraph and power disrupted.	
Ice Storm	December 29-30 1942	NH	Unknown- Typically damage to overhead wires and trees.	Glaze storm; severe intensity
Ice Storm	December 22 1969	Parts of NH	Power disruption	Many communities affected
Ice Storm	January 17, 1970	Parts of NH	Power disruption	Many communities affected
Ice Storm	January 8-25	NH	Major disruption of	

[10] For a complete description of the Fujita Tornado Damage Scale see Appendix D

Hazard	Date	Location	Critical Facility or Area Impacted	Remarks/Description
	1979		Power and transportation	
Ice Storm	March 3-6 1991	Southern NH	Numerous power outages in southern NH	Numerous in Southern NH
Ice Storm	January 7, 1998	Rockingham County	Power and phone disrupted, communication tower collapsed.	$17,000,000 in damages to PSNH equipment.
Snowstorm	February 4-7 1920	New England	Disrupt transportation for weeks	Boston 37-50cm of sleet , ice and snow
Snowstorm	February 15, 1940	New England	Paralyzed New England	30cm of snow with high wind.
Snowstorm	February 14-17 1958	Southern NH	Unknown	20-33" of snow
Snowstorm	March 18-21 1958	South central NH	Unknown	22-24"of snow
Snowstorm	March 2-5 1950	Southern NH	Unknown	25"of snow
Snowstorm	January 18-20 1961	Southern NH	Unknown	Blizzard Conditions; 50cm of snow
Snowstorm	February 8-10 1969	Southeastern NH	Paralyzing snow	27"of snow and high winds
Snowstorm	February 22-28 1969	Central NH	Unknown	34-98"of snow; very slow moving
Snowstorm "Blizzard of'78"	February 5-7 1978	Statewide	Trapped commuters on highways, businesses closed	Hurricane force winds; 25-33"of snow. People disregard warnings due to a series of missed forecasts
Snowstorm	April 5-7 1982	Southern NH	Unknown	Late season with thunderstorms and 18-22" of snow
Earthquake	November 18, 1929	Grand Banks Newfoundland	No damage	Richter Magnitude Scale: 7.2[11]
Earthquake	December 20, 1940	Ossipee	Ground Cracks and damage over a broad area	Richter Magnitude Scale: 5.5; Felt over 341 miles away.
Earthquake	December 24, 1940	Ossipee	Ground Cracks and damage over a broad area	Richter Magnitude Scale: 5.5; Felt over 550 KM away.
Earthquake	June 15, 1973	Quebec/NH border	Minor damage	Richter Magnitude Scale: 4.8
Earthquake	June 19, 1982	West of Laconia	Little damage	Richter Magnitude Scale: 4.5
Drought	1929-36	Statewide	Unknown	Regional
Drought	1939-44	Statewide	Unknown	Severe in southeast NH
Drought	1947-50	Statewide	Unknown	Moderate

[11] For a complete description of the Richter Magnitude Scale see Appendix E.

Hazard	Date	Location	Critical Facility or Area Impacted	Remarks/Description
Drought	1960-69	Statewide	Unknown	Longest recorded continuous period of below normal precipitation
Drought Warning	June 6, 1999	Most of State	Unknown	Governors office declaration; Palmer Drought Survey Index indicate "moderate drought" for most of state.

CHAPTER IV – CRITICAL FACILITIES

The Critical Facilities List for the Town of New Castle has been identified by the Hazard Mitigation Committee. The Critical Facilities List has been broken up into four categories. The *first category* contains facilities needed for Emergency Response in the event of a disaster. The *second category* contains Non-Emergency Response Facilities that have been identified by the committee as non-essential. These are not required in an emergency response event, but are considered essential for the everyday operation of New Castle. The *third category* contains Facilities/Populations that the committee wishes to protect in the event of a disaster. The *fourth category* contains Potential Resources, which can provide services or supplies in the event of a disaster. Map 3: Critical Facilities at the end of this Chapter identifies the location of the facilities and the evacuation routes. A detailed description of critical facilities can be found in Table __.

Table 4.1: Category 1 - Emergency Response Services and Facilities:

Critical Facility Name	Comments	Hazard Vulnerability
Town Hall/ Police Station	Back-up Power	
Fire Station / EOC	Back-up Power	High Winds
Public Works		
Parish Hall	Primary Shelter	
Seabrook Siren	New Castle can access	

Table 4.2: Category 2 - Non Emergency Response Facilities:
The town has identified these facilities as non-emergency facilities; however, they are considered essential for the everyday operation of New Castle.

Critical Facility Name	Comments	Hazard Vulnerability
Town Rec. Center / Library	Potential Shelter	
Coast Guard Station/ NH Marine Patrol		Storm Surge
Sewer Pump Stations (3)	All have Back-up Power	Storm Surge
NOAA/ UNH Pier	Soon to be updated	Storm Surge
Post Office		
Postal Annex		

Table 4.3: Category 3 - Facilities/Populations to Protect:
The third category contains people and facilities that need to be protected in event of a disaster.

Critical Facility Name	Comments	Hazard Vulnerability
Mid-Trefethen School	Grade School	
Wentworth by the Sea	Hotel, 100+ rooms, Back-up Power	Storm Surge
Causeway (Route 1 B)	Currently wave damaged	Storm Surge
1B Bridge (near Wentworth)		Earthquake
1B Bridge (Northside)		Earthquake
Great Island Common	Recreation area, 1000+ in the summer	Storm Surge

Critical Facility Name	Comments	Hazard Vulnerability
Fort Stark State Park		Storm Surge
Fort Constitution State Park		Storm Surge
Wentworth Marina	Fuel Storage and Boat Storage	Storm Surge, High Winds
Portsmouth Yacht Club	Fuel Storage and Boat Storage	Storm Surge, High Winds

Table 4.4: Category 4 - Potential Resources:

This category contains facilities that provide potential resources for services or supplies in the event of a natural disaster.

Critical Facility Name	Comments	Hazard Vulnerability
Parish Hall	Primary Shelter	
Coast Guard Station/ NH Marine Patrol		Storm Surge
Town Rec. Center / Library	Potential Shelter	

CHAPTER V – POTENTIAL HAZARD AFFECTS

IDENTIFYING VULNERABLE FACILITIES

It is important to determine what the most vulnerable areas of the Town of New Castle are and to estimate their potential loss. The first step is to identify the areas most likely to be damaged in a hazard event. To do this, the locations of buildings and other structures were compared to the location of potential hazard areas identified by the Hazard Mitigation Committee using GIS (Geographic Information Systems). Vulnerable buildings were identified by comparing their location to possible hazard events. For example, all of the structures within the 100-year and 500-year floodplains were identified and used in conducting the potential loss analysis for flooding.

CALCULATING THE POTENTIAL LOSS

The next step in completing the loss estimation involved assessing the level of damage from a hazard event as a percentage of the buildings' assessed value. The assessed value for every parcel in New Castle was provided for the purpose of calculating damage estimates. The damage estimates are divided into two categories based on hazard types: hazards that are location specific (e.g. flooding), and hazards that could affect all areas of New Castle equally. Damage estimates from hazards that could affect all of New Castle equally are much rougher estimates, based on percentages of the total assessed value of $167,191,000. Damage estimates from hazard with a specific location are derived from the average assessed values of a residential structure. 2003 digital aerial images of the Town were used to determine which buildings were potentially in danger from each of the location specific hazard areas.

Flooding – Special Flood Hazard Zones

The average replacement value was calculated by totaling the assessed values of all structures in the 100-year (VE and AE SFHZ) floodplains, No structures were identified in the 500-year floodplains (X500 SFHZ). These structures were identified by overlaying digital versions of FEMA's FIRM maps and locally identified flood hazard areas on digital aerial photography of the Town of New Castle. Because of the scale and resolution of the FIRM maps this is only an approximation of the total structures at risk to these various flood hazards. If a structure is outside of the SFHZ identified in this exercise it does not mean that it is not at potential risk to flood damage. The damage estimates were calculated using FEMA's method for modeling flood damage to structures and their contents according to the depth of the flood[12].

The potential loss was calculated by making the assumption that all the building in the flood hazard areas are residential structures. The total assessed value of all the residential structures in New Castle is $145,414,500. This number divided by the total number of housing units (510[13]) establishes an estimate of per unit value of $285,126. The costs for repairing or replacing bridges, railroads, power lines and telephone lines are not included in these estimates. In addition, the figures used were based on buildings which are one or two stories high with basements, buildings without basements could expect to receive less damage. The following calculations are based on three possible flood events: a two-foot flood, a four-foot flood, and a eight-foot flood.

[12] "Understanding Your Risks, Identifying Hazards and Estimating Losses", FEMA, page 4-13.
[13] NH Employment Security, Economic & Labor Market Information Bureau.

The following calculation is based on **eight-foot flooding** and assumes that, on average, one or two story buildings with basements receive 49% damage (Understanding Your Risks, Identifying Hazards and Estimating Losses, FEMA page 4-13):

Potential Structure Damage: 49%
Approximately 20 structures in the AE Zone assessed at $5,702,520 = $2,794,234 potential damage
Approximately 16 structures in the VE Zone assessed at $4,562,016 = $2,235,387 potential damage

The following calculation is based on **four-foot flooding** and assumes that, on average, one or two story buildings with basements receive 28% damage:

Potential Structure Damage: 28%
Approximately 20 structures in the AE Zone assessed at $5,702,520 = $1,596,705 potential damage
Approximately 16 structures in the VE Zone assessed at $4,562,016 = $1,277,364 potential damage

The following calculation is based on **two-foot flooding** and assumes that, on average, one or two story buildings with basements receive 20% damage (Understanding Your Risks, Identifying Hazards and Estimating Losses, FEMA page 4-13):

Potential Structure Damage: 20%
Approximately 20 structures in the AE Zone assessed at $5,702,520 = $1,140,504 potential damage
Approximately 16 structures in the VE Zone assessed at $4,562,016 = $912,403 potential damage

The percentage of structural damage and contents damage that could be expected for each flood depth is shown in Table 5, along with estimates of functional downtime (how long a business/residence would be down before relocating) and displacement time (how long a business/residence would be displaced from its flooded location).

Table 5: Percentages of structural and content damage, based on the assessed value of a flooded parcel. Also shows the functional downtime and displacement time for each flood event.

Flood Depth	One-foot	Two-foot	Four-foot
% Structural Damage: Buildings	15%	20%	28%
% Structural Damage: Mobile Homes	44%	63%	78%
% Contents Damage: Buildings	22.5%	30%	42%
% Contents Damage: Mobile Homes	30%	90%	90%

Flood Functional Downtime: Buildings	15 days	20 days	28 days
Flood Functional Downtime: Mobile Homes	30 days	30 days	30 days
Flood Displacement Time: Buildings	70 days	110 days	174 days
Flood Displacement Time: Mobile Homes	302 days	365 days	365 days

Flooding – Locally Identified Flood Hazard Areas

Several areas of New Castle were identified as having high risk of flooding. These areas are identified in Chapter III and Map 2: Past and Future Hazards. In the case of Local flooding problems, no structures were identified that were not identified in the Flooding section above. No specific damage estimates were done for these areas.

Hurricane/ High Wind Events

~Hurricane

Hurricanes do affect the Northeast coast periodically. Since 1900, 2 hurricanes have made landfall in the State of New Hampshire. Due to the location of the Town of New Castle most hurricanes would likely degrade to tropical storms by the time they impact the City. As shown in the figure in Appendix C, hurricanes that strike New England tend to come from the south, and therefore have a chance to weaken or downgrade as they pass over land on there way to New Hampshire. Even degraded hurricanes or tropical storms could still cause significant damage to the Town of New Castle. The assessed value of all the residential and commercial structures in New Castle, including exempt structures such as schools and churches, and public utilities is $167,191,000 (New Castle 2003 Town Report). Assuming 1% to 5% damage, a hurricane could result in $1,671,910 to $8,359,550 of structure damage.

~Tornado

Tornadoes are relatively uncommon natural hazards in New Hampshire. On average, about six touch down each year. Damage largely depends on where the tornado strikes. If is strikes an inhabited area, the impact could be severe. In the State of New Hampshire, the total cost of tornadoes between 1950 and 1995 was $9,071,389 (The Disaster Center). The assessed value of all the residential and commercial structures in New Castle, including exempt structures such as schools and churches, and public utilities is $167,191,000 (New Castle 2003 Town Report). Assuming 1% to 5% damage, a tornado could result in $1,671,910 to $8,359,550 of structure damage.

~Severe Lightning

The amount of damage caused by lightning will vary according to the type of structure hit and the type of contents inside. There is now record of monetary damages inflicted in the Town of New Castle from lightning strikes.

Coastal Storms

~Storm Surge

Storm Surge could affect approximately57 structures in the Town of New Castle. Using the same flood damage assumptions as above in the ***Flooding*** section for this type of the flooding, the damage estimates would be as follows:

8-foot flood (49% damage to structures) = $7,963,569 potential damage
4-foot flood (28% damage to structures) = $4,550,610 potential damage
2-foot flood (20% damage to structures) = $3,250,436 potential damage

Severe Winter Weather

~Heavy Snowstorms

Heavy snowstorms typically occur during January and February. New England usually experiences at least one or two heavy snow storms with varying degrees of severity each year. Power outages, extreme cold and impacts to infrastructure are all effects of winter storms that have been felt in New Castle in the past. All of these impacts are a risk to the community, including isolation, especially of the elderly, and increased traffic accidents. Damage caused as a result of this type of hazard varies according to wind velocity, snow accumulation and duration. The assessed value of all the residential and commercial structures in New Castle, including exempt structures such as schools and churches, and public utilities is $167,191,000 (New Castle 2003 Town Report). Assuming 1% to 5% damage, a heavy Snow Storm could result in $1,671,910 to $8,359,550 of structure damage.

~Ice Storms

Ice storms often cause widespread power outages by downing power lines, making power lines at risk in New Castle. They can also cause severe damage to trees. In 1998, an ice storm inflicted $12,466,202 worth of damage to New Hampshire as a whole. Ice storms in New Castle could be expected to cause damage ranging from a few thousand dollars to several million, depending on the severity of the storm.

Wildfire

The risk of fire is difficult to predict based on location. Forest fires are more likely to occur during years of drought. The areas of potential wildfire include large tracts of open vegetation including forests and wetlands. Drought conditions increase the risks of wildfire in these open vegetated areas. The total assessed value of all the residential structures in New Castle is $145,414,500. This number divided by the total number of housing units (510[14]) establishes an estimate of per unit value of $285,126. Total wildfire damage could be estimated by multiply the number of houses destroyed by the estimate of per-unit value.

Earthquakes

Earthquakes can cause buildings and bridges to collapse, disrupt gas, electric and phone lines and are often associated with landslides and flash floods. Four earthquakes in New Hampshire between 1924-1989 had a magnitude of 4.2 or more. Two of these occurred in Ossipee, one west of Laconia, and one near the Quebec border. If an earthquake were to impact the Town of New Castle, buildings that are not built to a high seismic design level would be susceptible to structural damage. The assessed value of all the residential and commercial structures in New

[14] NH Employment Security, Economic & Labor Market Information Bureau.

Castle, including exempt structures such as schools and churches, and public utilities is $167,191,000 (New Castle 2003 Town Report). Based on Table 6 below, an earthquake could cause a range of damage depending on the construction and materials used to build the structures. Making the assumption that all of the structures in New Castle are single family homes built Pre-code, and wood frame construction, an earthquake could result in $668,764 of damage for a 0.07 PGA earthquake to $5,517,300 of damage for a 0.20 PGA earthquake.

FEMA has a model to predict damage to buildings based on their construction materials and seismic design level. It is not in the scope of this Plan to estimate the damages for each assessed structure for the Town of New Castle. What is possible for this Plan is to display the potential damage to several types of structures of varying construction materials, as a percentage of there total value. Table 6 provides two damage estimates for each building type, one from a small earthquake and one from a larger earthquake (PGA of 0.07 and 0.20 respectively). The damage estimates are shown as Building Damage (bold) and as a Loss of Function in days. Building Damage is an estimate of structural damage as a percentage of the building value. Contents of the buildings can also be assumed to be damaged to a value of half that of the structure[15]. For example, a building predicted to receive $100,000 in structural damage could expect $50,000 in additional damage to the contents of that building.

Table 6: Earthquake Damage and Loss of Function Table. Building Damage and Functional Loss are based on the type of Structure and the PGA (g). Two PGA (Peak Ground Acceleration) were chosen for this Table, 0.07 and 0.20 which represent a low and high example of potential earthquake in New Castle New Hampshire, NH.

		Wood Frame Construction				**Reinforced Masonry**				**Unreinforced Masonry**	
PGA (g)		High	Mod.	Low	Precode	High	Mod.	Low	Precode	Low	Precode
0.07	**Single Family**	**0.1**	**0.2**	**0.3**	**0.4**	**0.1**	**0.2**	**0.4**	**0.5**	**0.6**	**1.0**
0.20		**1.3**	**1.7**	**2.8**	**3.3**	**1.3**	**2.5**	**6.1**	**9.0**	**6.5**	**9.4**
0.07		0	0	1	1	0	1	2	7	6	12
0.20		2	3	9	15	4	16	58	106	64	114
0.07	**Apartment**	**0.1**	**0.2**	**0.3**	**0.3**	**0.1**	**0.2**	**0.4**	**0.5**	**0.6**	**0.8**
0.20		**1.5**	**1.9**	**3.0**	**3.2**	**1.5**	**2.6**	**5.4**	**6.9**	**5.5**	**7.5**
0.07		0	0	1	1	0	1	2	8	7	13
0.20		2	3	10	16	4	19	72	129	76	147
		Steel Frame (Braced)				**Reinforced Masonry**				**Unreinforced Masonry**	
		High	Mod.	Low	Precode	High	Mod.	Low	Precode	Low	Precode

[15] "Understanding Your Risks, Identifying Hazards and Estimating Losses", FEMA, pages 4-16 through 4-24.

0.7	**Retail Trade**	**0.2**	**0.3**	**0.4**	**0.5**	**0.1**	**0.2**	**0.4**	**0.6**	**0.7**	**1.0**
0.20		**2.4**	**2.8**	**3.8**	**5.6**	**1.5**	**2.7**	**5.9**	**8.3**	**6.1**	**8.7**
0.07		0	0	0	0	0	0	0	1	1	2
0.20		2	3	6	12	1	3	12	22	14	24
		Pre-Cast Concrete Tilt-up				**Light Metal Building**					
		High	Mod.	Low	Precode	High	Mod.	Low	Precode		
0.07	**Wholesale Trade**	**0.2**	**0.4**	**0.5**	**0.6**	**0.4**	**0.7**	**1.0**	**1.6**		
0.20		**2.6**	**4.1**	**8.3**	**10.8**	**3.8**	**5.4**	**10.3**	**14.8**		
0.07		0	1	1	2	1	2	3	6		
0.20		4	8	22	36	6	13	28	43		
0.07	**Office Building**	**0.2**	**0.3**	**0.4**	**0.6**	**0.2**	**0.3**	**0.4**	**0.5**		
0.20		**2.0**	**2.9**	**5.6**	**8.1**	**2.5**	**2.9**	**3.7**	**5.2**		
0.07		0	0	0	1	0	0	0	1		
0.20		1	3	11	21	2	3	5	11		
		Pre-cast Concrete Tilt-up									
		High	Mod.	Low	Precode						
0.07	**Light Industrial**	**0.1**	**0.4**	**0.4**	**0.5**						
0.20		**2.6**	**3.9**	**6.0**	**7.4**						
0.07		0	1	1	2						
0.20		4	7	21	34						

2.0	Building Damage = % of damage based on value
2	Loss of Function (# of Days)
	No Information

High, Moderate, Low and Precode refer to general seismic design level

CHAPTER VI – EXISTING HAZARD MITIGATION ACTIONS

This section identifies those programs that are currently in place as hazard mitigation actions or strategies for the Town of New Castle, NH. The table below (Table 7), displays existing ordinance, regulations, plans and Town departments that plan for, or react to, natural hazards to mitigate possible damage.

Table 7: Existing Hazard Mitigation Programs for the Town of New Castle.

Existing Protection	Protections Provided and Additional Comments
Member NFIP	New Castle entered in the NFIP as a regular member in 1986, and has had a community Assistance Visit February 2005. Currently 16 polices in force totaling $4,116,500.
Zoning: Wetlands	Wetland setbacks: 75' from Septic Systems, 50' for tidal wetlands, 25' poorly drained Soils.
Zoning: Overlay	Sensitive Area Overlay Zone provides low density development in environmentally sensitive areas.
Zoning: wooded buffers	50% of basal area must remain in wooded buffers.
Subdivision Regulations	25-year storm drainage plan required
Site Plan Review	25-year storm drainage plan required
Building Codes	Current building Codes enforced: 2000 International Building Code, 2003 International Residential Code, 2000 International Fire Code, 2000 International Plumbing Code, 2000 International Mechanical Code, 2002 National Fuel Gas Code, 2002 National Electric Code, 2000 Life Safety Code
Back-up Power	Fire Station , police station, Town Hall and Primary Shelter.
Emergency Drill	Drills conducted through the State for Seabrook Radiological Plan
Police and Fire Mutual Agreements Mutual Aid	Mutual aid agreements in place with surrounding communities

CHAPTER VII – POTENTIAL MITIGATION ACTIONS

POTENTIAL MITIGATION STRATEGIES

The Action Plan was developed by analyzing the existing Town programs, the proposed improvements and changes to these programs. Additional programs were also identified as potential mitigation strategies. These potential mitigation strategies were ranked in five categories according to how they accomplished each item:

- Prevention
- Property Protection
- Structural Protection
- Emergency Services
- Public Information and Involvement

The Committee brainstormed a list of strategies and actions that could be taken to mitigation future hazards are compiled in Table 8. Following the table is a summary of each proposed strategy or action.

Table 8: Potential Hazard Mitigation Strategies or Actions

Mitigation Strategies or Action	Hazard(s) Mitigated	Type of Mitigation Strategy
Investigate Updating Building Codes to Hurricane Standards for the State of Florida	Hurricane, High Wind Event, Coastal Flooding	Prevention, Property Protection
Increase Wetland Setbacks	Coastal and Inland Flooding	Prevention, Property Protection
Update Emergency Operations Plan	All Hazards Requiring Emergency Response	Emergency Services
Investigate Making the Rec. Center the Primary Shelter (Including Supplies and Back-Up Power)	All Hazards Requiring the Opening of an Emergency Shelter	Emergency Services
Increase ability to response to Marine Emergencies including Training and equipment	Coastal Storms, High Wind Events	Emergency Services
Portable Electronic Signage for Traffic Control	All Hazard that require Traffic Rerouting	Emergency Services
Consolidate Public Safety into One Building (current Fire Station/ EOC susceptible to high winds)	All Hazards Requiring Emergency Response	Emergency Services
Increase Rip-Rap on the River Side of the Causeway, and repair damage on Route 1B	Coastal Storms, Storm Surge	Structural Protection, Prevention
Investigate Possible Culverts at Pit Lane and Route 1B to allow water to pass and retreat	Coastal and Inland Flooding	Structural Protection, Prevention
Investigate Updates to building codes to improve towns resistance to earthquakes	Earthquakes	Structural Protection, Prevention, Property Protection
Educate Town Residents of location of Flood Hazard Zones and Storm Surge Inundation Zone through Town Imagery and Mylar Overlays	Coastal and Inland Flooding	Prevention, Property Protection, Public Information and Involvement
Hazard Mitigation Updates in the Town's Quarterly newsletter Including information on When and Where Imagery and Overlays would be displayed	Coastal and Inland Flooding	Prevention, Property Protection, Public Information and Involvement

Mitigation Strategies or Action	Hazard(s) Mitigated	Type of Mitigation Strategy
Provide Residents with NFIP information at the display of Flood and Storm Surge Zones	Coastal and Inland Flooding	Prevention, Property Protection, Public Information and Involvement
Investigate Building Codes, Zoning Ordinance, Subdivision and Site Plan Review Regulations for possible changes to mitigate of wildfires	Wildfires	Prevention, Property Protection,

CHAPTER VIII – PRIORITIZATION OF MITIGATION ACTIONS

The goal of each strategy or action is reduction or prevention of damage from a hazard event. In order to determine their effectiveness in accomplishing this goal, a set of criteria was applied to each proposed strategy. The STAPLEE method was developed to rank the proposed mitigation actions. The STAPLEE method analyzes the Social, Technical, Administrative, Political, Legal, Economic and Environmental aspects of a project and is commonly used by public administration officials and planners for making planning decisions. The following questions were asked about the proposed mitigation strategies identified in Table 8:

STAPLEE criteria:

- **Social**: Is the proposed strategy socially acceptable to the community? Are there equity issues involved that would mean that one segment of the community is treated unfairly?
- **Technical**: Will the proposed strategy work? Will it create more problems than it solves?
- **Administrative**: Can the community implement the strategy? Is there someone to coordinate and lead the effort?
- **Political**: Is the strategy politically acceptable? Is there public support both to implement and to maintain the project?
- **Legal**: Is the community authorized to implement the proposed strategy? Is there a clear legal basis or precedent for this activity?
- **Economic**: What are the costs and benefits of this strategy? Does the cost seem reasonable for the size of the problem and the likely benefits?
- **Environmental**: How will the strategy impact the environment? Will the strategy need environmental regulatory approvals?

Each proposed mitigation strategy was evaluated using the above criteria and assigned a score (Good = 3, Average = 2, Poor = 1) based on the above criteria. An evaluation chart with total scores for each strategy can be found in 9 tables under Table9.1 – 9.14.

Table 9.1: Investigate Updating Building Codes to Hurricane Standards for the State of Florida

Criteria	Evaluation Rating (1-3)
S: Is it Socially acceptable?	2
T: Is it Technically feasible and potentially successful?	2
A: Is it Administratively workable?	2
P: Is it Politically acceptable?	2
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	2
E: Are other Environmental approvals required?	2
Score	**15**

Table 9.2: Increase Wetland Setbacks

Criteria	Evaluation Rating (1-3)
S: Is it Socially acceptable?	2
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	2
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	2
E: Are other Environmental approvals required?	2
Score	**17**

Table 9.3: Update Emergency Operations Plan

Criteria	Evaluation Rating (1-3)
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	2
E: Is it Economically beneficial?	2
E: Are other Environmental approvals required?	2
Score	**18**

Table 9.4: Investigate Making the Rec. Center the Primary Shelter (Including Supplies and Back-Up Power)

Criteria	Evaluation Rating (1-3)
S: Is it Socially acceptable?	2
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	2
L: Is there Legal authority to implement?	2
E: Is it Economically beneficial?	2
E: Are other Environmental approvals required?	2
Score	**16**

Table 9.5: Increase ability to response to Marine Emergencies including Training and equipment

Criteria	Evaluation Rating (1-3)
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	2
A: Is it Administratively workable?	2
P: Is it Politically acceptable?	2
L: Is there Legal authority to implement?	2
E: Is it Economically beneficial?	2
E: Are other Environmental approvals required?	2
Score	**15**

Table 9.6: Portable Electronic Signage for Traffic Control

Criteria	Evaluation Rating (1-3)
S: Is it Socially acceptable?	2
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	2
P: Is it Politically acceptable?	2
L: Is there Legal authority to implement?	2
E: Is it Economically beneficial?	2
E: Are other Environmental approvals required?	2
Score	**15**

Table 9.7: Consolidate Public Safety into One Building (current Fire Station/ EOC susceptible to high winds)

Criteria	Evaluation Rating (1-3)
S: Is it Socially acceptable?	2
T: Is it Technically feasible and potentially successful?	2
A: Is it Administratively workable?	2
P: Is it Politically acceptable?	2
L: Is there Legal authority to implement?	2
E: Is it Economically beneficial?	2
E: Are other Environmental approvals required?	2
Score	**14**

Table 9.8: Increase Rip-Rap on the River Side of the Causeway, and repair damage on Route 1B

Criteria	Evaluation Rating (1-3)
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	1
E: Is it Economically beneficial?	2
E: Are other Environmental approvals required?	1
Score	**16**

Table 9.9: Investigate Possible Culverts at Pit Lane and Route 1B to allow water to pass and retreat

Criteria	Evaluation Rating (1-3)
S: Is it Socially acceptable?	2
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	1
E: Is it Economically beneficial?	2
E: Are other Environmental approvals required?	1
Score	**15**

Table 9.10: Investigate Updates to building codes to improve towns resistance to earthquakes

Criteria	Evaluation Rating (1-3)
S: Is it Socially acceptable?	2
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	2
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	2
E: Are other Environmental approvals required?	2
Score	**17**

Table 9.11: Educate Town Residents of location of Flood Hazard Zones and Storm Surge Inundation Zone through Town Imagery and Mylar Overlays

Criteria	Evaluation Rating (1-3)
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	2
E: Are other Environmental approvals required?	2
Score	**19**

Table 9.12: Hazard Mitigation Updates in the Town's Quarterly newsletter including information on when and Where Imagery and Overlays would be displayed

Criteria	Evaluation Rating (1-3)
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	2
E: Are other Environmental approvals required?	2
Score	**19**

Table 9.13: Provide Residents with NFIP information at the display of Flood and Storm Surge Zones

Criteria	Evaluation Rating (1-3)
S: Is it Socially acceptable?	3
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	3
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	2
E: Are other Environmental approvals required?	2
Score	**19**

Table 9.14: Investigate Building Codes, Zoning Ordinance, Subdivision and Site Plan Review Regulations for possible changes to mitigate of wildfires

Criteria	Evaluation Rating (1-3)
S: Is it Socially acceptable?	2
T: Is it Technically feasible and potentially successful?	3
A: Is it Administratively workable?	3
P: Is it Politically acceptable?	2
L: Is there Legal authority to implement?	3
E: Is it Economically beneficial?	2
E: Are other Environmental approvals required?	2
Score	**17**

After each strategy was evaluated and prioritized according to the final score. The highest scoring strategies were determined to be of more importance, economically, socially, environmentally, and politically feasible and, hence, prioritized over those that were lower scoring. This prioritizing was used as a basis for developing the Action Plan.

CHAPTER IX – ACTION PLAN

This step involves developing an action plan that outlines who is responsible for implementing each of the prioritized strategies determined in the previous step, as well as when and how the actions will be implemented. The following questions were asked to develop an implementation schedule for the identified priority mitigation strategies:

WHO? Who will lead the implementation efforts? Who will put together funding requests and applications?

HOW? How will the community fund these projects? How will the community implement these projects? What resources will be needed to implement these projects?

WHEN? When will these actions be implemented, and in what order?

Table 10 is the Action Plan. In addition to the prioritized mitigation projects, Table 10 includes the responsible party (WHO), how the project will be supported (HOW), and what the timeframe is for implementation of the project (WHEN).

Table 10: Action Plan for proposed mitigation actions

Score	Project	Responsibility/ Oversight	Funding/ Support	Estimated Cost	Timeframe
19	Educate Town Residents of location of Flood Hazard Zones and Storm Surge Inundation Zone through Town Imagery and Mylar Overlays	Emergency Management Director	Local	Under $200	Within 1 year
19	Hazard Mitigation Updates in the Town's Quarterly newsletter Including information on When and Where Imagery and Overlays would be displayed	Emergency Management Director	Local	free	Within 1 year
19	Provide Residents with NFIP information at the display of Flood and Storm Surge Zones	Emergency Management Director	Local	free	Within 1 year
18	Update Emergency Operations Plan	Emergency Management Director	Local, State Grants	$10,000	Within 1 year
17	Increase Wetland Setbacks	Planning Board, Conservation Commission	Local	free	Within 1 year
17	Investigate Updates to building codes to improve towns resistance to earthquakes	Planning Board	Local	free	Within 1 year
17	Investigate Building Codes, Zoning Ordinance, Subdivision and Site Plan Review Regulations for possible changes to mitigate of wildfires	Planning Board	Local	free	Within 1 year
17	Investigate Updating Building Codes to Hurricane Standards for the State of Florida	Planning Board	Local	free	Within 1 year

Score	Project	Responsibility/ Oversight	Funding/ Support	Estimated Cost	Timeframe
16	Increase Rip-Rap on the River Side of the Causeway, and repair damage on Route 1B	Emergency Management Director, Board of Selectmen	HMGP, NHDOT	$2,000,000	2 years
16	Investigate Making the Rec. Center the Primary Shelter (Including Supplies and Back-Up Power)	Emergency Management Director, Board of Selectmen	Local, HMGP	free	2 years
15	Investigate Possible Culverts at Pit Lane and Route 1B to allow water to pass and retreat	Emergency Management Director, Board of Selectmen	HMGP, NHDOT	$50,000	2 years
15	Increase ability to response to Marine Emergencies including Training and equipment	Emergency Management Director	Local, HMGP	Variable	1 year
15	Portable Electronic Signage for Traffic Control	Emergency Management Director, Board of Selectmen	Local, HMGP	$25,000 each	2 years
14	Consolidate Public Safety into One Building (current Fire Station/ EOC susceptible to high winds)	Emergency Management Director, Board of Selectmen	Local, HMGP	$10 mil +	5 years

CHAPTER X – INCORPORATING, MONITORING, EVALUATING AND UPDATING THE PLAN

Incorporating the Plan into Existing Planning Mechanisms

Upon completion and approval by FEMA and the State of New Hampshire, the *Plan* will be adopted as a stand alone document of the Town and as an appendix of the Town's Emergency Operations Plan (EOP). Future updates the EOP will incorporate the *Plan* as a referenced appendix, but the two plans will always be printed as separated documents. The EOP is subject to annual review.

The *Plan* will also be consulted when the Town updates its Capital Improvement Program (CIP). The Planning Board is responsible for updating the CIP annually, and will review the Action Plan during each update. The Planning Board in conjunction with New Castle Emergency Management will determine what items can and should be added to the CIP based on the Town's annual budget and possible sources of other funding.

The *Plan* will also be referenced in any future update of the New Castle Master Plan. Portions of the *Plan* could be incorporated into a Natural Hazards Chapter of the Master Plan. It will also be the responsibility of the Planning Board to incorporate current and future strategies identified in the *Plan* into proposed zoning ordinances and updates to Town Subdivision and Site Plan Review Regulations.

Monitoring, Evaluating and Updating the Plan

Recognizing that many mitigation projects are ongoing, and that while in the implementation stage communities may suffer budget cuts, experience staff turnover, or projects may fail altogether, a good plan needs to provide for periodic monitoring and evaluation of its successes and failures and allow for updates of the *Plan* where necessary.

In order to track progress and update the Mitigation Strategies identified in the Action Plan (Table 10), it is recommended that the Town revisit the *Plan* annually, or after a hazard event. If it is not realistic or appropriate to revise the *Plan* every year, then the *Plan* will be revisited no less then every five years. The Emergency Management Director is responsible for initiating this review with members of the Town that are appropriate including members of the public. In keeping with the process of adopting the 2005 *Plan*, a public hearing to receive public comment on *Plan* maintenance and updating will be held during the any review of the *Plan*. This publicly noticed meeting will allow for members of the community not involved in developing the *Plan* to provide input and comments each time the *Plan* is revised. The final revised *Plan* will be adopted by the Board of Selectmen appropriately, at a second publicly noticed meeting.

Changes should be made to the *Plan* to accommodate for projects that have failed or are not considered feasible after a review for their consistency with STAPLEE, the timeframe, the community's priorities, and funding resources. Priorities that were not ranked high, but identified as potential mitigation strategies, should be reviewed as well during the monitoring and update of this *Plan* to determine feasibility of future implementation.