



HURRICANE EARL, 2010



TOWN OF CARVER HAZARD MITIGATION PLAN 2015

Draft for Review by MEMA and FEMA
August 2015

TOWN OF CARVER

HAZARD MITIGATION PLAN

ACKNOWLEDGEMENTS AND CREDITS

This plan was prepared for the Town of Carver by Carver's Local Hazard Mitigation Planning Committee under the direction of the Massachusetts Emergency Management Agency (MEMA) and the Massachusetts Department of Conservation and Recreation (DCR).

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Chapter One: Introduction

Introduction and Purpose of the Plan

Carver is a rural community with great natural beauty. The landscape features cranberry bogs, natural wooded areas, and largely low-density residences. The New England weather means natural hazards are a fact of life in Carver with each season presenting its own challenge-- heavy spring rains, summer droughts, early fall hurricanes, or winter snowstorms. The intersection of these natural hazards with the man-made environment can transform these routine events into natural disasters.

This plan examines natural hazards facing the Town of Carver, assesses vulnerabilities of the area's residents and businesses, and makes recommendations on ways to mitigate the negative effects of typical natural hazards. The effort has drawn from the local knowledge of a group of officials and residents; the recommendations presented are meant to be realistic and effective steps for mitigating natural hazards. Ultimately it is hoped that these actions will translate into savings – fewer lives lost, less property destroyed, and minimal disruption to essential services.

Development and Update of the Plan

On May 12, 2010 the Carver Board of Selectmen appointed the Pre-Disaster Mitigation Committee—now the Hazard Mitigation Plan Committee—and charged them with updating the 2004 Pre-Disaster Mitigation Plan—now the Hazard Mitigation Plan (HMP). A list of Committee members is attached. The group included representatives from: Emergency Management, Board of Health, Department of Public Works, the Building Commissioner, Conservation, and Planning. The individual members were then sworn in by the Town Clerk. The group held five posted public meetings to discuss and update the plan—June 15, 2010, August 4, 2010, January 20, 2011, February 24, 2011, and March 23, 2011. All meetings were posted in accordance with appropriate Open Meeting Laws.¹ No member of the public came to the meeting and no public comments were made. Each member was assigned research or portions of the Plan for development at each meeting.

At our first meeting, the Committee reviewed the Community profile portion of the Hazard Mitigation Plan (HMP) and assigned members with various portions to update. Rob Tinkham, Sarah Hewins, and Jack Hunter contacted Mike Utley, Gary Garretson, and Andrew LaPerriere—three local business leaders, two of whom are residents—to invite them to participate with the committee in the update. It was agreed that the master document of the revisions to the HMP would be maintained by Tom Walsh who would also document the process of the review that is now being incorporated into the document. At our second meeting, we reviewed the changes we had made so far and covered additional portions of the plan, assigning research and changes to different committee members. Our September 3 meeting was canceled due to a possible Hurricane. The Committee had its third meeting on January 20 and continued its review of the Plan. After several more revisions of the Plan were made, another meeting was scheduled. At our fourth meeting, the Committee reviewed the current version of the Plan and identified edits needed to be made by Tom Walsh. A final version was circulated prior to transmitting the Plan to MEMA for review/comment. At the fifth meeting, the committee reviewed the “Crosswalk” and decided on changes/enhancements to the plan. In June of 2011, a draft of the Plan was sent to MEMA for their review. Due to staffing changes at MEMA and multiple disasters, we were not able to get any feedback from MEMA until late 2011; at that point, MEMA asked to meet with us.

In January 2012, Sarah Hewins, who has done much of the revising and editing for this document, and Tom Walsh met with S. White, C. Fatherly and R. Zingarelli from MEMA in the Emergency Operations Center at Carver Town Hall. FEMA guidelines and requirements have changed since we last revised our Plan. We had

¹ Massachusetts General Law Chapter 30A, Section 20 Amended, July 1st, 2010.

done much of the work, but there was still more to be done. Extensive notes were taken over the course of the meeting on the newly-required revisions and edits. Sarah Hewins agreed to attempt to make these new changes. In September 2012, we submitted the document to MEMA for review and possible forwarding to FEMA. The document then stayed in the MEMA office for about one year without comment.

In September 2013, Tom Walsh heard from MEMA about corrections, not-met requirements, and other revisions/editing still needed in the Plan. Marybeth Groff then submitted the Plan Review Final Tool to the Committee. As part of the Final Plan, Sarah Hewins contacted Bill Napolitano, Environmental Program Director at the Southeastern Regional Planning and Economic Development District (SRPEDD), and, through him, contacted the Taunton River Stewardship Council to request regional reviews of Carver's (as it was called at the time)Mitigation Plan. Both regional organizations reviewed and commented favorably on the draft Plan in November 2013.² Sarah Hewins completed some editorial revisions in December 2013, with Tom Walsh giving the final review for the Committee. The Plan was submitted to FEMA in January 2014. In June 2015, Tom Walsh and Sarah Hewins (now a Selectman and no longer the Town's Conservation Agent) met again with Marybeth Groff of MEMA to review FEMA's most recent comments and suggestions. Sarah Hewins made all final revisions in June and July 2015, per FEMA's *Local Mitigation Plan Tool Review* notes, with Tom Walsh's final approval.

All data and statistics in Chapter Two, "Profile of the Community and Existing Mitigation," were updated with special emphasis on the impacts of population growth on the town's ecosystems such as wetlands, as presented on page 7, and the potential that these impacts have to create other damaging consequences.

Chapter Three, "Hazard Identification and Risk Assessment," was reviewed by the committee and all data and references were brought up-to-date. The impact of flooding was updated (pp. 17-18) to reflect the community's experience with the 100-year storms that occurred in 2010 and the groundwater flooding that occurred in basements and public drainage areas in a highly-populated part of town. The Potential Vulnerability to Future Hazards was reviewed/updated by the Emergency Management members and all members reviewed and agreed with the frequency, severity, area of impact, and occurrence as outlined on Table 3.1 (page 13). The risk associated with Hurricanes was updated/enhanced with a section, on pages 9 and 10, addressing the impact of Carver's large number of Mobile Homes and elderly population.

Chapter Four, "Existing Protection Matrix," was reviewed and updated. Each member of the Hazard Mitigation Committee reviewed categories of the matrix that were appropriate to their departmental responsibilities and made any up-dated comments. All categories, including Capital Improvement protection measures, were cross-reviewed and approved by the committee.

Chapter Five, "Proposed Hazard Mitigation Actions," was updated to reflect efforts that have been made, although unsuccessful, to obtain funding for an additional tanker and completion of a project obtaining GPS for all fire vehicles. The Town has also resolved a road-flooding problem on Beaver Dam Road and Popes Point Road. The Town adopted Floodplain Zoning in 2009, with amended updates to the Floodplain Zoning in 2012,³ and has updated its Comprehensive Emergency Management Plan (CEMP). Emergency Management continues to update the CEMP as required. Based upon the current risk assessment analysis, Mitigation Goals have been discussed by the committee, determined to be consistent with the new risk assessment analysis, and were then added to the matrix in Table 5-1 (p. 35). The remaining Proposed Mitigation Actions were then prioritized.

Chapter Six, "Monitoring, Evaluation, and Update of Plan," is a new chapter added in 2013. The chapter discusses the processes of monitoring, evaluation, and up-dating the 2015 Hazard Mitigation Plan and of incorporating this Plan with other local plans and continuing to engage public awareness of disasters and preparedness.

² These regional reviews can be found in Appendix F, p.100.

³ See attached Appendix A regarding the Town Meeting votes for the 2009 and 2012 Floodplain Bylaws.

Chapter Two: Profile of the Community and Existing Mitigation

Geography, Geology, Topography, and Climate

The Town of Carver is located in southeastern Massachusetts and is bordered by Middleborough on the west, Plympton on the north, Kingston on the northeast, Plymouth on the east, and Wareham on the south. Carver is 40 miles southeast of Boston and 39 miles east of Providence, Rhode Island. It has a total land area of 39.47 square miles.

Geologists classify the southeastern Massachusetts area as part of the Northeast Coastal Lowlands/Coastal Plain region. The area is characterized by the conditions created over 12,000 years ago when massive glaciers receded. These characteristics include: low hills; highly porous soils; deposits of sand and gravel; multiple swamps, lakes, rivers, and ponds; and a high water table. The glaciers left behind glacial till that contains thick deposits of both sand and gravel, lying over bedrock. There are occasionally boulders, known as glacial erratics, of different rock types that were carried from northern regions and left behind as the glaciers receded. Carver has rolling hills with elevation changes from 50 to 150 feet above sea level.

According to the Town's Master Plan,⁴ about half of the town is covered with wetlands, and surface waters "which form an intricate network protecting and feeding the aquifer that provides drinking water for the town and beyond." The Winnetuxet, Wankinco, and Weweantic Rivers are in Carver, as are many smaller brooks and several major ponds: Sampson's Pond, Atwood Reservoir, Muddy Pond, Wenham Pond, Dunham Pond, Federal Pond, John's Pond, Barrett's Pond, Raccoon Pond, Golden Field Pond, Fresh Meadow Pond, Ward Pond, Clear Pond, and Cooper's Pond. In total there are 39 ponds and reservoirs in Carver. The Great South Meadow Cedar Swamp, an area within the floodplain, covers a total of approximately 600 acres.

Within Carver there are 2,200 acres of the 14,000 acre Myles-Standish State Forest and the Carver State Forest. In addition, the Rocky Gutter Wildlife Management Area is located directly across the southwestern town border in Middleborough. Most of the forest soils are sandy, droughty, and excessively well-drained, with little organic matter. Myles Standish has a history of significant and devastating wildfires. Recent construction has increased the risk by placing homes within highly-flammable vegetated areas in a town without a public water supply. The Carver Fire Department reports that during the past 35 years there have been numerous fires around Myles Standish ranging from 100 acres up to 1,000 acres. Carver is one of two local fire departments responsible for combating fires in Myles Standish State Forest.

Carver is distinguished by having the most dams of all the communities within the Southeastern Regional Planning and Economic Development District (SRPEDD) region—a total of 60 covered by the Office of Dam Safety. Many of these facilities are smaller dams (or flumes) associated with the cranberry industry and are used to manage water supply relative to cranberry growing and harvesting.

The Office of Dam Safety (ODS), a division of the Department of Conservation Recreation (DCR), under the Executive Office of Energy and Environmental Affairs, has jurisdictional authority over dams that meet the following criteria: dam structure six feet or higher, or impoundment of 15 acre-feet⁵ or more, or a significant downstream hazard as determined by staff review (e.g. campground, densely-developed area, major thoroughfare, etc.). This includes government-owned and privately-owned dams. New regulations that went

⁴ Town of Carver Master Plan, 2009, p. 4-1.

⁵ Acre-foot = Amount of water that fills one acre of land to a depth of one foot, approx. 326,700 gallons of water. See http://montecitowater.com/how_many_gallons_of_water_in_a_c.htm.

into effect at the end of 2003 require owners to register the dams and have them professionally inspected at the owner's expenses, every two years. While the monitoring of dam condition falls to the owner, be it a private or public entity, damage from dam failure may include multiple owners and even property across town boundaries.

Massachusetts in general has a humid climate with temperatures that average 68 to 72 degrees in the summer and about 28 to 32 degrees in the winter. The National Climatic Data Center reports the following normal temperatures by season in Carver:

January	27.4 Degrees F
July	72.2 Degrees F

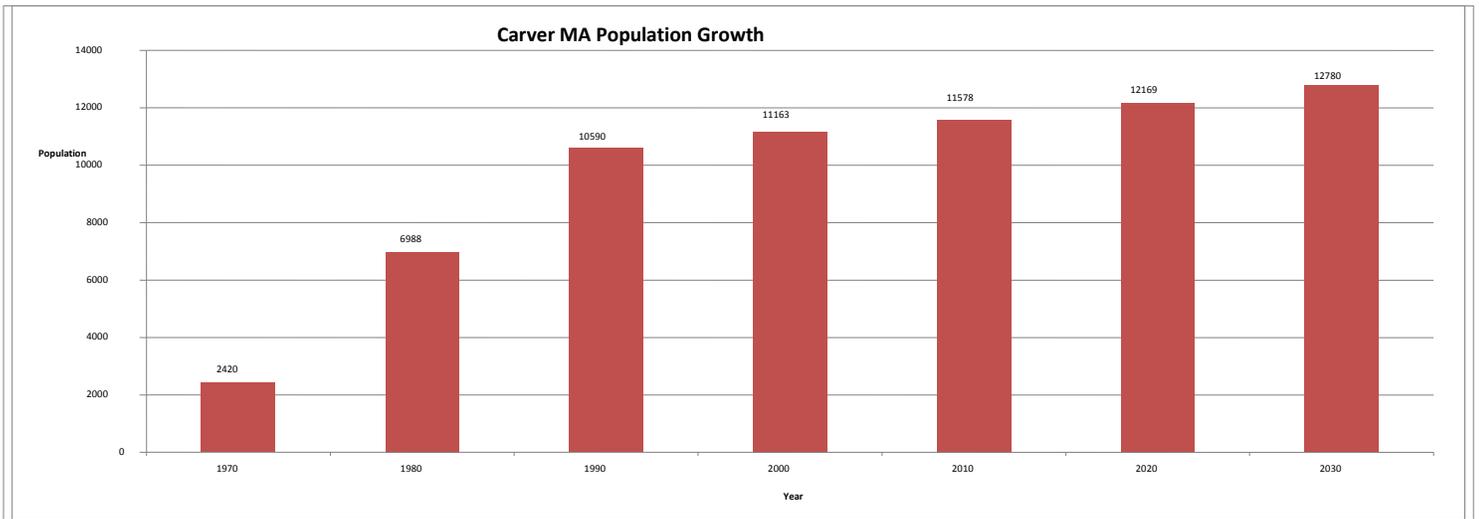
The normal annual precipitation is 44.23 inches. The growing season, from the last killing frost in the spring to the first killing frost in the fall, runs between 180 – 200 days. The area is subject to a variety of severe weather events: hurricanes, Nor'easters, thunderstorms, blizzards, tornadoes, and drought. All of these are discussed more fully in the next chapter.

Population Characteristics and Political Structure

The 2010 Census conducted by the Carver Town Clerk's office indicates that Carver has a total population of 11,510. With a land area of 39.78 square miles the average population density is 289 persons per square mile. A swath of the northern part of Carver along with a small area in the southern part are classified by the Census as urbanized; the majority of the land area is developed as a low-density rural/agricultural community. The population can be broken down by ages in the following manner: 262 (2.27%) under 5 years; 1,539 (13.37%) between 5 and 19 years old; 7,432 (64.56%) between 20 and 64 years old; and 1,911 (16.6%) 65 years or older. With a total of 5,765 households, the average household size is 2.80 persons.⁶

Carver has experienced a rapid population increase over the past thirty years, and is expected to continue this growth. Population growth adds more housing stock, new roadways, and more drainage structures to the town's existing impervious surfaces. These, in turn, cause more stormwater run-off and road run-off and can affect the quality and quantity of our groundwater. Less groundwater recharge due to more and more impervious surfacing can negatively impact the ability of a fire department to access water for fire suppression, especially in a town such as Carver where the Fire Department depends on local ponds (that are largely groundwater-fed) and reservoirs for its fire suppression water supply. Less groundwater recharge can also lead to vegetation drying and becoming more susceptible to wild fire. Impervious surfaces can also affect the ability of natural ecosystems such as wetlands to perform their functions, one of which is flood prevention through flood storage. Too many impervious surfaces too near to wetlands can overwhelm these sensitive systems. And the more wetlands that stop functioning properly or are filled for development, the less the remaining wetlands systems will be able to perform their disaster-mitigating functions. The figure on page 8 indicates census population figures and growth projections prepared by the Southeastern Regional Planning and Economic Development District (SRPEDD) & MassHighway.

⁶ These population figures are from the Carver Town Clerk's office, 24 January 2011.



Consistent with national trends, Carver has seen a steady increase in the absolute number of residents who are over 65 years of age. This is a trend that is expected to continue as the “baby-boomer” generation ages. The number of residents over the age of 65 has increased from 510 in 1980 to 1,396 in 1990, 1,650 in 2000, and to 1,911 in 2010. From 2000 to 2010, this segment of the population increased from 14.8 % of the total Carver population to 16.6%.⁷ This population generally has a higher incidence of special needs for emergency response—due to health afflictions and mobility restrictions—although overall this population is a healthier and more active group than they were thirty years ago. The Federal Administration on Aging notes the following as reasons the elderly are more vulnerable to disasters:

- ✓ They have difficulty getting assistance due to progressive physical and mental impairments and other frailties that accompany aging;
- ✓ They are slower to fill out forms for disaster notification and/or disaster relief assistance;
- ✓ They are often at higher post-disaster nutritional risk and medication risk;
- ✓ They are often targeted by fraudulent contractors; and
- ✓ They may be susceptible to abuse as overall family stress levels increase in the later stages of a disaster.⁸

Other vulnerable populations are youth and the disabled. Youth are vulnerable due to their need for supervision and guidance in times of emergency—especially groups of children under the care of a limited amount of adults. This is best assessed at the local level through critical facilities identification of childcare centers and schools. There are thirty-one critical facilities in Carver including six daycare centers and three schools. These facilities can be found in Carver’s Comprehensive Emergency Management Plan (2014).

The 2000 Census represents the first time that data on the disabled was collected. The Census long form allowed self-reporting by the respondent on questions that would indicate disabilities of various types:

- | | |
|------------------------------------|-------------------------|
| -sensory disability, | -physical disability, |
| -mental disability, | -self-care disability, |
| -going-outside-the-home disability | -employment disability. |

⁷ Carver Town Clerk’s office, 24 January 2011.

⁸“Disaster Preparedness for Older Americans”, 2002. Business Publishers, Inc.: Silver Spring, MD, p.1. See also [American Journal of Geriatric Psychiatry](#), 2009 Nov, 17(11):916-24. “AAGP position statement: disaster preparedness for older Americans: critical issues for the preservation of mental health.” [Sakauye, K. M.](#), et al.

The Census reports that Carver had a total of 1,249 respondents to these categories. Due to the ability to select more than one category, this translates into a smaller number of residents. The special circumstances of the disabled population that may affect disaster response include:

- ✓ the visually-impaired are reluctant to leave familiar surroundings;
- ✓ those with mental retardation or cognitive impairment may not understand or may become confused;
- ✓ guide dogs and other assistance animals may become disoriented in a disaster;
- ✓ proper transport techniques are required to reassure anyone being carried that they will not be dropped;
- ✓ many respiratory illnesses are aggravated by stress;
- ✓ medically-dependent individuals may not be able to communicate their needs; and
- ✓ all temporary shelters must meet accessibility standards.⁹

The governing body of Carver is a five-member elected Board of Selectmen, with the legislative body being Town Meeting. The Planning Board and Board of Health are elected positions. The Board of Selectmen hires a Town Administrator. The Town had a full-time Conservation Agent (now part-time), and a full-time Health Agent and Director of Planning and Community Development.

Transportation Network

Carver has a total of 105.64 miles of roadway. Route 58/Main Street acts as the only major north/south route and Route 44 serves as the major east/west route. The Myles Standish Forest, located in the southeastern section of town, serves as a barrier to through travel. Only one bridge is classified by MassHighway as functionally obsolete and no bridges are classified as structurally deficient.

The re-location of Route 44 in Carver was completed in December of 2005 and has improved the connection between Carver and Route 3. This project included an upgrade of the drainage system along existing stretches of the highway from an open ditch system to a closed treatment system.

<i>Carver</i>					
Miles of Roadway	Interstate	Arterials	Collectors	Local	Total
	0	4.88	20.96	77	105.64
Functionally Obsolete Bridges	Roadway	Over	Age	Owner	
In TIP- @ 25% design	Rochester Road	Weweantic River	1924	Town of Carver	

Source: SRPEDD and MassHighway

Land Use: Housing, Commerce, Industry, and Agriculture.

Statistics presented in the 2009 Carver Master Plan, “*Protecting Our Town Character While Responding to the Challenge of Growth*” indicate the following breakdown of land uses for the 24,749 total acres of Carver:¹⁰

- 3,197.0 acres Residential (13%)
- 112.5 acres Commercial (.5%)
- 64.0 acres Industrial (.3%)
- 183.2 acres Unprotected Public Recreation (.007%)

⁹ *Ibid.* p.20.

¹⁰ Town of Carver, *op. cit.*

- 497.88 acres Protected Public Passive Recreation (2%) (not including Muddy Pond and the Myles Standish State Forest)
- 324.0 acres Transportation/Utilities (1.3%)
- 6,726.2 acres Agriculture (27.2%)
- 12,594.6 acres Undeveloped land (50.9%)
- 563.3 acres Water (6.3%)

Residential growth has been steady. Between 1991 and 2010, 290 residential building permits were issued, an average of 24 per year. Carver has a phased development by-law that limits building permits to 30 per year. This is to ensure that, due to Carver’s environmental constraints—our sole source aquifer, our wetlands, and our sandy, permeable soils that are easily contaminated—housing is built at a more gradual rate than elsewhere and with protection of these resources in mind.

There are three village district areas in Carver: North Carver, Center Carver, and South Carver. The housing stock in Carver is generally single-family homes (according to the 2010 Census 68.1% of the 4,127 units are single-family detached units) of which 21% were constructed prior to 1969.

A significant figure is that 1,118 of Carver’s housing units (27% of the 4,127 total) are in mobile homes. According to the 2009 Master Plan the following are the major Mobile Home Parks in Carver:

Mobile Home Park	Number of Units
South Meadow Village	522
Cranberry Village	279
Pine Tree Village	186
MeadowWoods	64
Waterview Village	67
<i>Source: 2009 Carver Master Plan, p.2-8.</i>	

These mobile home parks are a concern because the population tends to be elderly and the parks are located in forested areas. The Carver Fire Department notes that “the nature of these housing units, the age of the occupants, and the surrounding fuel source for fires are a deadly combination.”

There are two private campgrounds in Carver: Pinewood Way with 100 sites and Shady Acres with 280 sites. The Emergency Management Director coordinates evacuations with the campground directors.

National Flood Insurance Program Participation

Participation in the National Flood Insurance Program (NFIP) is voluntary for communities and is based on an agreement between each participating community and FEMA. The Town of Carver has been a participant in the NFIP since 1985. Participating in the NFIP has three basic aspects that are discussed on the next page.

1. Flood plain identification and mapping

NFIP participation requires community adoption of a floodplain bylaw. Carver’s floodplain bylaw was adopted and became effective on December 31, 2009. Draft maps of Carver’s new floodplain were also received in 2009 and the recommended action was that the Town adopt these maps when they are finalized by the state. Mapping flood hazards creates broad-based awareness of the flood hazards and provides the data needed for our community to effectively administer a floodplain management program. The Town of Carver passed articles on its 2012 Annual Town Meeting Warrant that adopted the maps that have been finalized by the state to date. The flood maps can be viewed by the public and are located in the Conservation Department located at the Carver Town Hall and on Carver’s website at www.carverma.org under the Conservation Department. Maps can also be

accessed from FEMA’s website at <http://msc.fema.gov/>. In June 2012, the Town submitted its certified 2012 flood plain bylaws that were adopted at its 2012 Town Meeting to the Department of Conservation and Recreation (DCR). In an e-mail of June 21, 2012, Colleen Bailey at DCR advised Sarah Hewins, our Conservation Agent, that Bailey had received these certified bylaws and was entering Carver into FEMA’s system for approval on their end.¹¹ Our Conservation Agent also converted the FEMA mapping abbreviations to a decoded legend and produced flood plain maps for North Carver, Center Carver, and South Carver. These can be found at Figures 7-A through 7-C at the end of this document.

2. Floodplain management

Floodplain management can be defined as a community program of corrective and preventative measures for reducing flood damage. The program is led by the Town’s Conservation Agent and aided by the Building Commissioner, Town Planner, and Health Agent. These measures take a variety of forms and generally include requirements for wetlands and floodplain protection, zoning, subdivision or building, and special-purpose floodplain bylaw. In Massachusetts, a majority of the required regulations are covered under state laws that are enforced locally. Those regulations are

- Massachusetts State Building Code: 780 CMR 3107.0, "Flood Resistant Construction"
- Wetlands Protection Regulations: 310 CMR 10.00
- Inland Wetlands Regulations: 302 CMR 6.00
- Coastal Wetlands Regulations: 302 CMR 4.00
- Minimum Requirements for Subsurface Disposal of Sanitary Sewage 310 CMR 15, Title 5

Carver’s local floodplain management bylaw (Carver Zoning Bylaws; Section 3700) enforces minimum floodplain management regulations on new or improved structures and provides additional protection to natural resource areas and buffer zones. Carver passed this floodplain zoning at Town Meeting on May 19, 2009 and updated that bylaw in June 2012. As stated earlier, the Town participates in the NFIP. The table below indicates that in Carver there are only a few structures in the NFIP program and no repetitive loss structures.

Carver and the National Flood Insurance Program (NFIP)					
Policies in Force (#)	Property Value Insured (\$)	Total # Losses Paid Out	Total Losses (\$)	Total Repetitive Loss Structures (Two or more Claims)	Total Repetitive Loss Claims Paid (\$)
5	1,470,000	9	24,692.08	0	0

3. Insurance

Since Carver participates in the NFIP, property owners and renters residing anywhere in the community (not only in a special flood hazard area) are able to purchase insurance as a protection against flood losses.

Cultural and Historical Sites

Carver has two historic district areas listed on the State Register of Historic Properties with a total of 84 structures. The historic cemeteries, stone walls, and known and unknown archeological sites are also significant cultural and historical resources of the Town.¹²

¹¹ See e-mail correspondence between Colleen Bailey, DCR, and Sarah Hewins, Carver’s Conservation Agent, dated June 21, 2012, attached in Appendix A. Copies of the certified 2012 floodplain bylaws are also attached in Appendix A. Carver’s flood plain maps are Figures 7-A to 7-C on pages 50-52..

¹² See Figure 6-3: Carver Scenic Resources and Unique Environments at the end of this document.

Utilities

In Carver there is some localized municipal water, but no wastewater facilities. Each home or business must have its own private well water and septic system. Such a system is more vulnerable to power outages, as pumps in residential wells will not run without electricity. Individual homeowners would need generators to keep water running. All of Carver’s shelters have back-up generators available to cover this need. There are a few community well systems that serve groups of households in Carver. These are: one in the center of town that services the Town Hall, Library, and an elderly and low-income housing complex; four additional community wells that service Mobile Home parks; and three that serve condominium developments. There is also a new municipal water system in North Carver, called the North Carver Water District, that serves most businesses and some residents in a restricted area.

Carver is located within the 10-mile emergency planning radius of the Pilgrim Nuclear Power Plant in Plymouth, MA. Residents of Carver use the Beth Israel Deaconess Hospital, Plymouth or Tobey Hospital in Wareham for medical emergencies.

Community	Electric Provider	Gas Provider	Water Source	Wastewater	Hospitals
Carver	EverSource	EverSource	Private Wells	ISDS	Beth Israel Deaconess, Tobey

Conclusions

The following general characteristics, drawn from this profile, are relevant to the design of a disaster mitigation strategy:

- Carver is a growing community and the future indicates this will continue especially as infrastructure improvements make it easier to live in Carver and work elsewhere (Route 44 improved connection to Route 3; proposed I-195/I-495 interchange upgrade; possible Boston / New Bedford rail line, etc.).
- The growth of the past two decades has brought to town many new residents who are unfamiliar with the weather and hurricane pattern of the area.
- The substantial agriculture resources of Carver are at risk from natural hazards.
- The rural nature of the community makes communication more difficult.
- The town is located in the Pine Barrens area with vegetation that relies on wildfire. The presence of a large state forest, abutting wildlife management area, and major undeveloped tracts make Carver more vulnerable to wildfires than other areas. New construction is occurring in areas vulnerable to wildfire and the Town lacks a town- wide public water supply. Most residents rely on private wells.
- High water table areas are subject to private well and basement flooding and flooding of drainage areas, as noted below and on pages 17 and 18.
- Mobile homes are particularly vulnerable to natural hazards and Carver has a sizeable number of mobile homes. In addition, while there are no firm figures, it is assumed that much of this population is elderly.
- In general, Carver is a wet town – with swamps, bogs, ponds, streams, and rivers. Flooding can be an issue and can be exacerbated when natural vegetation debris collects in the many miles of connected waterways in the town. However, flooding of drainage basins, or retention ponds, is more likely to occur in neighborhoods with high water tables than is flooding of Carver’s natural waterways.

Chapter Three: Hazard Identification and Risk Assessment

This chapter will discuss the natural hazards and evaluate the risk they pose residents, homes, and businesses. Each natural hazard is identified and profiled with information on the hazard’s dimensions, history, and risk factors. Risk will be examined in terms of the likelihood of the natural hazard occurring; the geographic area that the natural hazard could affect; and the impacts that could be expected. The “likelihood” or probability of an event occurring is determined by reviewing historical events and consulting expert opinion, while GIS mapping is used to evaluate the area that could be affected. Information on the development characteristics of Carver from the profile chapter is used to estimate the impacts of natural hazards on critical facilities, vulnerable populations, and infrastructure.

The discussion here on risk assessment draws heavily from the discussion in the Regional 2004 Plan that has now expired.

Potential Vulnerability to Future Natural Hazards

	Frequency				Severity				Area of Impact				Area of Occurrence		
	Very Low	Low	Medium	High	Minor	Serious	Extensive	Catastrophic	Isolated	Local	Regional	Widespread	Isolated	Regional	Statewide
Flood			X		X				X					X	
Dam Failure			X		X				X					X	
Hurricane/ Tropical storm			X				X					X			X
Thunderstorm				X		X				X					X
Tornado		X					X			X					X
Nor’easter				X	X							X			X
Snow and Blizzard				X	X							X			X
Ice Storm			X		X							X			X
Wild Fire			X				X			X			X		
Drought			X		X							X			X
Extreme Temperature				X	X							X			X
Earthquake	X				X						X				X
Landslides	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Ice Jams	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Flash Floods	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Table 3-1

In the above matrix, the areas with “X” indicate the likely level of frequency, severity, extent, and likelihood of occurrence of each hazard. In this assessment, public infrastructure is defined as roads, bridges, trains, airports, public parks, etc. and essential services are utilities, hospitals, schools, etc. The following is a description of the criteria and Frequency Categorization:

- Very low:** events that occur less frequently than once in 100 years (Less than 1% per year)
- Low:** events that occur from once in 50 years to once in 100 years (1% to 2% per year)
- Medium:** events that occur from once in 5 years to once in 50 years (2% to 20% per year)
- High:** events that occur more frequently than once in 5 years (Greater than 20% per year)

Landslides, Ice Jams, and Flash Floods are not historically hazards that have ever occurred in the Town of Carver and, therefore, were not analyzed.

Severity Categorization

Minor: Limited and scattered property damage; limited damage to public infrastructure and essential services not interrupted; limited injuries or fatalities.

Serious: Scattered major property damage; some minor infrastructure damage; essential services are briefly interrupted; some injuries and/or fatalities.

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

Catastrophic: Property and public infrastructure destroyed; essential services stopped; numerous injuries and fatalities.

Area of Impact (*extent of impact on any locality for a particular event*)

Isolated: a single whole or partial community impacted

Local: One community to several communities impacted

Regional: many communities to a county impacted

Widespread: multiple counties impacted

Area of Occurrence (*the areas and the size of the areas that are likely to experience this type of hazard in the future*)

Isolated: Scattered areas around the state can experience this hazard

Regional: Multiple communities and counties can experience this hazard

Statewide: The entire state can experience this hazard

Table 3-2 below shows any previous federal / state disaster declarations that have occurred in Plymouth County since 1991 and that have affected the Town of Carver.

Table 3-2
Federal / State Disaster Declarations in Plymouth County Since 1991

DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS
Hurricane Bob (August 1991)	FEMA Public Assistance Project Grants	Counties of Barnstable, Bristol, Dukes, Essex, Hampden, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Hampden, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk (16 Projects)
DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS

No-Name Storm (October 1991)	FEMA Public Assistance Project Grants	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk
	FEMA Individual Household Program	Counties of Barnstable, Bristol, Dukes, Essex, Middlesex, Plymouth, Nantucket, Norfolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Bristol, Dukes, Essex, Hampden, Middlesex, Plymouth, Nantucket, Norfolk, Suffolk (10 Projects)
December Blizzard (December 1992)	FEMA Public Assistance Project Grants	Counties of Barnstable, Dukes, Essex, Plymouth, Suffolk
	Hazard Mitigation Grant Program	Counties of Barnstable, Dukes, Essex, Plymouth, Suffolk (7 Projects)
March Blizzard (March 1993)	FEMA Public Assistance Project Grants	All 14 Counties
January Blizzard (January 1996)	FEMA Public Assistance Project Grants	All 14 Counties
May Windstorm (May 1996)	State Public Assistance Project Grants	Counties of Plymouth, Norfolk, Bristol (27 communities)
October Flood (October 1996)	FEMA Public Assistance Project Grants	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
	FEMA Individual Household Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
	Hazard Mitigation Grant Program	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk (36 Projects)
1997	Community Development Block Grant-HUD	Counties of Essex, Middlesex, Norfolk, Plymouth, Suffolk
DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS

June Flood (June 1998)	FEMA Individual Household Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester (19 Projects)
1998	Community Development Block Grant-HUD	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
March Flood (March 2001)	FEMA Individual Household Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester
	Hazard Mitigation Grant Program	Counties of Bristol, Essex, Middlesex, Norfolk, Suffolk, Plymouth, Worcester (16 Projects)
February Snowstorm (February 17-18, 2003)	FEMA Public Assistance Project Grants	All 14 Counties
January Blizzard (January 22-23, 2005)	FEMA Public Assistance Project Grants	All 14 Counties
Hurricane Katrina (August 29, 2005)	FEMA Public Assistance Project Grants	All 14 Counties
May Rainstorm / Flood	Hazard Mitigation Grant Program	Statewide
April Nor'easter (April 15-27, 2007)	FEMA Public Assistance Project Grants	Barnstable, Berkshire, Dukes, Essex, Franklin, Hampden, Hampshire, Plymouth
DISASTER NAME (DATE OF EVENT)	TYPE OF ASSISTANCE	DECLARED AREAS

	Hazard Mitigation Grant Program	Statewide
Flooding (March 2010)	FEMA Public Assistance FEMA Individuals and Households Program SBA Loans	Bristol, Essex, Middlesex, Suffolk, Norfolk, Plymouth, Worcester
Hurricane / Tropical Storm Irene (August 28, 2011)	FEMA Public Assistance	Statewide
Super Storm Sandy (October 29, 2012)	FEMA Public Assistance	Statewide
Blizzard (February 8-9, 2013)	Emergency Protective Measures and Debris Removal	Statewide
Blizzard (January 26-28, 2015)	Emergency Protective Measures and Snow Removal	Statewide

(Source: database provided by MEMA)

Flood-Related Hazards

Floods

“Floods can be defined as a rising and overflowing of a body of water onto normally dry land.”¹³ The state Hazard Mitigation Plan of 2010 records flooding as one of the top hazards faced within the state—“75% of federal disaster declarations are related to flooding.”¹⁴ This is not surprising given that a number of natural hazards can cause flooding including: hurricanes, Nor’easters, thunderstorms, and winter storms. The 100-year flood is “the flood that has a one percent chance of being equaled or exceeded each year. Thus, the 100-year flood could occur more than once in a relatively short period of time.”¹⁵ Carver has only a few flooding problems with the hundred-year floodplain although flooding after a hurricane or after a 100-year storm event has occasionally been severe. Homes built in areas of high groundwater or too close to wetlands have, and will continue to have, losses due to basement flooding or private water well flooding. Building houses where there is already high groundwater is a special recipe for disaster. We saw this in the spring of 2010 when, after two 100-year storms hit Carver, basements, private water wells, and public drainage areas remained flooded for weeks in a neighborhood built on extremely high groundwater. The worst amount of water in this neighborhood was about one foot. Some of this neighborhood—the Great Meadow area in northeast Carver—had—before it was filled in 40 years ago—originally been home to many isolated wetlands as well the riverfront area to a brook. Much of this flooding could have been prevented years ago had attention been paid to the functions of wetlands and the elevations of groundwater, and had the neighborhood been built somewhere more suitable. In addition, bridges, culverts, and flumes in Carver on Beaver Dam Road, Holmes Street, Pope’s Point Road, Cross Street, and France Street are at some risk of flooding or failing. In fact, during the two 100-year storm events in the spring of 2010, the France Street Bridge did collapse, although there were no injuries. Since that time, upgrades have been done on the roads themselves at Beaver Dam Road, Pope’s Point Road, and France Street and the France Street Bridge has been re-built by our Department of Public Works to lessen that risk. The growth of Carver has also meant that pervious land has become impervious, increasing the amount of

¹³ See http://www.mass.gov/Eeops/docs/mema/disaster_recovery/state_plan_2010_rvn4.pdf, for the Commonwealth of Massachusetts State Hazard Mitigation Plan, 2010, prepared by the Massachusetts Emergency Management Agency (MEMA) and the Department of Conservation and Recreation (DCR), p. 36.

¹⁴ Commonwealth of Massachusetts State Hazard Mitigation Plan, 2010, *op. cit.*

¹⁵ Commonwealth of Massachusetts, 2010, *op. cit.*

stormwater and road runoff from normal precipitation. According to MassGIS, the total area developed between 1971 and 1999 was 2,760 acres or an increase of 10.8 %. Town-wide, however, the total impervious surface area is still listed in 2013 at only 3%.¹⁶ According to the “Atlas of Precipitation Extremes for the Northeastern United States and Southeastern Canada,” there are more “extreme precipitation events” and more rainfall¹⁷ now than in 1961¹⁸ when the original “Rainfall Frequency Atlas of the United States”¹⁹ was published. Thus, the probability of future flooding in Carver has increased.

As indicated by Figure 7-A, 7-B, and 7-C (pp. 49-51), “Carver Flood Hazard Areas,” the 100-year floodplain areas in Carver are primarily located along riverine corridors. Land area within the 100- year floodplain that, as of 2010, was undeveloped and not preserved in perpetuity is approximately 3,795.29 acres or 14.9% of the total land area. In order to decrease future flooding damage and preserve areas that hold floodwaters, Carver should consider the mitigation value of conserving these properties. Further evaluation should be undertaken to assess whether this land area is the rear portion of developed lots, wetland areas, or in any other way restricted from development. Much of this area may be associated with bogs.

The frequency of occurrence of flooding in Carver is medium and the severity of these floods is relatively minor. Although the areas of impact from flooding in Carver tend to be isolated, the area of occurrence remains regional. The worst flooding ever to happen in Carver was in one area of town, as noted above, and the extent was approximately one foot.

Dam Failure

“A ‘dam’ is an artificial barrier that has the ability to impound water, wastewater, or any liquid-borne material for the purpose of storage or control of water.”²⁰ The confluence of high groundwater and extreme rain events can also cause damage to local bridges and to water control structures.²¹ Most dams in the Town of Carver are defined as “flumes,” or agricultural water-control structures that consist of metal pipes connecting a cranberry bog, brook, or other wetland or waterway to another, through which the flow of water is controlled by inserting or removing wooden boards. *The frequency of both flooding and dam failure noted above is low, the severity is minor, and the extent of impact is extremely low, although the areas and the size of the areas that are likely to experience this type of hazard in the future remain regional since flooding and dam failure upstream tend to impact areas downstream from the incident area. The probability of dam failure in the future in Carver is medium, or lower than in the past, since repairs to many keys roads have been made since the 2004 Plan. However, there is also some evidence that extreme fluctuations between opposite types of conditions (for example, between flooding and drought) may become increasingly likely to occur²² and these events may result in future dam failures in unanticipated areas. However, at present, our dams are all small, insignificant, and minor.*

¹⁶ <http://maps.massgis.state.ma.us/dcr/forestry/forestry23.html>

¹⁷ Wilks, D. S. and R. P. Cember, Northeast Regional Climate Center, Cornell University, 1993, pp. 1, 22, Ithaca, NY, Publication No. RR 93-5.

¹⁸ This is supported by data from other parts of the country as well. See also Faiers, G. E. and B. D. Keim, 1997. p. 2, “Rainfall Frequency/Magnitude Atlas for the South-Central United States,” Southern Regional Climate Center Technical Report 97-1, Louisiana State University, Baton Rouge, LA, and Huff, F. A. and J. Angel, 1992, p. 49, “Rainfall Frequency Atlas of the Midwest,” Midwestern Climate Center, Champaign, IL: Illinois Water Survey, Illinois Dept. of Energy and Natural Resources, RR 92-03.

¹⁹ Hershfield, D. M., 1961, p. 56, “Rainfall Frequency Atlas of the United States,” U. S. Department of Commerce, Weather Bureau Technical Paper 40.

²⁰ Commonwealth of Massachusetts, *op. cit.*, 2010, p. 40.

²¹ This occurred in Carver in the spring of 2010 when the France Street Bridge collapsed during the above-referenced storm events.

²² http://www.colorado.edu/hazards/o/archives/2010/sep_observerweb.pdf

The Massachusetts Office of Dam Safety reports that the region's dams, like the other parts of New England infrastructure, are an aging infrastructure that is expensive to repair. The majority of Carver's dams or flumes are owned by cranberry growers. Routine maintenance is necessary to control the growth of trees and keep the area clear so defects can be detected. In addition to aging, the region's dams are often doing work beyond their original design. The increase in impervious surfaces leads to increased flows in some streams and rivers and thus greater demands are placed on the dams. In 2003, a dam in a north shore community "overtopped" after heavy precipitation. When this happens, the dams can fail quickly as the earthen structures are subject to erosion pressures. Over 15 years ago in Carver, a car was lost when a dam under a roadway failed. Since that time, however, there have been no dam failures in Carver.

The Riverways Program, within the Massachusetts Division of Ecological Restoration (DER) within the Department of Fish and Game, has been studying the larger environmental costs of both operational dams and dam failures. Dam failures may cause loss of life and property downstream, but they may also degrade the environment. Many dams act as a holding area for contaminated sediments. With a dam failure, these sediments are released and can damage wildlife and the ecology of the river system. An associated cost of dam failures is the potential for such destruction to affect fish ladders or culverts for directing water. The Riverways program is looking to develop an assessment tool for evaluating dams for all aspects of safety, including environmental safety.

In summary, although the probability of flood-related hazards occurring is relatively low, *flood-related hazards due to a variety of causes (hurricanes, Nor'easters, thunderstorms, winter storms, dam failure) occur with medium frequency. The extent or severity of the impacts on persons, property, and public infrastructure can be expected to be relatively minor, the area of those impacts fairly isolated, and the area of their occurrence remains regional.*

Atmospheric and Wind-Related Hazards

Hurricanes and Tropical Storms

"Hurricanes are relatively fast moving [storms], rarely impacting the coast over multiple tidal cycles. When landfall is made, these concentrated, strong low-pressure systems usually pound south-facing shores with high winds, precipitation, and storm surge. A Category 2 storm [hurricane] can cause millions of dollars in damage."²³ While New England is not the area of the United States most burdened by hurricanes, the Atlantic coast of the United States can expect to see, on the average, close to seven hurricanes every four years (~1.75 per year) strike the United States, while about three major hurricanes cross the U.S. coast every five years (0.60 per year)²⁴ and New England can expect one major landfall in each decade.²⁵ This

²³ Commonwealth of Massachusetts, 2010, *op. cit.*, pp. 43 and 44.

²⁴ <http://www.aoml.noaa.gov/hrd/tcfaq/E19.html> (Last Revised April 22, 2010). See also Blake, E.S., E.N. Rappaport, J.D. Jarell, and C.W. Landsea, 2005: "The Deadliest, Costliest, and Most Intense United States Hurricanes from 1851 to 2004 (and Other Frequently Requested Hurricane Facts.) NOAA Technical Memorandum NWS-TPC-4, 48 pp. See also Jarell, J.D., B.M. Mayfield, E.N. Rappaport, and C.W. Landsea, 2001: "The Deadliest, Costliest, and Most Intense United States Hurricanes from 1900 to 2000 (and Other Frequently Requested Hurricane Facts.) NOAA Technical Memorandum, NWS-TPC-3, 30 pp.

²⁵ Vallee, David R., "A Centennial Review of Major Land-Falling Tropical Cyclones in Southern New England," 2002, National Oceanic and Atmospheric Administration, National Weather Service Forecast Office, Taunton, MA, can be viewed at <http://www.mass.gov/czm/coastlines/2002/pdf/c12.pdf>

is in part due to the geography of Massachusetts—its projection easterly into the Atlantic places it in the typical path of storms that originate in Cape Verde or the Bahamas. Hurricanes are tropical storms that obtain wind speeds of 74 miles per hour or greater and are accompanied by heavy rainfall. Since hurricanes are formed at sea, storm surge is a concern when hurricanes make landfall. The National Weather Service reports, “Southern New England has been affected by forty-one such storms since 1900, 12 of which made landfall with **significant** impact.”²⁶ Table 3-3 (p. 20, “History of Southern New England Hurricanes”) reflects the history, or *previous occurrence*, of these events through the end of the 20th century. The tracks of storms that made landfall within the region are reflected in Table 3-2, “Federal / State Disaster Declarations in Plymouth County Since 1991,” on page 14. It should be noted, however, that these paths are neither indicators of future behavior nor the full representation of hurricane impacts in the region. The heaviest areas of hurricane damage are on the eastern side of landfall, as the storm moves in a large counter-clockwise spinning spiral. The most damaging storms have made landfall and tracked to the west of this region- including the major 1938 unnamed hurricane that made landfall in Milford Connecticut and the 1954 Hurricane Carol that made landfall in Old Saybrook, Connecticut. A Mapping of the paths of hurricanes that made landfall in the region since 1860 shows eight hurricanes, of varying intensity, crossed the region. The inset tells a more complete story about hurricane damage, by indicating those hurricanes that made landfall as far west of the region as the Rhode Island border. Figures 3-1 and 3-2 on page 21 (“Monthly Tropical Cyclone Distribution” and “Tropical Cyclone Frequency”) indicate the *frequency* of hurricane events in southern New England during the past hundred years. While it looks highly likely that southeastern Massachusetts will experience a hurricane, flooding in Carver from the hurricane is “**likely**.”

TABLE 3-3 History of Southern New England Hurricanes

	NAME	DATE	INTENSITY
<i>Twelve significant tropical cyclones impacted southern New England, 1900-1999. Storm intensity at landfall is given by the Saffir/Simpson scale or TS for tropical storm.</i>	Unnamed	7/21/1916	CAT 1
	Unnamed	9/21/1938	CAT 3
	Unnamed	9/14-15/1944	CAT 3
	Carol	8/31/1954	CAT 3
	Edna	9/11/1954	CAT 3
	Diane	8/18-20/1955	TS
	Donna	9/12/1960	CAT 2
	Belle	8/9-10/1976	CAT 1
	Gloria	9/27/1985	CAT 2
	Bob	8/19/1991	CAT 2
	Bertha	7/12-13/1996	TS
	Floyd	9/18/1999	TS

Source: Vallee, D. “A Centennial Review of Major Land Falling Tropical Cyclones in Southern New England. Available at <http://www.mass.gov/czm/coastlines/2002/pdf/c12.pdf>.

²⁶ *Ibid*, p 1.

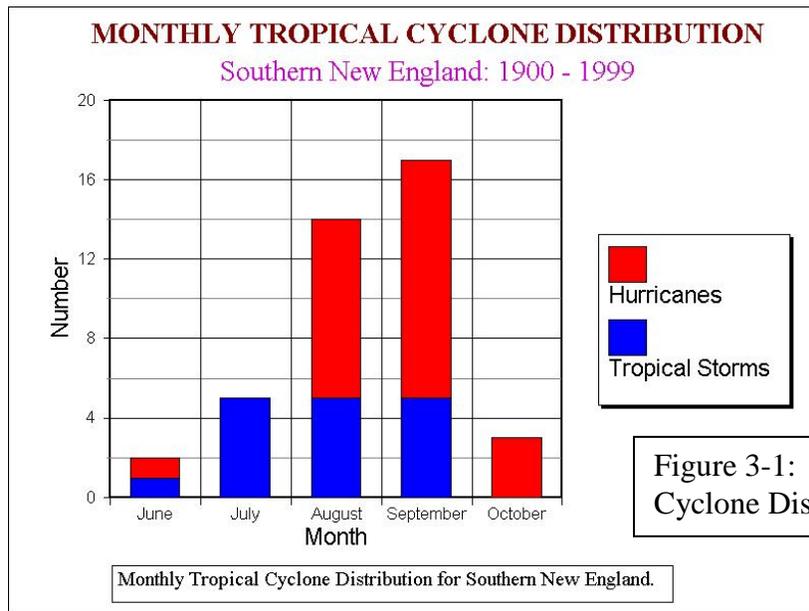


Figure 3-1: Monthly Tropical Cyclone Distribution

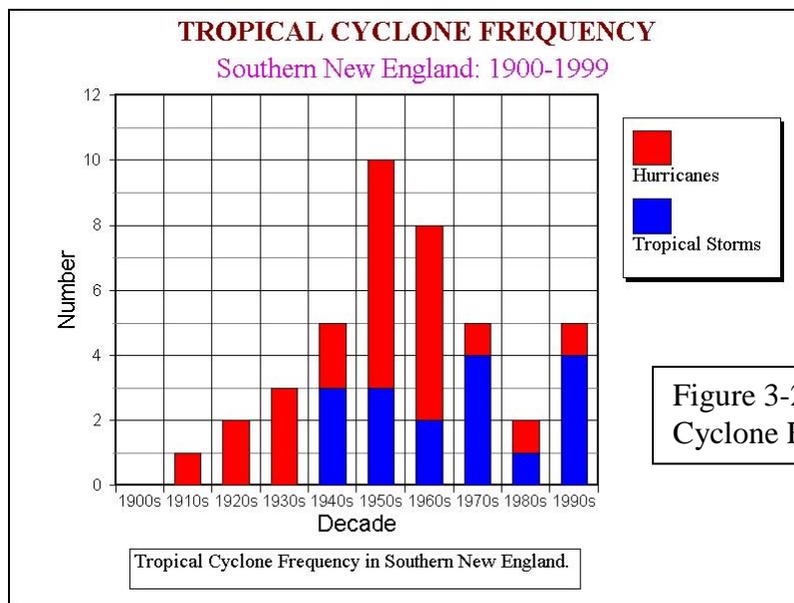


Figure 3-2: Tropical Cyclone Frequency

Vallee, D. "A Centennial Review of Major Land Falling Tropical Cyclones in Southern New England." Available at: <http://www.mass.gov/czm/coastlines/2002/pdf/c12.pdf> , p.2.

Strength	Wind Speed (mph)	Pressure (millibars)	Storm Surge (feet)
Category 1	74-95	>980mb	4-5 ft.
Category 2	96-110	965-979mb	6-8 ft.
Category 3	96-113	945-964	9-12 ft.
Category 4	131-155	920-944	13-18 ft.
Category 5	>135	919	18 ft.
Tropical Cyclone Classification			
Tropical Depression		20-34 kt or 23-39 mph	
Tropical Storm		35-64 kt or 40-73 mph	
Hurricane		65+ kt or 74+ mph	

In assessing the magnitude or severity of damage from a hurricane in southeastern Massachusetts, consideration must be given to the timing of the event. Hurricanes that make landfall during high tide will have much greater

storm surge and thus flood larger areas. In addition, hurricane season runs from June 1 to November 30, a period that includes the summer population swells experienced by several southeastern Massachusetts communities. *The frequency of occurrence of hurricanes in the region is considered medium.* The timing of the storm relative to other weather events also has a bearing on the overall impact of the hurricane. If a hurricane follows another hurricane or a major rain event, the effects can be magnified as flooding is greater, and weakened or loosened trees are more susceptible to toppling.

The severity of an event considers the potential for loss of life, property damage, and critical facility or business interruption. *The severity of a hurricane event in Carver is predicted as “extensive.” The entire town would be affected since hurricanes have a wide path and would be located over the entire region.* **Most experts anticipate that the probability has increased that the next major New England hurricane will have severe impacts because present residents are unaware of the serious danger and major property investment has also increased the value of structures in the region.** Given that the last major storm event was nearly twenty-three years ago, there is concern that those who have re-located to the area during this period or come of age during this period, are unaware of the real danger posed by a powerful hurricane. NOAA (National Oceanic and Atmospheric Administration) estimates that 80-90% of the population now living in United States coastal areas has never experienced a major hurricane.²⁷ This lack of firsthand knowledge can cause lax response to warnings and poor or little preparedness.²⁸ When residents are slow to respond to warnings the severity of impacts can be expected to be greater.

The new population has come with increased residential construction. As described in the Profile section, Carver has had new housing constructed to accommodate the population growth of an additional 4,175 persons (+ 60%) during the years 1980 – 2000. The area of impact for Carver would be widespread and the area of occurrence would likely be statewide. Carver was eligible for over \$96,000 in recovery costs for Hurricane Bob in 1991. This included cleaning and clearing; tree removal, and road repairs. The 1986 Hurricane Gloria did less damage in Carver, with reimbursement for clean-up at \$42,250.

The potential for loss of life and property is also increased in Carver due to the large number of mobile homes (1118) with 932 of these in communities made up of residents at least 55 years old. Almost all of these mobile homes were manufactured prior to improvements in regulations that required stronger construction after Hurricane Andrew’s devastation in Florida. Many mobile homes do not have tie-downs and are located close to towering White Pine trees that will be very vulnerable in a major wind event due to their shallow roots and Carver’s sandy soil. The elderly population in these mobile homes also is often reluctant to move to shelters since they have never experienced a Hurricane in their mobile home and don’t fully understand or accept the weakness of the structure; many will refuse to leave unless they can bring pets, creating a challenge for Carver’s sheltering plans. Efforts to mitigate this increased risk have centered on community education, in particular to the mobile home parks, stressing the need for advanced preparation, detailed Hurricane Emergency Management Plans, and shelter plans that will accommodate animals if required to do so.

Tornados and Wind

A number of the storm events discussed under “Flood-Related Hazards,” also represent wind hazards to the region. Hurricanes and Nor’easters typically have high winds that can topple trees, knock out power lines, and carry dangerous debris. Consistent with flooding, the occurrence of these storm events can be expected to be “**highly likely**,” that is the frequency of 1-2 times each year means that southeastern Massachusetts

²⁷ “Hurricanes: Unleashing Nature’s Fury,” Revised January 2007, NOAA, FEMA, American Red Cross. p. 10. This can be viewed at <http://www.nws.noaa.gov/om/hurricane/pdfs/HurricanesUNF07.pdf>.

²⁸ Jarrell, J. “The Deadliest, Costliest, and Most Intense United States Hurricanes from 1900 – 2000. NOAA Technical Memorandum NWS TPC-1, [Available at www.aoml.noaa.gov/hrd/Landsea/deadly/index.html], p. 8.

communities need to be prepared for high wind events. Wind has primary and secondary impacts. That is, property damage may occur as roofs are blown off or power lines blown down, but this is often followed by secondary impacts as the debris from one structure is blown into another structure or vehicle, and downed power lines cause fire or electrocution.

Occasional contributors to wind hazards are tornadoes. **A tornado is defined as “a narrow violently-rotating column of air that extends from the base of a thunderstorm to the ground.”**²⁹ “The Fujita Tornado Damage Scale” (Table 3-5 (p. 23)) reflects the 100-year wind exposure zones defined by the American Society of Civil Engineers (ASCE) construction standards. The wind exposure standard is used to determine the construction needed to withstand an average wind gust lasting 3 seconds at 33 feet off the ground. According to the ASCE construction standards, Carver is in the 100 mph zone. The ASCE standards are only used for high-rise structures, but the mapped zones indicate wind patterns as determined through readings and modeling. These patterns are consistent with the general regional weather patterns that indicate inland areas have less severe winds than coastal areas.

Since 1950, the southeastern Massachusetts region has experienced 15 tornadoes but there have been none in Carver. Within this region, tornadoes tend to be more likely in the months of May – September and between the hours of 3 – 6PM. The National Weather Service reports that despite technological advances in equipment, the warning window for a tornado is still only about 2 minutes. In addition, this warning is very general, typically covering an area as large as a county.³⁰ Massachusetts ranks nationally as 35th in occurrences of tornadoes for the period 1950 – 1995, but 16th in fatalities and 12th in property damages based on these same events.³¹ Massachusetts can expect on average, three tornadoes per year throughout the state.³² Tornadoes and other natural hazards that bring high winds, can affect the entire southeastern Massachusetts region. Thus all populations are vulnerable, but given that 38% of tornado fatalities are in mobile homes,³³ mobile home park residents are a more vulnerable group than the general population. The higher fatalities do not reflect the fact that mobile home parks are more likely to be hit by a tornado, but rather that, if hit, mobile homes are more vulnerable to damage. According to the 2010 census Carver has 1,118 mobile homes.

SCALE	WIND (MPH)	TYPICAL DAMAGE
F0	< 73	Light Damage: Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged
F1	73-112	Moderate Damage: Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.
F2	113-157	Considerable Damage: Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground
F3	158-206	Severe Damage: Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.
F4	207-260	Devastating Damage: Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.
F5	261-318	Incredible Damage: Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena will occur.

²⁹ Commonwealth of Massachusetts, *op. cit.*, 2010, p. 61.

³⁰ Interview with Glenn Field, July 2003.

³¹ www.nebraskaweather.unl.edu/severe/USspc_state_tornado_information_alpha_2.htm

³² www.ncdc.noaa.gov/img/climate/severeweather/small/avgt5095.gif

³³ www.nebraskaweather.unl.edu/severe/UStormfacts.htm

In summary, the expected frequency of wind damage specifically due to tornadoes is low in Carver and, although it would affect a state-wide area, the area of impact would be local. Although the probability of a tornado occurring in Carver is relatively low, the severity of tornados would likely be serious, however, particularly in our mobile home park communities.

Nor'easters

The Massachusetts Hazard Mitigation Plan reports that while hurricanes strike the area with much more force than Nor'easters, the state suffers more damage from Nor'easters because they are a more frequent occurrence (1-2 each year)³⁴ **Nor'easters are defined as “a large, counter-clockwise wind circulation around a low-pressure center often resulting in heavy snow, high winds, and [sustained] rain.”**³⁵ They are more problematic than hurricanes in part because they have a longer duration – 12 hours to 3 days, versus 6 to 12 hours for hurricanes. Many southeastern Massachusetts communities will have flooding associated with the heavy precipitation of Nor'easter storms. Problems can be exacerbated when the rains fall and the melting of snow and ice is added to the flow. The large chunks of ice that are freed can clog drainage passages and storm drains. When Nor'easters do occur in Carver, they blanket the entire town; all areas of town are vulnerable to them. Since 2005, Carver has experienced significant Nor'easter weather during the following days: April 15-27, 2007. *The probability of Nor'easters occurring in Carver is relatively high as is the frequency of Nor'easters in Carver. Their severity is rated as minor, although the area of impact remains widespread and the area of occurrence widespread.*

Snow and Blizzards

Snow can be defined as “frozen precipitation in the form of a six-sided ice crystal. Snow formation requires temperatures to be below freezing in all or most of the atmosphere from the surface up to cloud level.”³⁶ **A blizzard can be defined as “a winter snow storm with sustained or frequent wind gusts to 35 mph or more, accompanied by falling or blowing snow reducing visibility to or below ¼ mile.”**³⁷

Table 3-6 Snowstorm Climatology³⁸

Average number of snowstorms per season (1952-53 through 1991-92)				
Storm Size/	1”-2.9”	3”-5/9”	6” plus	Total
Boston	6.08	2.85	1.40	10.33
Worcester	9.23	4.60	2.35	16.18
Providence	6.03	2.63	1.23	9.88
Hartford	6.90	3.40	1.60	11.90
Chance per year of at least 1 snowfall amounting to 12 inches or more: Based on data from 1953 to 1992.				
	Boston	33%		
	Worcester	55%		
	Providence	20%		
	Hartford	25%		

³⁴ Commonwealth of Massachusetts, *op. cit.*, 2010, p. 66.

³⁵ *Ibid.*, p. 65.

³⁶ *Ibid.*, p. 70.

³⁷ *Ibid.*

³⁸ See: <http://www.erh.noaa.gov/box/climate/snow-climate.html>

The majority of Carver falls within a band of lower than average annual snowfall, 24.1 to 36 inches per year, with approximately the northern fourth classified in the higher snow band of 36 – 48 inches of snow each year. The “Snowfall Climatology” chart on the previous page (Table 3-6) indicates our area’s snowfall pattern. According to NOAA, the greater Providence area (covering the western section of southeastern Massachusetts) has a 20% chance each year of having at least 1 snowfall amounting to 12 inches or more, and is likely to experience 9.88 snowstorms each year. The greater Boston area (covering the northern/central area of southeastern Massachusetts) has a 33% chance each year of having at least 1 snowfall amounting to 12 inches each year and is likely to experience 10.33 snowstorms annually. Carver is most accurately placed within the Boston area. While melting snow adds to flooding, snowfall also presents a non-flooding hazard as access to critical facilities may be compromised by large amounts of snowfall. Variations on this hazard are a snowstorm in combination with rain that produces a very heavy wet snow or ice storms, both of which weigh down trees and power lines. As a community with a limited public water supply, the loss of power in Carver results in homeowners and businesses that lack a back-up generator being without running water.

In February of 2004, the American Meteorological Society initiated a rating scale for winter storms. The Category 1-5 scale is intended to be used to assess damage rather than predict impacts. Snowstorms are difficult to predict and small temperature fluctuations mean the difference between snow and rain. The scale that includes by increasing intensity- **notable, significant, major, crippling, and extreme** storms- assesses the amount of snow, area affected, and population impacted.³⁹

Category	Cat 1 Notable	Cat 2 Significant	Cat 3 Major	Cat 4 Crippling	Cat 5 Extreme
Snow Depth	4-10 inches	10+ inches	10-20 inches	20+ inches	10, 20, or 30 inches
Area	Size of RI	Southern New England	1-3 times NY State	Northeast	Northeast
Population Affected	10 million	10-20 million	20-40 million	50 million	60 million

(Source: American Meteorological Society)

Significant historic snow events in Carver have occurred on the following dates: December 1992, February 20, 2003, January 22-23, 2005, Blizzard Nemo on February 8, 2013, and Blizzard Juno on January 26-28, 2015. *In Carver, snow and blizzards occur with high frequency, although their severity is relatively minor. The area of impact of snow and blizzards tends to be widespread and the area of occurrence is usually statewide. As stated earlier, Carver has a 33% chance each year of having at least 1 snowfall amounting to 12 inches each year and is likely to experience 10.33 snowstorms annually.*

Ice Storms

“Ice storm conditions are defined by liquid rain falling and freezing on contact with cold objects creating ice build-ups of 1/4-inch or more that can cause severe damage. Other types of freezing precipitation are ice pellets, sleet, and hail. Ice pellets occur when “snowflakes melt into raindrops when they pass through a thin layer of warmer air. Sleet occurs when raindrops fall into subfreezing air thick enough that the raindrops refreeze into ice before hitting the ground.”⁴⁰ Hail will be discussed below under “Thunderstorms.” Ice storms occur with only medium frequency here in Carver, occurring only 8 times in Plymouth County as a whole in the roughly 40 years between 1971 and 2009.⁴¹ No significant ice storm

³⁹ Allen, Diane. “Snow Watchers now rate the effects from 1-5.” *The Boston Globe*, March 17, 2004, p.B4.

⁴⁰ Commonwealth of Massachusetts, *op. cit.*, 2010, p. 71

⁴¹ *Ibid.*, p 72.

events have occurred in Carver. The extent of these ice storms, i. e., their scale and magnitude, has been mild to moderate. The previously-mentioned blizzards and severe snow storms have been of a higher magnitude—downing power lines and breaking trees—than most of our ice storms ever have. *The severity of ice storms in Carver is usually minor, although when they do occur, the areas of impact and occurrence are widespread.* The probability of having some kind of ice storm in Carver remains high.

Thunderstorms

“A thunderstorm is a storm with lightning and thunder, produced by a cumulonimbus cloud, usually producing gusty winds, heavy rain and sometimes hail.”⁴² Hail is freezing precipitation that “falls from convective clouds (usually thunderstorms) and often during warm spring and winter months.”⁴³ In June of 1998 and again in May of 2009, thunderstorms occurred that produced such heavy rains that widespread flooding took place. In fact, during the May 2009 thunderstorm, “quarter-sized to golf-ball sized hail” occurred in Plymouth County.⁴⁴ Hail of any size occurring during peak bloom season of May through June can cause serious damage to Carver’s cranberry crop. If it hails early in the budding stage, cranberry buds can be broken off; if it hails when the blossom has set, blossoms can be knocked off and the amount of fruit set greatly reduced. If hail occurs and it’s during the portion of the season when the fruit has already set, hail has the potential to bruise the berries as it did during the May 2009 thunderstorm. *Thunderstorms occur with high frequency in Carver, and their severity is usually serious. Their area of impact is usually quite localized, sometimes occurring in one end of town and not in the other. Thunderstorms do occur statewide.*

Wildfire

“Wildland fire can be defined as any non-structure fire that occurs in the wildland. Three distinct types of wildland fire have been defined and include wildfire (naturally-occurring or human caused), and prescribed fire. Many of these are highly destructive and can be very uncontrollable. They occur in forested, semi-forested, or less developed areas. Wildland fires can be caused by lightning, human carelessness, and arson.”⁴⁵ Wildfires are a natural part of the southeastern Massachusetts ecosystem. Fires keep the forest floor clean of debris, encourage the growth of grasses that serve as wildlife feed, and ensure that trees have plenty of room to grow. Natural fires, recurring in a cyclical manner, can recycle nutrients and create a diversity of natural habitats. In these ways, wildfires that occur in isolated areas can be a positive force. Increasingly, however, development is encroaching into isolated areas and wildfires present a danger to human life and man-made facilities. **Forest fires that used to be in remote areas are now forest fires in people’s backyards.** The dual issues of human suppression of forest fires and human encroachment into forest areas, has increased the risks associated with wildfire. Portions of southeastern Massachusetts are classified as “pine-barrens.” These are areas where the vegetation is predominately pitch pine with an understory of scrub oak and black huckleberry. Not only is this vegetation highly flammable, the ecosystem of the pine-barrens relies on periodic fire to perpetuate the barrens.⁴⁶

The dispersion of growth into rural and undeveloped areas described in the Profile Chapter is consistent with the national phenomenon documented in discussions of the Wildlands/Urban Interface. The Wildlands/Urban Interface is getting attention because as development (particularly low-density residential development) pushes into flammable vegetated areas, the threats of wildfires increase. Carver does have low-density development sited within forested landscapes.

⁴² *Ibid.*, p. 59.

⁴³ *Ibid.*

⁴⁴ *Ibid.*, p. 61.

⁴⁵ *Ibid.* p. 73.

⁴⁶ Barbour, Henry et al, “Our Irreplaceable Heritage: Protecting Biodiversity in Massachusetts” 1998, Natural Heritage and Endangered Species Program & MA Audubon, pp.46-7.

Vegetation Type	Acres	Percent of Total*
Pitch Pine/Scrub Oak	120,332.00	23 %
Northern Hardwood	41,423.49	8 %
Red Maple Dominant	19,191.91	4 %
Oak/Maple Birch	3,908.96	1 %
Open Meadow	7,283.46	1 %
Forested Wetlands	56,101.70	11 %
Mixed Hardwood Pine	42,023.78	8 %
Suburban Forest	92,233.93	18 %
Water Bodies/Beaches/No Vegetation	132,883.69	26 %

The above Table 3-8 (p. 27), “Vegetated Coverage in Southeastern Massachusetts,” indicates vegetated coverage of the region that can be used to assess flammability. Pitch pine/scrub oak vegetation is resinous and waxy, characteristics that make it the most highly-flammable vegetation in the region. The dark green areas on the Forest Vegetation Map (see Figure 8, p. 53) are mostly Pitch Pine/Scrub Oak vegetation with some White Pine. Pitch Pine/Scrub Oak is particularly prevalent in the southeastern area of town where Myles Standish State Forest is located. Carver has a long history of wildfires and a number of risk factors including: lack of a public water supply for fighting a fire; rapid population growth; concentrations of mobile homes and elderly; and significant risk areas including 1,900 acres of state forest. The Carver Fire Department was a responder to the 1957 major crown fire that burned from Carver to the Atlantic Ocean destroying a total of 14,000 acres. In 1964, the “White Island” fire began on Federal Road in Carver and burned 800 acres towards Charge Pond in the state forest and this triggered the burning of an additional 5,500 acres with 28 structures in neighboring Wareham. During the last 30 years there have been numerous fires of 100 acres or less associated with the Myles Standish State Forest. Some fires reached more than 1,000 acres. Since 2005 there have been no large wild fires.

The types of injuries that wildfire can cause include: loss of life, loss of property, and environmental damage. Fighting fires relies on having adequate access to the area and sufficient water. Since there is no public water supply, Carver relies on one tanker truck and fire ponds for fighting wildfire and structural fires. Myles Standish State Forest is home not only to a large contiguous Pitch Pine/Scrub Oak community, but to Coastal Plain Pondshore, Sandplain Heathland, and Scrub Oak Scrubland communities. These communities are also known as Pine Barrens. Although, as mentioned earlier, the ecosystem of the Pine-Barrens relies on periodic fire to perpetuate the Barrens, a widespread area of impact from wildfire could also cause significant environmental damage to these natural communities.

In conclusion, *although the frequency of wildfire in Carver is considered medium, the severity would be extensive. And although the area of impact would probably be localized, the area of occurrence is certainly regional.*

Drought

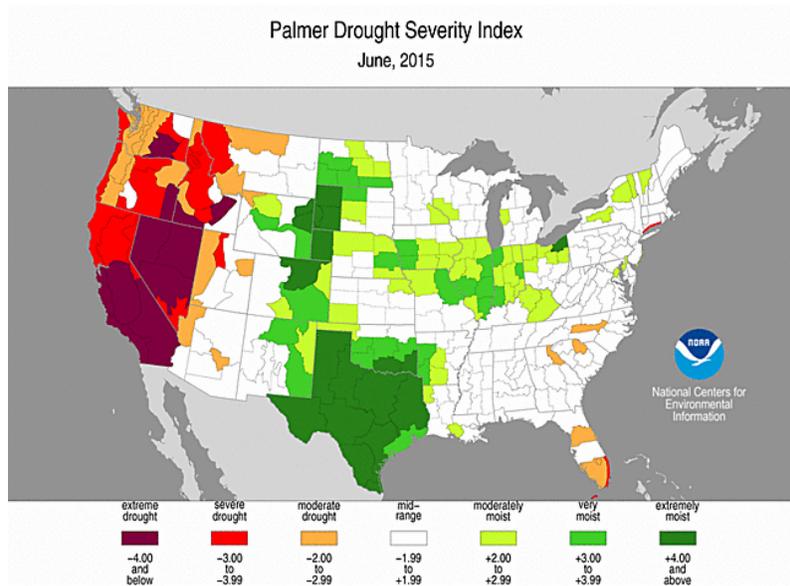
“Drought is a period characterized by long durations of below normal precipitation. ...Drought can affect agriculture, water supply, aquatic ecology, wildlife, and plant life.”⁴⁷ Drought is the main factor that determines the intensity of a wildfire season - the less moisture present in trees and vegetation, the more likely they are to ignite and the hotter they will burn. Table 3-9 (p. 28) below indicates the amount of time it takes for vegetation to dry after rainfall, to reach its point of flammability.

⁴⁷ Commonwealth of Massachusetts, *op cit.*, 2010, p. 75.

Table 3-9 Drying Hours to Reach Flammability	
Size of Fuel	Hours Post Rain to Reach Flammability
¼" diameter or less	1 hour
¼ – 1" diameter	10 hours
1 - 3" diameter	100 hours
4 – 7" diameter	1,000 hours
8" + diameter	10,000 hours

Source: MA Bureau of Fire Control.

Beyond its role as a factor leading to wildfire, drought also has impacts on public safety for all firefighting activity, agricultural production, and the economic vitality of large water users such as golf courses, industrial processes, and cranberry farms. According to the December 2001 Draft Massachusetts Drought Management Plan, Massachusetts generally has enough precipitation to support the demands residents and businesses place on water. Periods of drought are not unheard of though, with the 1960s and more recently 1999 – 2000 and 2002 being notable times of water stress in the southeastern region.⁴⁸ Most recently, the Massachusetts Drought Management Task Force issued a Drought Advisory on October 10, 2007 for all of Massachusetts, except for Berkshire County and Cape Cod and the Islands.⁴⁹



The Palmer Drought Severity Index shown above portrays Massachusetts as currently being in a fairly normal or “mid-point range”⁵⁰

The Carver Fire Department reports that Carver has been subject to 10 major droughts, of 6 months to two years duration, since 1963. Drought conditions mean less water available for fighting fires and more need for water to extinguish fires that get started. *Droughts occur with medium frequency in Carver and their severity is usually minor. Droughts usually have a widespread area of impact and can occur statewide.* Carver is a largely agricultural town and over 50% of the town is considered wetlands—with many, many cranberry bogs, reservoirs, wetlands, and waterways, many of which are interconnected. Since there is no town-wide municipal

⁴⁸ Working Draft: “Massachusetts Drought Management Plan,” prepared by EOE and MEMA, December 21, 2001, p. 4.

⁴⁹ From an e-mail from the Executive Director of the Massachusetts Association of Conservation Commissions to our Conservation Agent on October 30, 2007, in which the state’s Department of Environmental Protection’s posted “Advisory Drought” was forwarded along with the following links: <http://mass.gov/dcr/watersupply/rainfall/drought.htm> and <http://www.mass.gov/dep/water/resources/drought.htm>.

⁵⁰ See <http://www.ncdc.noaa.gov/temp-and-precip/drought/historical-palmers> and <http://www.ncdc.noaa.gov/oa/climate/research/prelim/drought/palmer.html>, page 8, for more indices and animation.

water, the Fire Department fills its tanker trucks from the town's ponds, rivers, and private reservoirs and other private wetlands for its fire suppressing water supply. If these water supplies were to become low or depleted and, since residents mostly depend on private well water, prolonged periods of drought could have serious consequences in terms of residential health and safety, fire suppression, and impairment of the natural environment. **The probability of drought occurring frequently in Carver is medium and its impact would be town-wide. Although a drought's severity would be minor, its area of occurrence would be widespread. This probability and the severity and length of future droughts could increase dramatically with potential warming climate trends.** The year 2012 saw some drought in the region, but whether this is a trend remains to be seen.⁵¹ It has been found to be extremely hard to identify drought risk and potential consequences due to the number and complexity of the variables involved in such a calculation.⁵²

Extreme Temperatures

“There is no universal definition for extreme temperatures. The term is relative to the usual weather in the region based on climatic averages. **Extreme temperatures can be defined as those that are far outside of the normal ranges for Massachusetts.** The average temperatures for Massachusetts are:

Winter (Dec-Feb) Average = 27.51°F

Summer (Jun-Aug) Average = 68.15°F”⁵³

Extreme temperatures could occur coupled with any of the other natural disasters discussed in this report, doubling or tripling the effects of any of these consequences of these disasters. The Emergency Operations Center has reported no examples of extreme temperature events in Carver; therefore, we did not include an analysis of extreme temperatures for our town. *The probability of frequent extreme temperatures occurring in Carver would be high, but its severity would be relatively minor. The area of occurrence of these extreme temperatures would be widespread and the area of occurrence would naturally be statewide.*

Geologic Hazards

Earthquakes

The hazards that present the least risk to southeastern Massachusetts are geologic hazards such as earthquakes and landslides. **“An earthquake is the vibration, sometimes violent, of the earth's surface that follows a release of energy in the earth's crust due to fault fracture and movement.”**⁵⁴ The United States Geological Service (USGS) categorizes the region as one of low risk for earthquakes, although small-scale earthquakes (under 3 on the Richter scale) are common in the region. The Weston MA Observatory of Boston College tracks earthquake activity throughout New England and reports that recent earthquakes in the vicinity of this region include an April 1996 3.5 Mn magnitude in Swansea; a July 11, 2002, 3.0 Mn magnitude in Martha's Vineyard; and a February 23, 2004 2.0 Mn magnitude in Dartmouth. There were no recorded earthquakes in Carver for the period between the years 1668-2010. Also indicated is Carver's classification within 1-3% Peak Ground Acceleration (PGA) zone⁵⁵, labeled as light shaking, no damage.⁵⁶ PGA is a measurement that compares the shaking of the ground with the force of gravity. While the likelihood of a powerful

⁵¹ “By the end of the month [April 2012], the [core drought areas](#) in the U.S. included: ... expanding moderate to severe (D2) drought stretching from the Mid-Atlantic states into the [Northeast](#), but limited to mainly along the coast.”

<http://www.ncdc.noaa.gov/sotc/drought/>, May 1 2012. “Four consecutive dry and warm months worsened the drought conditions in parts of the Northeast. As of April 24, 2012, the USDM had much of the eastern third of the region in moderate (D1) to severe (D2) drought. A few locations in Massachusetts had implemented mandatory or voluntary outdoor water use restrictions during the month.” (<http://www.ncdc.noaa.gov/sotc/drought/#NRCC>)

⁵² http://www.drought.gov/imageserver/NIDIS/workshops/un_drought_risk_2011/docs/GAR_Concept_Note.pdf, 2011, p. 3.

⁵³ Commonwealth of Massachusetts, *op cit.*, 2010, p. 77.

⁵⁴ *Ibid.*, 2010, p. 80.

⁵⁵ <http://www.earthquake.usgs.gov/hazards/products/conterminous/2008/maps>

⁵⁶ See Figures 9 and 10 at the end of this document (pp. 53, 54).

earthquake in the region is low, the actual risk is high because of how old the buildings are and because few structures have been built to withstand earthquakes. Critical infrastructure such as bridges and dams would be vulnerable. Overall the likelihood of a geological hazard in the region is considered to be **possible** but the type of event would be such that the impacts would be **small** and the severity **limited**, because earthquakes in the area are typically very small. *The probability of frequent earthquakes in Carver is very low, but the severity of an earthquake would be relatively minor, as witnessed by the three occurrences since 1996 listed above. The area of impact of an earthquake would only be regional while the area of occurrence would naturally be statewide.*

Table 3-10: Richter Scale	
M= 1-3	Recorded on local seismographs, but generally not felt
M= 3-4	Often felt, no damage
M= 5	Felt widely, slight damage near epicenter
M= 6	Damage to poorly-constructed buildings and other structures within 10's km
M= 7	"Major" earthquake, causes serious damage up to ~100 km
M= 8	"Great" earthquake, great destruction, loss of life over several 100 km
M=9	Rare great earthquake, major damage over a large region over 1000 km

Landslides and Ice Jams

Landslides are not an issue in Carver since our topography is relatively flat. Ice jams are also not an issue in Carver because our rivers are relatively narrow and shallow. Therefore, we did not analyze either type of event.

Chapter Four: Existing Protection Matrix: Town of Carver

The following table lists mitigation actions by category that the Town of Carver presently has in place.

EXISTING PROTECTION MATRIX: TOWN OF CARVER

Table 4-1

<i>Category of Protection Measure</i>	<i>Description</i>	<i>Area Covered</i>	<i>Effectiveness and/or Enforcement</i>	<i>Improvements or Changes Needed</i>
Capital Improvement Planning/Structural Improvements	Capital Improvement Planning (CIP) Committee in place. Prepares CIP on an annual basis covering a 5-year cycle.	Town-wide	Funding on as-possible basis.	The town struggles to fund CIP items and maintain a sufficient operating budget.
	Route 58 improvements - including changing stormwater from ditch drainage to partially closed system with water quality treatment	Route 58	Will be very effective in ensuring cleaner stormwater discharge and, thus, flood prevention (since wetlands function better to provide flood control when clean)	Will occur in 2014 or 2015-2016
Regulations/Bylaws-/Codes	Local Wetlands (including Floodplain) Protection Bylaw	Town-wide	Very Effective	None
	Local roadways sufficient width for fire response equipment	Town-wide	Effective – Planning Board and Fire Department work together to ensure site plans and regulations are adequate for emergency response purposes.	None

	Zoning upland requirements for residential lots- a minimum of 70% of lot must be upland (residential lot minimum is 60,000 sq. ft.). Local Floodplain Zoning Bylaw	Town-wide	Each residential lot must have adequate upland area – this protects floodplain areas by giving the resident enough useable land area for building and landscaping, i.e. prevents encroachment in floodplain/wetland areas.	None
	Subdivision Regulations- underground utilities required	Town-wide	Enforced.	None
	Soil Conservation Regulations- regulations that could impact sedimentation build up in waterways as a result of run-off from sand and gravel operations.	Town-wide	Adequate.	
<i>Category of Protection Measure</i>	<i>Description</i>	<i>Area Covered</i>	<i>Effectiveness and/or Enforcement</i>	<i>Improvements or Changes Needed</i>
Operations, Administration, and Enforcement	Tree Maintenance	DPW; Town-wide within public street ROW	As funding permits within Tree Warden workload	More funds
	Inter-department Emergency Coordination through Local Emergency Planning Committee	Emergency Management; Town-wide	Meets on as-needed basis.	None
	Disaster Warning System	Emergency Management; Town-wide	Cable TV; siren system,	None
	Maintenance of Drainage Facilities	DPW; Town-wide	On an as needed basis, routine annual program followed as permitted within the Highway Department workload.	None

	Winter Road Clean-up	DPW	Snow removal, tree removal as needed in response to storms.	None
	Clear-cutting by State for fire road maintenance	State; town-wide	As needed basis by state	None
	Fire Dept. review of all new site plans for vegetation clearance	Fire Dept.; town-wide	As new construction plans are submitted	None
	Fire Dept. patrols	Fire Dept.	Periodic and as needed	None
Planning	Comprehensive Plan / Master Plan-2009	Town-wide	No mention of disaster mitigation	On-Going
Conservation	Open Space and Recreation Plan –2010-2015	Town-wide	No mention of disaster mitigation--except for recommended building outside of wetland buffer zones and floodplain areas.	On-Going
Education & Training	Regular Training run on nuclear evacuation; hazardous materials, etc.	Town-wide	Effective	None
	Wide range of materials available at town hall on preparedness.	Town-wide	Adequate	Try to widen distribution – consider mailing with tax bill or utility bill.

Chapter Five: Proposed Hazard Mitigation Actions: Town of Carver, Massachusetts

The Hazard Mitigation team reviewed the proposed mitigation actions and determined what they felt were most important based on the Town’s history. The Town of Carver will make a good-faith effort to implement these actions within the constraints of the local budget, staff resources, and new demands from state and federal agencies. Actions were not prioritized in the previous plan due to these constraints, but they are prioritized in this plan and they will be analyzed and prioritized during the next update in 2019. It is clear, however, that the two most important potential hazards for the Town of Carver are hurricanes and wild fires. Riverine flooding, while a distant third potential hazard for the Town, is a rare but possible occurrence.

Hurricanes are by far the most potentially significant hazards facing the Town of Carver. Fortunately, Massachusetts state building code now requires many new structural mitigation devices for new building including wind engineering measures and construction techniques that may include structural bracing, straps and clips, anchor bolts, laminated or impact-resistant glass, reinforced pedestrian and garage doors, window shutters, waterproof adhesive sealing strips, or interlocking roof shingles.

Massachusetts building code also requires tie-downs with anchors and ground anchors appropriate for the soil type for manufactured homes. Our Emergency Management Director visits our mobile home parks on a regular basis and gives public talks and delivers hurricane information packets at the parks regarding mobile home parks and safety measures to be taken during the event of hurricanes. Our Emergency Management Director, in coordination with our school system's Facilities Manager, has also developed a pet-friendly shelter. One of the few pet-friendly shelters in the area, this shelter was designed specifically to encourage our elderly mobile home park residents to evacuate their homes and move to the shelter in the event of hurricanes.

Wildfires are the second most important potential hazard for the Town of Carver. Over the years, our Fire Department has applied for numerous grants to purchase additional tanker trucks and to add Global Positioning System units on all fire trucks. Twenty-three percent of the acreage in Carver is covered by highly-flammable pitch pine / scrub oak vegetation. As noted previously, Carver has a long history of wildfires and a number of risk factors including: lack of a public water supply for fighting a fire; rapid population growth; concentrations of mobile homes and elderly populations; and significant risk areas including 1,900 acres of the Myles Standish State Forest.

Our Fire Department focuses heavily on public education and fire prevention demonstrations to aid in the prevention of fires. The focus on wild fires and brush fires in Carver is due primarily to the rural—and heavily-forested—character of our town. The Fire Department has also recently acquired a new brushbreaker outfitted with the newest, most up-to-date equipment. In addition, the state has begun a program of thinning out the Myles Standish State Forest in an effort to prevent wildfires and brushfires in the forest through good forest management.

Coastal flooding does not occur in Carver since we are an inland town. Carver has three major rivers and many tributary brooks. Riverine flooding does not pose as great a threat to Carver as it might in some Massachusetts communities due to the abundance of wetlands and open space in the Town of Carver. About 600 acres of land in Carver is protected open space—one-half of 1% of the existing open space in town. About 12,000 acres of land in Carver remains unprotected open space. Wetlands and open space provide, among other things, groundwater recharge, infiltration, and flood control by holding or delaying riverine flood waters' release, by evaporating the flood waters, and by reducing peak flows. "The greater the area in lakes, [ponds,] and wetlands within a watershed of a stream, the lower the flood flow volumes."⁵⁷ Wetlands cover over 50% of the Town; with the proper care of these resources, Carver has its own built-in riverine flood protection.

By the same token, open space also "performs useful and valuable work in the form of air and water purification, flood control, creation of topsoil and agricultural land, water storage, and climate control. The removal of open space terminates these functions, which must be duplicated through technology at great cost."⁵⁸

The protection of wetlands and open space also saves public funds by preventing development of hazardous areas and of areas that provide natural flood protection. Although wetlands and open space protection does not appear to be a very dramatic hazard mitigation measure, it is perhaps one of the most important for a town like Carver given the natural abundance of wetlands and open space here. The Town of Carver has incorporated flood mitigation in our local conservation planning. The Town will continue—during the Open Space and Recreation Plan's normal up-date cycle—to implement the measures suggested in its latest Open Space and Recreation Plan⁵⁹ to protect its wetlands and open space by selective town acquisition when that land is

⁵⁷ The Value of Wetlands to People and Wildlife, J. S. Larson and R. B. Newton, Department of Forestry and Wildlife Management, UMass, Amherst, undated, p. 6.

⁵⁸ Open Space Pays: the Socioenvironmental Economics of Open Space Preservation, Darryl F. Caputo, New Jersey Conservation Foundation, in cooperation with Green Acres Program and the New Jersey Department of Environmental Protection, undated (1970s), p. 8.

⁵⁹ Town of Carver Open Space and Recreation Plan, 2010-2015, approved by the Executive Office of Energy and Environmental Affairs on February 9, 2012.

available and when acquisition is possible, by helping landowners obtain conservation restrictions on their land, and by continuing to regulate wetlands and floodplain protection as required by law.

Table 5-1 below represents the proposed mitigation actions by the Town of Carver, Massachusetts. Some of these activities will require grant funding; others will require the cooperation of other agencies.

PROPOSED MITIGATION ACTIONS: TOWN OF CARVER

The Town of Carver identifies the following goals that are relevant to the hazard-mitigation actions of the Town of Carver. 1) Reduce the loss of life, property, infrastructure, and environmental and cultural resources from natural disaster. 2) Investigate, design, and implement structural projects that will reduce and minimize the risks and impacts from riverine flooding. 3) Investigate, design, and implement structural projects that will reduce and minimize the risks and impacts from non-flooding hazards such as wildfires, tornadoes, hurricanes, etc. 4) Improve pre-disaster planning, communication, and coordination among federal, state, county, community, private, and non-profit entities so that they can plan for and mitigate natural hazards in a clear and comprehensive manner. 5) Increase the awareness of the public and communities to the risks presented by the multiple natural hazards that affect the region as well as to the mitigation activities and grant opportunities available to minimize the impacts of these hazards. 6) Improve existing policies and programs to reduce further or eliminate the impacts of natural hazards.

Table 5-1

Category of Protection Measure	Objectives	Action	Responsible Parties	Time-line	Resour-ces Needed	Status
Capital Improvement Planning/ Structural Improvements	To reduce wildfire in a rural community without a town-wide water supply and with high wildfire risk.	1. Develop wildfire prevention education in Elementary School 2. Public awareness at town-wide events	Fire Dept. and State	On-going	Fire Dept. personnel and some state personnel; part of responsibility and salary	On-going
Regulations/ Bylaws/ Codes	Ensure all new mobile homes constructed with tie-downs to prevent structural hurricane damage soil conditions examined to meet code to prevent frost heave under slabs; and c) meet	Update local process based on new state building codes and incorporate into local codes	Building Commissioner	To be done as applications arrive at Inspections office	Part of Building Commissioner's responsibility and salary	State building code changes yearly.

	wind load and other requirements. ⁶⁰					
	All new construction, remodeling, additions on existing residential homes meets hazard mitigation code ⁶¹	Update all new homes plans to guarantee hazard mitigation features of code are being met	Building Commissioner	To be done as all new applications arrive in Inspections office.	Part of Building Commissioner's responsibility and salary	On-going

Category of Protection Measure	Objectives	Action	Responsible Parties	Timeline	Resources Needed	Status
Operations, Administration, and Enforcement						
Planning	Ensure Master Plan is consistent with Hazard Mitigation Plan (HMP) and cross-references HMP.	Comprehensive Master Plan—No mention of disaster mitigation. At next re-write add cross-references to this plan.	Planning Board	At update process for Master Plan due to begin in 2014. Survey and 5-Year Plan due in 2016	In-house personnel able to conduct survey; Master Plan Update Committee	Planning Board is in process of establishing new Master Plan Update Committee
Emergency Management	Ensure that Mitigation Plan is up-dated regularly and coordinated with other Town Plans.	Update Mitigation Plan on 5-year cycle – coordinate with Carver's Emergency Management Plan (CEM), Open Space & Recreation Plan, and Master Plan updates; develop coordination process	Emergency Mgmt. Director	2018	Limited amount of work – if looks to be excessive, Town can apply to MEMA for funding.	Emerg. Mgmt. Dept. will set up coordinations within next 12 months

⁶⁰ See Appendix B, Mobile Home Hazard Mitigation Requirements, for an example of the documentation now needed by the Building Commissioner in order to approve a building permit on a new-construction mobile home.

⁶¹ See Appendix D, New Building Code Hazard Mitigation Requirements, 2013.

	Increase public awareness of hurricane hazards, particularly in mobile home communities	Update CEM's Hurricane Disaster Information Package ⁶² and deliver informational talks at mobile home parks annually.	Emergency Management Director	Within next 12 months	Part of the process and part of Emergency Management Director's responsibility and salary	Within next 12 months
Conservation	Ensure Open Space and Recreation Plan consistent c/ HMP and cross-references HMP.	Open Space Plan—at next re-revision, add cross-references to this plan.	Conservation Agent / Commission OS&RP Committee	New survey for OS&RP due 2015.	Part of a 5 – 7-year cyclical process and as part of Conservation Agent's responsibility and salary	Revised / Updated Goals & Objective due 2017 for 2015-2019 OS&RP
Category of Protection Measure	Objectives	Action	Responsible Parties	Timeline	Resources Needed	Status
Operations, Administration, and Enforcement						
Conservation	Re-establish a regional watershed council to help bring together resources for comprehensive analysis, planning, decision-making, and cooperation to study and advice on water issues, including flooding and groundwater pollution.	Formalize and appoint members to a regional aquifer advisory committee from the seven towns in the Plymouth / Carver Sole Source Aquifer region.	Boards of Selectmen in Towns of Bourne, Carver, Kingston, Middleborough, Plymouth, Plympton, Wareham appointed 7 voting delegates (one/town) and 7 non-voting alternates	Plymouth / Carver Aquifer Advisory Committee re-established in 2006 / 2007	Part of the process—part of Conservation Agent's responsibility and salary if also Delegate to the Aquifer Advisory Committee as former Agent was in Carver	Re-established in 2006 and was ongoing. Usually met once a month. Has not met for about 2 years (since 2013). Needs to be re-activated.

⁶² See Appendix E, *Carver Emergency Management Hurricane Disaster Information Package*, Thomas M. Walsh, Emergency Management Director, 2013.

The mitigation actions prioritization process developed by the Hazard Mitigation Committee requires the identification of projects and programs that appear to have a reduction in property damage, to have technical merit, to be cost-effective, and that will protect the health, safety, and welfare of the Town of Carver’s citizens. Although the prioritization process includes economic considerations, the project initiatives identified by the Hazard Mitigation Committee have also been analyzed for benefit / cost based on the following guidelines set forth by the state and by FEMA:

1. Does it accomplish one or all of the HMP goals? High
2. Does it promote the reduction of the loss of lives? High
3. Does it promote reduction in property damage? High / Medium
4. Does it promote reduction in damage to environmental and cultural resources? Medium
5. Does it promote reduction in damage to infrastructure? Medium
6. Is the project required by regulation and / or is there an additional benefit to be provided by a sponsoring agency (i.e., federal, state, regional, or local programs)? Medium
7. Funding availability (After a natural disaster event receives a presidential declaration and the state of Massachusetts is designated as a result of the disaster, the Town of Carver will be eligible for Hazard Mitigation Grant Program funding.)

The following table outlines the Town of Carver’s prioritization of proposed mitigation actions.

PRIORITIZATION OF PROPOSED MITIGATION ACTIONS

Action	Priority
Develop wildfire prevention education in Elementary School	High
Public awareness of wildfire prevention at town-wide events	High
Prevent structural hurricane damage / frost heave to mobile homes / all new construction	High
At next revision, ensure Master Plan is consistent with Hazard Mitigation Plan (HMP) and cross-references it	Medium
Ensure Hazard Mitigation Plan cross-references Master Plan / Open Space & Recreation Plan	High
Ensure Open Space & Recreation Plan is consistent with HMP and cross-references it	Medium
Re-establish Regional Watershed Council	Medium

COMPLETED MITIGATION ACTIONS

Category of Protection Measure	Objectives	Action	Responsible Parties	Time-line	Resources Needed	Status
Regulations, Bylaws, Codes	Ensure consistency with NFIP regulations— institute flood-plain zoning.	Adopted Floodplain zoning. Needed for consistency with NFIP regulations	Planning Board / Bldg Commissioner / Conservation Agent / Town Meeting	Done when new FEMA maps were made available in 2012	Up-dated zoning article; consistent with NFIP regulations; public info before Town Meeting in 2009/2012. No additional funds needed since Bldg. Comm/Conservation Agent/Planner did these things as part of their salaried jobs.	Adopted in 2009. Adopted in 2012 at Annual Town Meeting (ATM) and certified in 2012.

	Adopt stormwater bylaw consistent with EPA illicit connections and discharges to municipal storm drain systems since these types of discharges not only cause ground and surface water pollution and destruction of aquatic and other wildlife and habitat, but also cause flooding ⁶³	(8) Adopt Illicit Connections and Discharges to the Municipal Storm Drain System Bylaw	DPW / Conservation Agent	2011 Annual Town Meeting	Up-date article to be consistent with EPA regulations and conduct public informational tools before Town Meeting in 2011. No additional funds needed since dpw Supt./Conservation Agent do these things as part of their salaried jobs.	Adopted at 2011 Annual Town Meeting
Category of Protection Measure	Objective	Action	Responsible Parties	Time-line	Resources Needed	Status
Operations, Administration, and Enforcement	Proactive prevention of flooding on Beaver Dam Road.	Correct repetitive flooding problem at Beaver Dam Road. Required new box culvert and raising roadway bed for 700 feet.	DPW; Conservation permitting completed.	2005	Pursue grant funding in combination with Chapter 90 monies – total cost estimated at \$51,405.	Completed in Fall 2005.

⁶³ See Appendix C, page 78.

Category of Protection Measure	Objective	Action	Responsible Parties	Timeline	Resources Needed	Status
	Prevent repetitive and existing flooding in flood-prone areas of town by enforcing Conservation and Building Department requirements, bylaws, & regs.	Correct repetitive flooding problem at Popes Point Road. Required new box culvert and raising roadway bed for 3,000 feet.	DPW	2011	Grant funding in combination with Mass. General Law Chapter 90 monies - total cost estimated at \$196,360.	DPW installed two new headers on the Pope's Point Road Bridge in 2011 to mitigate flooding from S. Meadow Brook and Beaver Dam Brook
	Implement the Illicit Connections and Discharges to the Municipal Storm Drain System Bylaw ⁶⁴ .	Obtain Town Meeting approval for funding to implement	DPW / Conservation Agent	2012 Annual Town Meeting	Article consistent with EPA regulations; In-house DPW/Conservation Agent salaries, so no extra cost	Adopted at 2012 Annual Town Meeting
	Obtain funding to develop a regional Aquifer Action Plan and Plymouth / Carver Aquifer Regional Open Space Plan.	Request appropriation from the state legislature to fund writing of a Regional Aquifer Action Plan and a Plymouth / Carver Aquifer Regional Open Space Plan	Regional Plymouth / Carver Aquifer Advisory Committee	Funding obtained in 2007	Funded by the Dept. of Energy and Environmental Affairs and assisted by planning agency—SRPEDD—and by members of Regional Aquifer Advisory Committee	Both Regional Plans completed in 2007 ⁶⁵ and in 2008 ⁶⁶ respectively

⁶⁴ See Appendix .C, p. 78.

⁶⁵ See <http://www.srpedd.org/environmental/reportaugust.pdf> for a copy of the 2007 Aquifer Action Plan.

⁶⁶ See <http://www.srpedd.org/environmental/plymouthcarversourceplan.pdf> for the 2008 Plymouth-Carver Sole Source Regional Open Space Plan.

CHAPTER SIX: MONITORING, EVALUATION, AND UP-DATE OF PLAN

This section is written to provide a framework for gauging progress and adjusting to new conditions, such as new policies, Federal requirements, and new initiatives, as they may arise.

Monitoring

Monitoring of the Hazard Mitigation Plan will be the responsibility of Carver Emergency Management. If need be, site visits or additional follow up will occur for actions outlined in the previous section. Monitoring will include site visits to appropriate locations where these measures have been implemented and will coincide with the annual review of the town's Comprehensive Emergency Management Plan (CEMP). Mitigation measures that have not been implemented will be reviewed to determine if they will still minimize natural hazards or if they are no longer a viable option. Additionally, any new options to include an update of the plan will be considered. A questionnaire will be developed and distributed to all appropriate department heads / departments in Carver's municipal government—i.e., “responsible parties” to the implementation of all protective measures in this document. This questionnaire will be used in the monitoring review process to ensure that all updates are sensible, timely, and are being completed by the various parties responsible. The Emergency Management Director will be responsible for the Plan's Monitoring as well as its Update and Evaluation.

Evaluation

Evaluation of the Hazard Mitigation Plan in its entirety will be done on a 5-year basis in accordance with the Disaster Mitigation Act of 2000 or after any significant natural hazard disaster. At that time, the Board of Selectmen will appoint a Hazard Mitigation Committee when requested to do so by the Emergency Management Director. Any new problems that arise will be reviewed by the hazard mitigation team and incorporated into the Hazard Mitigation Plan. The plan will be up-dated with possible new goals, mitigation measures, and plans of action as determined from the evaluation. This allows for up-dates to be made as the Town of Carver grows and changes.

The evaluation will include a review of the goals and actions and whether each still addresses current and expected conditions. The identification and magnitude of hazards will be reviewed. Local fiscal issues, administrative challenges, or major regulation changes will be discussed during this evaluations process. The evaluation will also consider local development and land use changes.

Up-date

The Emergency Management Department will oversee the hazard mitigation review and up-dating process.

The official up-date process will commence 4 years from this plan's approval date of [DATE TO BE ANNOUNCED],⁶⁷ not to begin more than 18 months from the expiration date of this plan. A Mitigation Team to be appointed at that time will be responsible for conducting this review and up-date. The up-date will be in conformance with federal requirements and will evaluate the effectiveness of whether the previously approved plan's method and schedule for monitoring, evaluating, and up-dating the plan worked, and what elements or processes, if any, need to be changed or modified to provide a more successful outcome in future plans.

Integration of the Hazard Mitigation Plan into Other Planning Initiatives

⁶⁷ See Appendix G, “Certificate of Adoption” template, p. 103

Although many of the recommended mitigation measures from the Town of Carver, Massachusetts, 2015 Hazard Mitigation Plan have been implemented since the plan was adopted, there has not been an on-going local process to guide implementation of the Plan or to integrate it with Carver's other plans and programs. Such a process is needed over the next five years for the implementation of this Plan update and will be structured as described below.

Upon approval of the 2015 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 on-going work. At a minimum, the Plan will be reviewed and discussed with the following departments: Building, Conservation, Department of Public Works, Emergency Management, Fire, Health, Planning and Community Development, Police, and Recreation.

The Town will incorporate and consider elements from this Hazard Mitigation Plan and its process during other community planning projects as they are updated and renewed during their normal up-date cycles—the Town's Capital Improvement Plan, Comprehensive Emergency Management Plan, Master Plan, Open Space and Recreation Plan⁶⁸, the regional Plymouth/Carver Aquifer Action Plan⁶⁹, the Plymouth/Carver Sole Source Aquifer Regional Open Space Plan,⁷⁰ and any local Land Use and Management Plans⁷¹ that are available.

Continued Public Involvement and Review by Regional Agencies

The public and important stakeholders will have opportunities to submit feedback and solicit comments from the Town of Carver regarding the plan and projects. The residents and businesses shall be notified when hazard mitigation issues are brought to the Board of Selectmen. This may be done using the local newspaper (*The Carver Reporter*), the Town of Carver's Town Clerk's bulletin board, The Carver Council on Aging newsletter, Annual Town Meeting, the Annual Old Home Day event, and through the Southeastern Regional Planning and Economic Development District (SRPEDD). The plan will also be posted on the town's website, at www.carverma.org, and on the town's School Department website, at www.carver.org, with the caveat that the local team coordinator will review the plan for sensitive information that would be inappropriate for public posting. Regional review and comments by SRPEDD and by the Taunton River Stewardship Council are attached.⁷²

MAPS OF THE TOWN OF CARVER, MASSACHUSETTS

⁶⁸ Town of Carver 2010-2015 Open Space and Recreation Plan, Carver Open Space and Recreation Planning Committee, March 2010. See also www.carverma.org for an on-line copy of this Plan.

⁶⁹ See the Plymouth/Carver Aquifer Plan, 2007, at www.srpedd.org/environmental/reportaugust.pdf

⁷⁰ See the Plymouth/Carver Sole Source Aquifer Regional Open Space Plan, 2008, at www.srpedd.org/environmental/plymouthcarversourceplan.pdf.

⁷¹ Town of Carver Land Use and Management Plan for the Cole Property, 2007, prepared by Sarah G. Hewins, available at the Conservation Department at the Carver Town Hall, 108 Main Street, Carver, MA, 02330.

⁷² See Appendix F for regional reviews and comments.



Figure 6-1: Locus: Town of Carver, Massachusetts

2005 Land Use Map

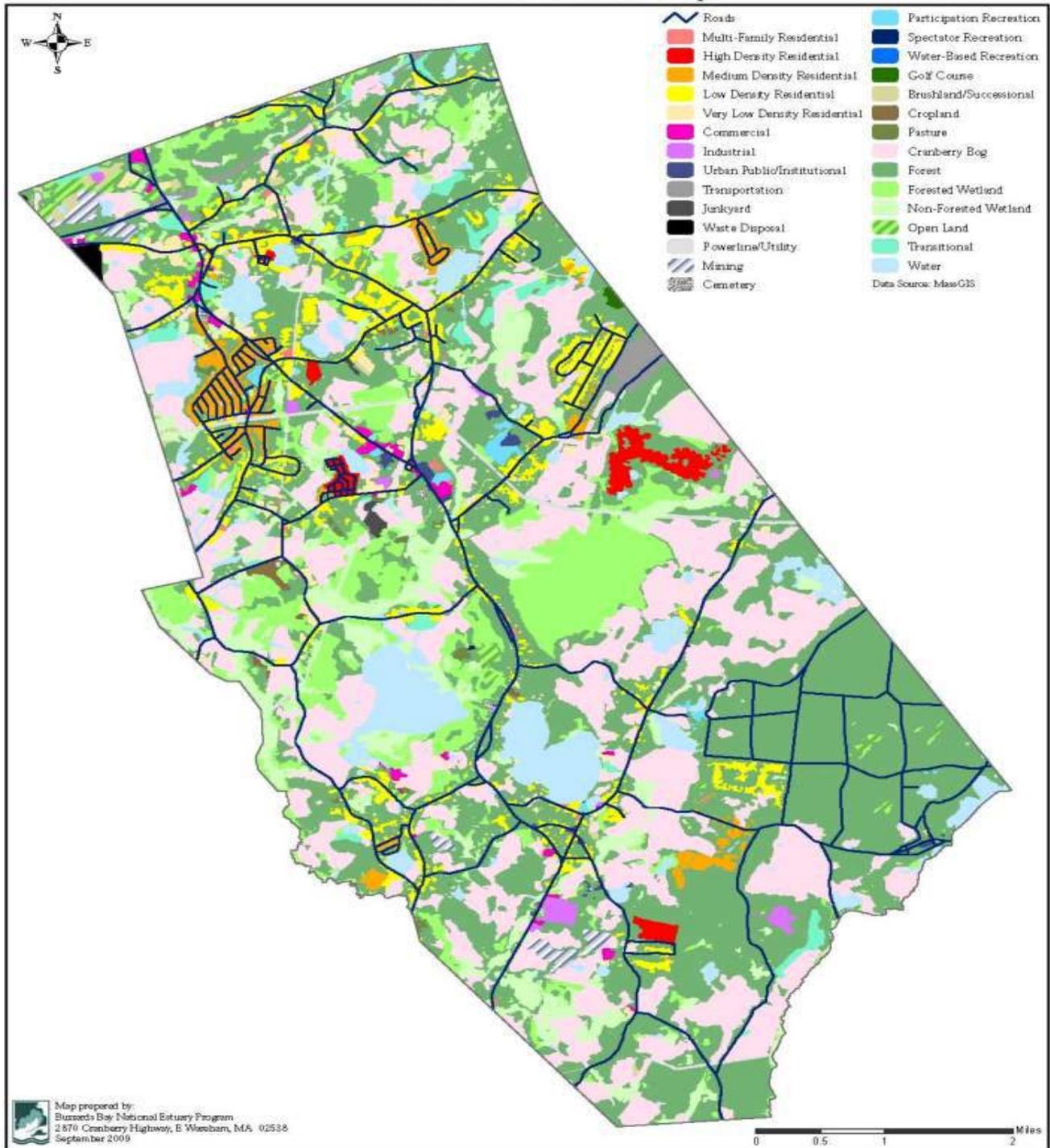


Figure 6-2: Carver Land Use
 (Source: Town of Carver 2010-2015 Open Space and Recreation Plan, p. 32,
 GIS provided by MassGIS. Mapping provided by the Buzzards Bay
 National Estuary Program.)

Map 3: Zoning

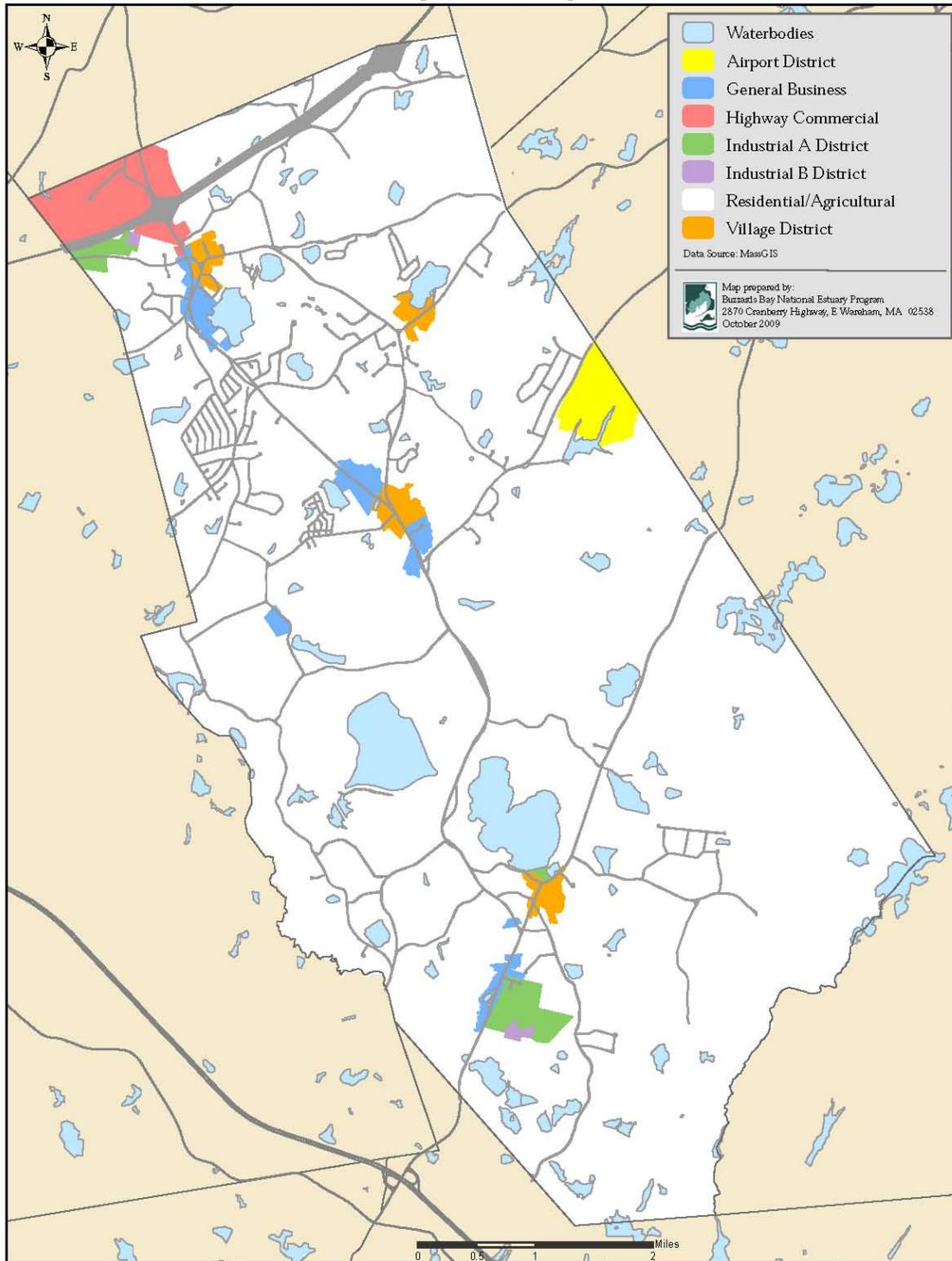


Figure 6-4: Carver Zoning

(Source: Town of Carver 2010-2015 Open Space and Recreation Plan, p. 24, GIS provided by MassGIS. Mapping provided by the Buzzards Bay National Estuary Program.)

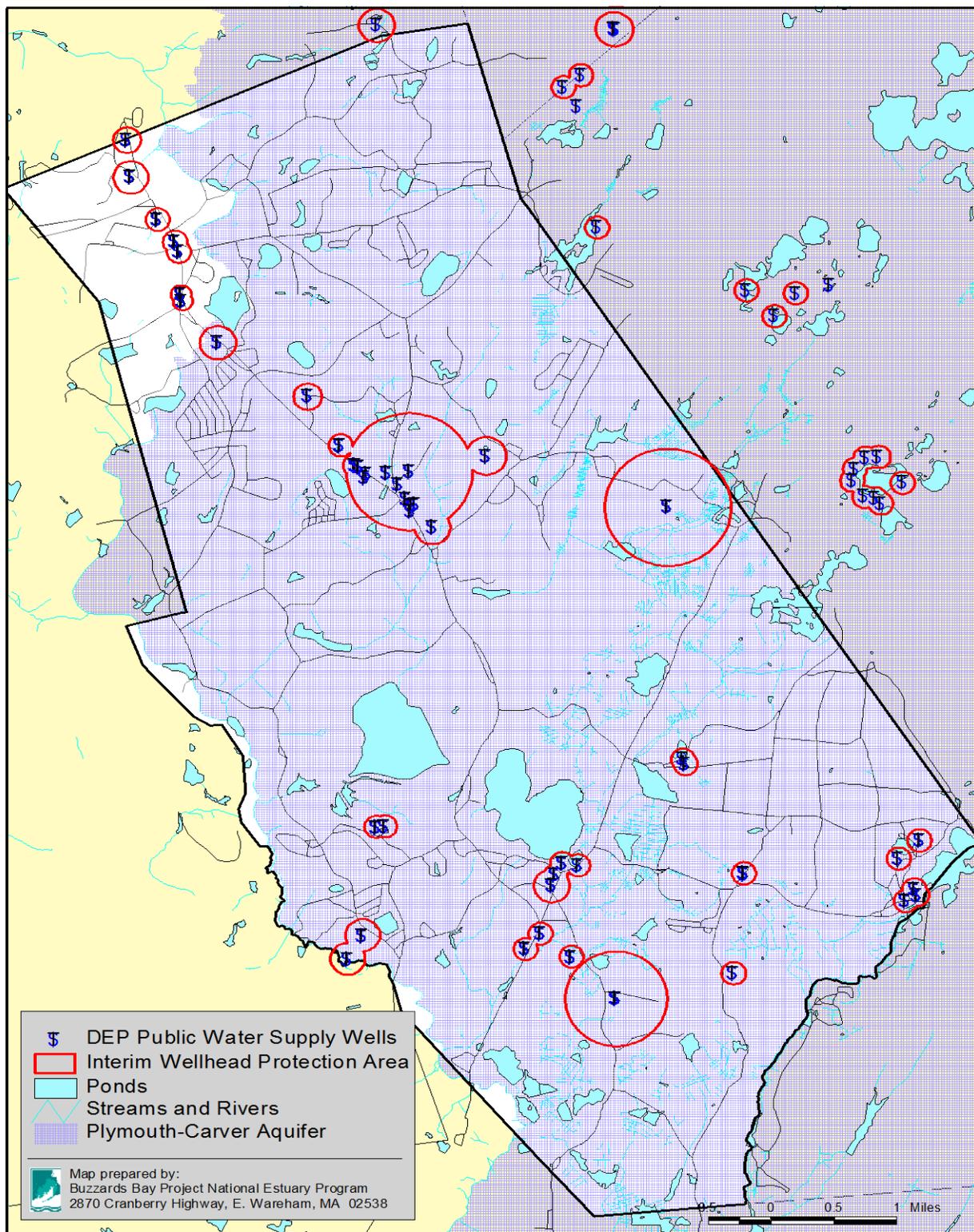


Figure 6-5: Plymouth/Carver Sole Source Aquifer
 (Source: Town of Carver 2010-2015 Open Space and Recreation Plan, p. 49,
 GIS provided by MassGIS. Mapping provided by the Buzzards Bay National
 Estuary Program)

General Soils Map

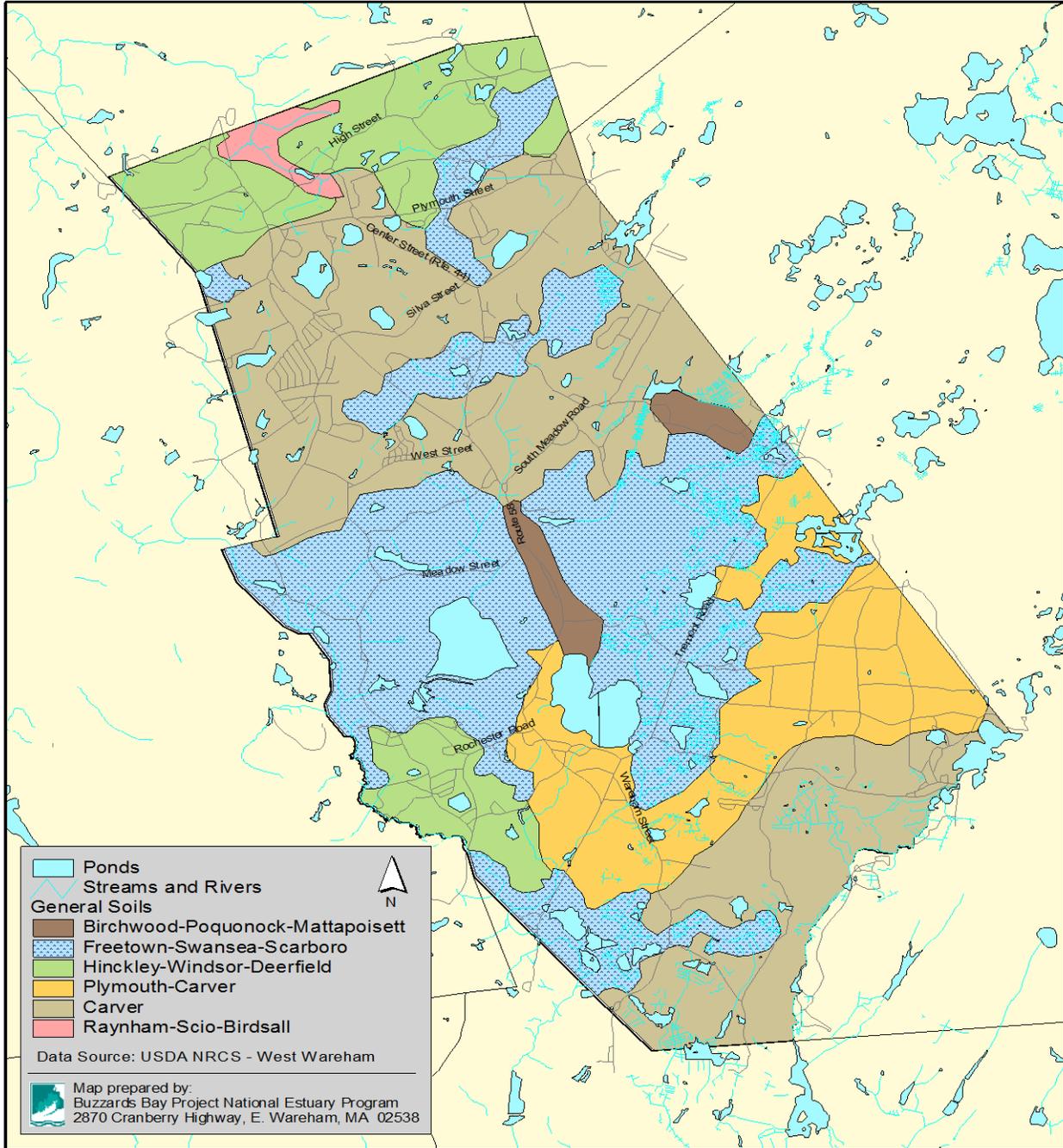
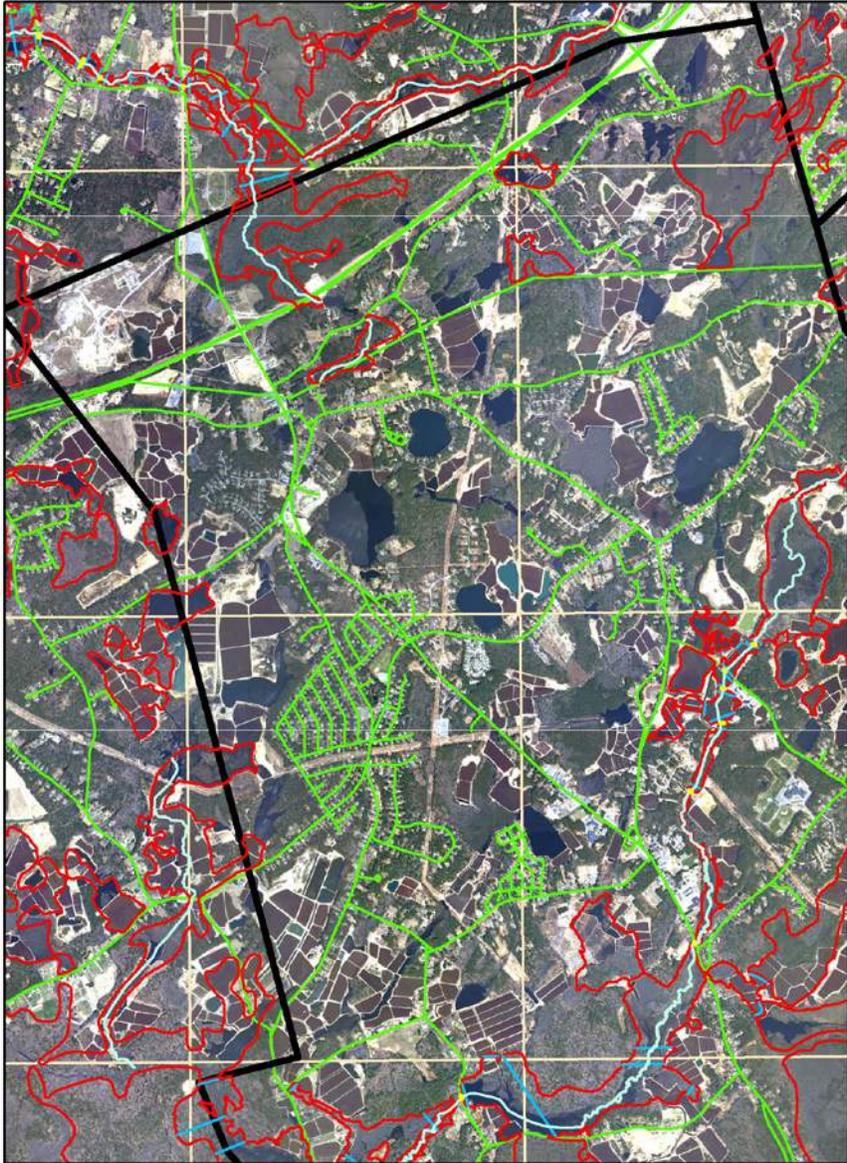


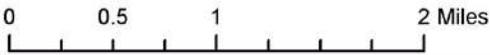
Figure 6-6: Carver Soil Types
 (Source: Town of Carver 2010-2015 Open Space and Recreation Plan, p. 40,
 GIS provided by MassGIS. Mapping provided by the
 Buzzards Bay National Estuary Program.)

Flood Zones North Carver 2013

Prepared by the Carver Conservation Commission 2013



(Data Source: Federal Emergency Management Agency, Effective Date July 17, 2012. See <http://msc.fema.gov>, Plymouth County, All Jurisdictions, 25023C FIRM)

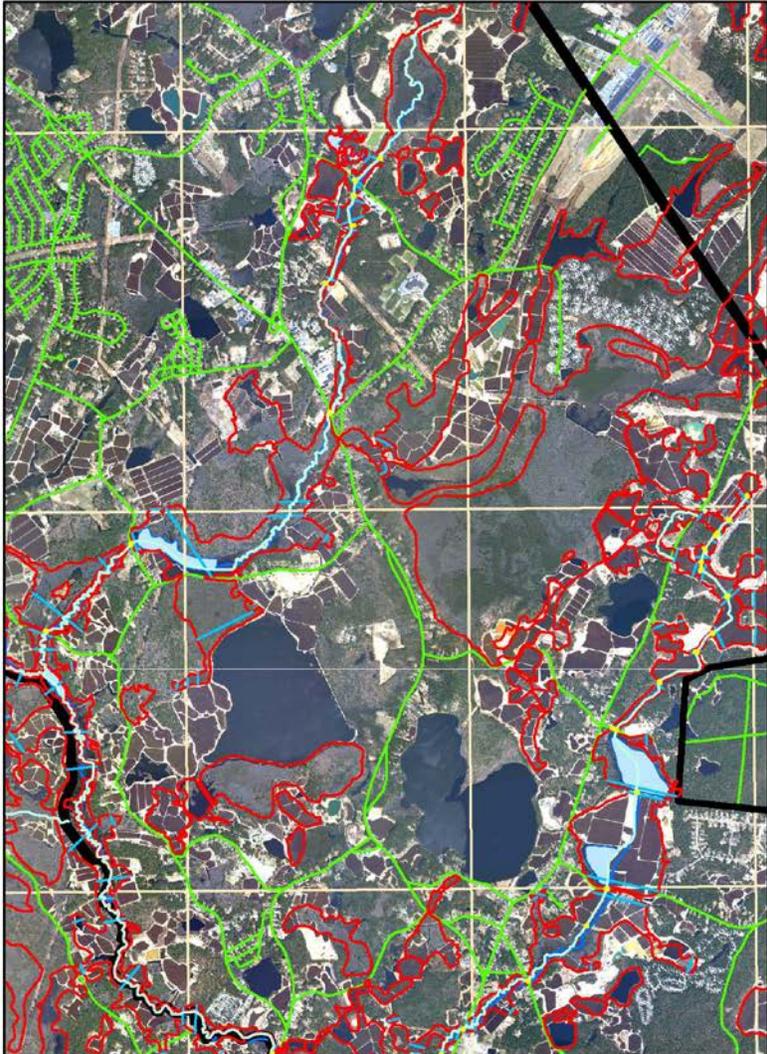


Legend	
Flood Control Structures	Boundaries of Flood Insurance Risk Zones
Hydrography Features	Town of Carver Boundary
Base Flood Elevations	Transportation Features
	Flood Insurance Rate Map Paneling Scheme

Figure 7-A

Flood Zones Center Carver 2013

Prepared by the Carver Conservation Commission 2013



(Data Source: Federal Emergency Management Agency, Effective Date July 17, 2012. See <http://msc.fema.gov>, Plymouth County, All Jurisdictions, 25023C FIRM)

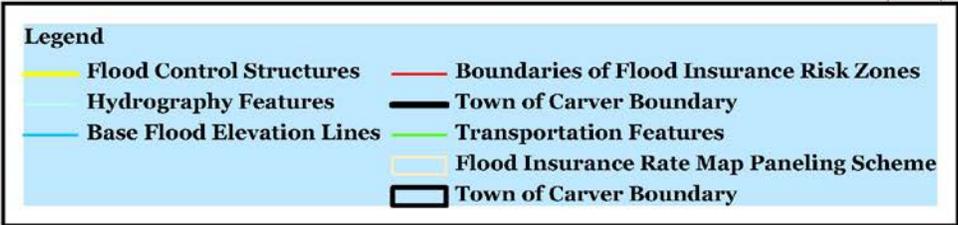
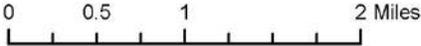
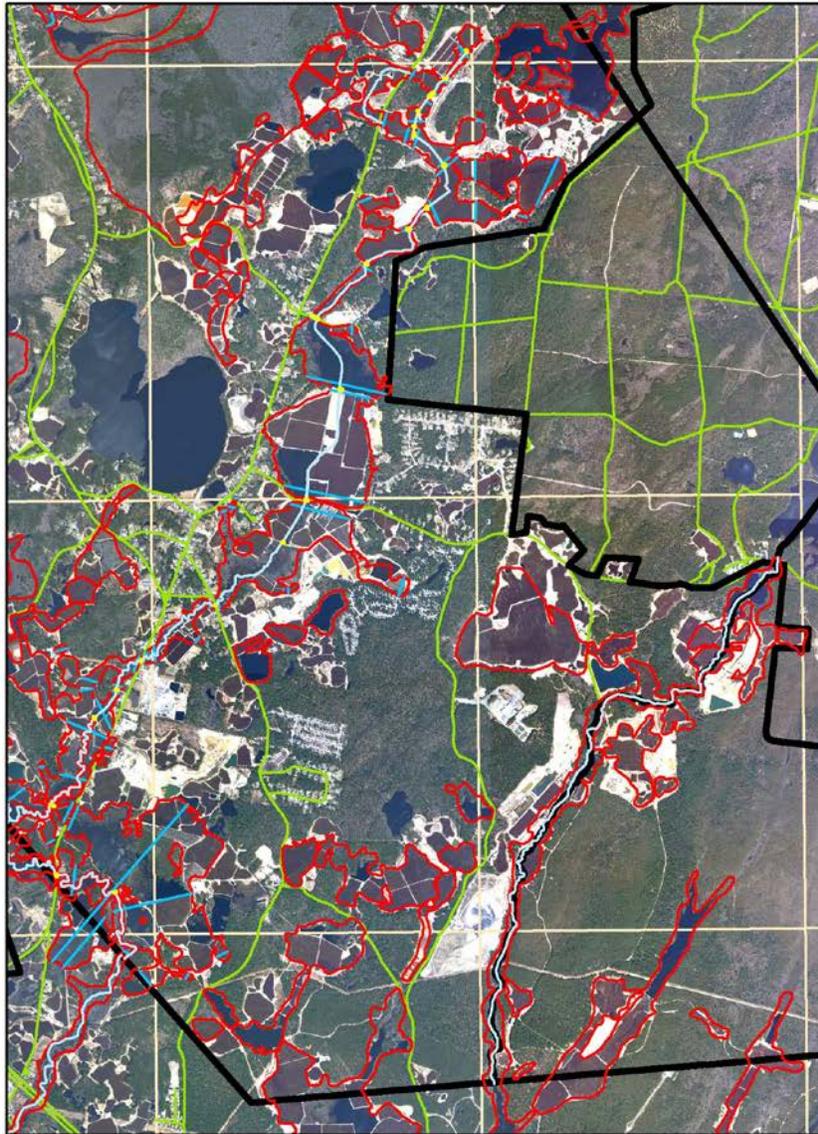


Figure 7-B

Flood Zones South Carver 2013

Prepared by the Carver Conservation Commission 2013



(Data Source: Federal Emergency Management Agency, Effective Date July 17, 2012. See <http://msc.fema.gov>, Plymouth County, All Jurisdictions, 25023C FIRM)



Legend

- | | |
|--|---|
| Flood Control Structures | Town of Carver Boundary |
| Hydrography Features | Roads, Railroads, and Other Transportation Features |
| Base Flood Elevations | Flood Insurance Rate Map Paneling Scheme |
| Boundaries of Flood Insurance Risk Zones | |

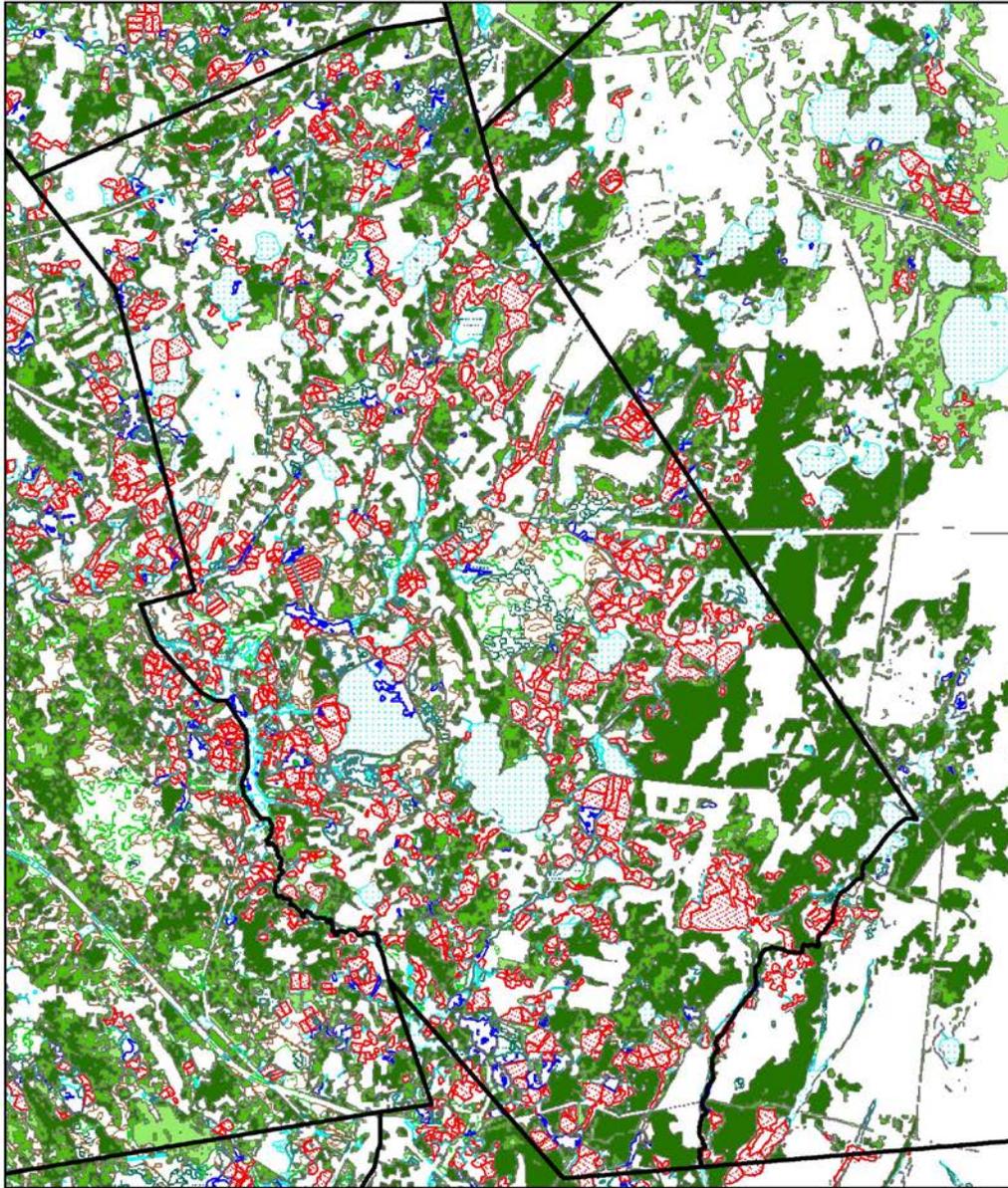
Figure 7-C

Figure 8. Carver Forest Vegetation Map

GIS provided by MassGIS. Mapping provided by the Carver Conservation Commission

Carver Forest Vegetation Map

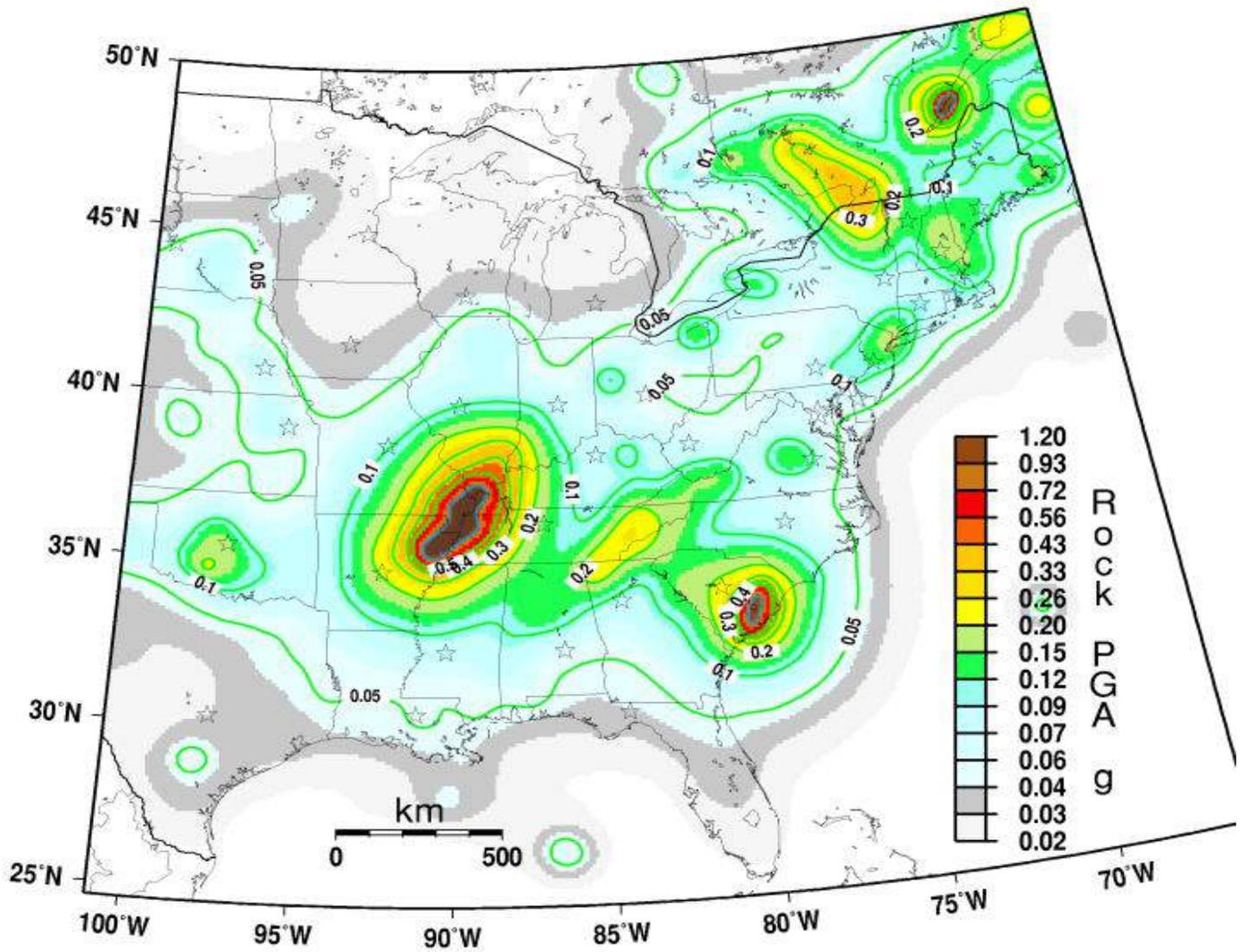
Prepared by the Carver Conservation Commission 2013



0 0.5 1 Miles



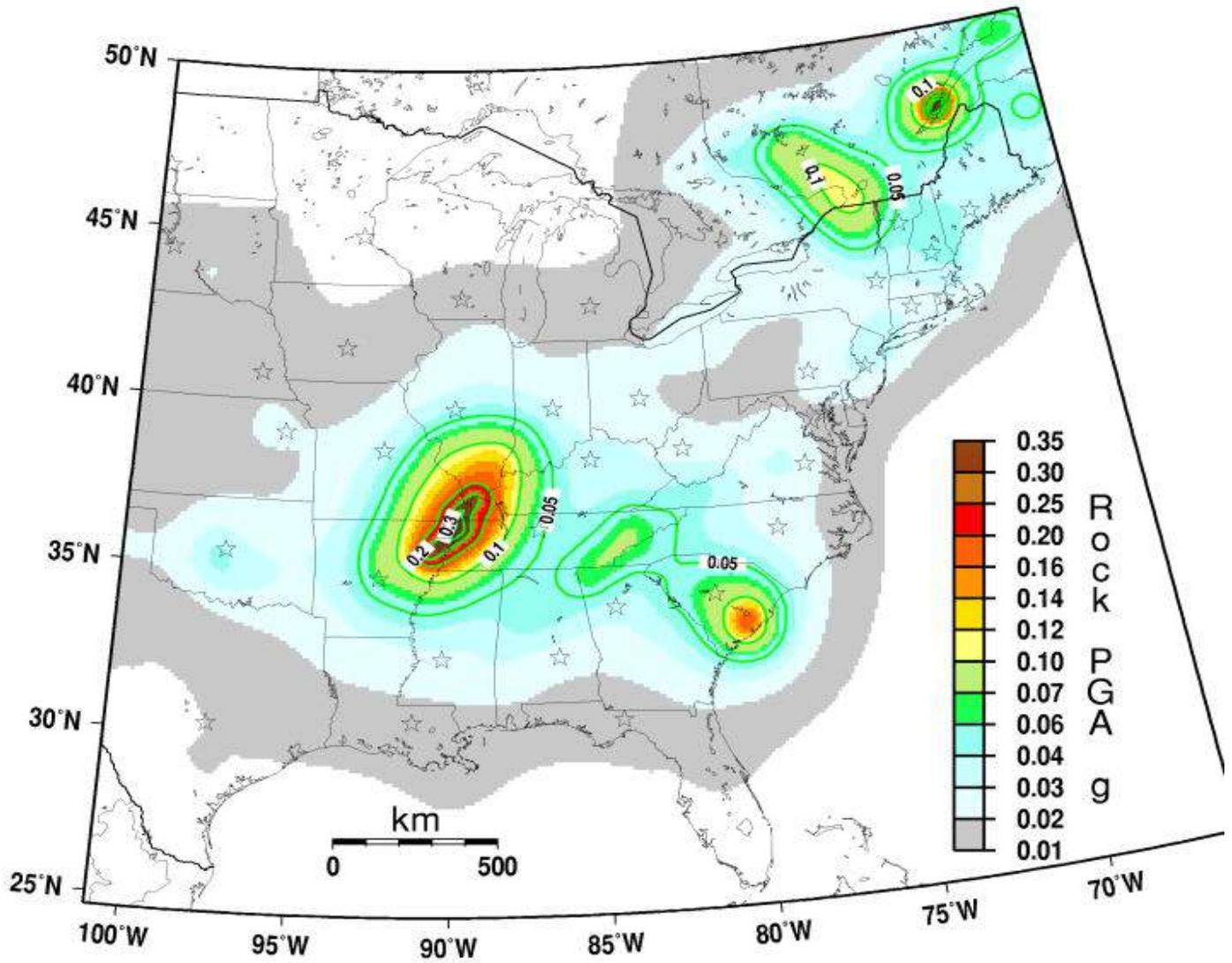
PGA with 2%/50 yr PE, 2008



GMT Apr 11 15:37 PGA 2%/50yr PE. BC rock site condition

Figure 9: 2% Peak Ground Acceleration (PGA) Zone, Eastern US. Source: USGS.

CEUS PGA 10%/50 years, 2008



GMT May 2 10:59 PGA 10%50yr PE using half-wt on NMSZ cluster models. Stars: state capitals.

Figure 10: 10% Peak Ground Acceleration (PGA) Zone, Eastern US: Source: USGS.

Appendix A: 2012 Flood Plain Bylaw and Bylaw Certification



Cranberry Land USA

Carver Conservation Commission

Town Hall, 108 Main Street
Carver MA 02330

Telephone: 508-866-3482
Fax: 508-866-3430

13 June 2012

Colleen Bailey, CFM
Flood Hazard Mapping Coordinator
MA DCR Flood Hazard Management Program
251 Causeway Street, Suite 800
Boston, MA 02114-2119

Dear Ms. Bailey:

Enclosed, please find an original certification from the Carver Town Clerk of the Carver Town Meeting adoption of our Floodplain Bylaw on May 19, 2009 and an original certification from the Carver Town Clerk of the Carver Town Meeting adoption of amendments to the same Floodplain Bylaw, as proposed by your office, on June 4, 2012. Both certifications contain the raised seal of the Carver Town Clerk's office.

Please let us know as soon as possible when we are approved by your office prior to the July 17, 2012 deadline. If you need additional information, please do not hesitate to contact me as soon as possible.

Sincerely yours,

Sarah G. Hewins, Ph. D., Agent
Carver Conservation Commission
108 Main Street
Carver, MA 02330
(T) 508.866.3482
(F) 508.866.3430
(E) sarah.hewins@carverma.org

Cc: Richard J. LaFond, Town Administrator
Thomas Walsh, Director, Emergency Operations Center
Michael Mendoza, Building Commissioner
Jack Hunter, Town Planner
Jim Nauen, Chair, Conservation Commission



Cranberry Land U.S.A

Town Clerk

Jean F. McGillicuddy, CMC/CMMC
Notary Public

108 Main Street
Carver, Massachusetts 02330
Tel: 508-866-3403 • Fax: 508-866-3408

June 11, 2012

TO WHOM IT MAY CONCERN:

THIS IS TO CERTIFY that at the Special Town Meeting of the Inhabitants of the Town of Carver was held on Monday, June 4, 2012 at the Carver High School Auditorium at 7:00 P.M., pursuant to a Warrant of the Board of Selectmen dated May 17, 2012. The meeting was called to order by the Moderator, Robert E. Bentley, there being a quorum 75 present. The total registered voters at this time were 300. The following Article was voted on:

Article 7. Upon motion duly made and seconded and motion made by Jack Hunter, Town Planner, it was Unanimously Voted for the Town to amend Article III, Sections 3700 through 3793 of the Town of Carver Zoning By-Laws, "Floodplain District," by deleting Sections 3731; 3732; 3733; 3741; 3776; and 3782 in their entirety and inserting the following new sections 3731; 3732; 3741; 3776; and 3782.

3731. The Floodplain District is herein established as an overlay district. The District includes all special flood hazard areas within the Town of Carver designated as Zone A or AE on the Plymouth County Flood Insurance Rate Map (FIRM) issued by the Federal Emergency Management Agency (FEMA) for the administration of the National Flood Insurance Program. The map panels of the Plymouth County FIRM that are wholly or partially within the Town of Carver are panel numbers 25023C0333J, 25023C0334J, 25023C0337J, 25023C0339J, 25023C0341J, 25023C0342J, 25023C0343J, 25023C0344J, 25023C0361J, 25023C0363J, 25023C0364J, 25023C0456J, 25023C0457J, 25023C0458J, 25023C0459J, 25023C0467J, 25023C0476J, 25023C0477J, 25023C0478J, 25023C0479J, 25023C0485J, 25023C0486J, and 25023C0487J dated July 17, 2012. The exact boundaries of the District are defined by the 100-year base flood elevations shown on the FIRM and further defined by the Plymouth County Flood Insurance Study (FIS) report dated July 17, 2012.

3732. The FIRM and FIS report are incorporated herein by reference and are on file with the Board of Assessors and Town Clerk.

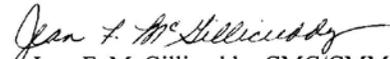
3741. Floodway Data: In Zones A and AE, along watercourses that have not had a regulatory floodway designated, the best available Federal, State, local, or other floodway data shall be used to prohibit encroachments in floodways which would result in any increase in flood levels within the community during the occurrence of the base flood discharge.

3776. In Zone AE, along watercourses within the Town of Carver that have a regulatory floodway designated on the Plymouth County FIRM encroachments are prohibited in the regulatory floodway which would result in any increase in flood levels within the community during the occurrence of the base flood discharge.

3782. MGL Chapter 131 Section 40; 310 CMR 10.00 (Wetlands Protection Regulations); and 310 CMR 13.00 (Inland Wetlands Restrictions).

The attached bylaw was voted on and passed at town meeting and is awaiting the Attorney General's approval.

IN TESTIMONY WHEREOF I have hereunto set my hand and the official seal of the Town of Carver on this 11th day of June 2012.


Jean F. McGillicuddy, CMC/CMMC
Town Clerk



From: sarah.hewins@carverma.org
Sent: Thursday, June 21, 2012 1:54 PM
To: 'Bailey, A.Colleen (DCR)'
Cc: 'Richard LaFond'; 'Dan Fortier'; 'DPH-OEMS-TWalsh'; 'michael.mendoza@carverma.org'; 'Jack Hunter'; jim nauen
Subject: RE: abbreviations key

Thanks, Colleen.

That would be great if you could sign the certified card and return it in the mail. One never knows if it will be needed at some later point.

Great news. Thanks again,
Sarah

Sarah G. Hewins, Ph. D., Agent
Carver Conservation Commission
108 Main Street
Carver, MA 02330
(T) 508.866.3482
(F) 508.866.3430
(E) sarah.hewins@carverma.org

From: Bailey, A.Colleen (DCR) [<mailto:a.colleen.bailey@state.ma.us>]
Sent: Thursday, June 21, 2012 9:31 AM
To: 'sarah.hewins@carverma.org'
Cc: 'Richard LaFond'; 'Dan Fortier'; DPH-OEMS-TWalsh; michael.mendoza@carverma.org; 'Jack Hunter'
Subject: RE: abbreviatons key

I just wanted to let you know, we received your certified bylaws- it looks great and I'm entering Carver into FEMA's system today for approval on their end.

I wanted to let you know this because the certified mail card was still on the outside of the envelope! I didn't sign for it (I wasn't here when we received it) and I guess no one else did, so they left it anyway without a signature? So, just a FYI, you probably won't be getting that back, unless you want me to sign it and put it in the outgoing mail? I can do that if you want!

Thanks!
Colleen

Colleen Bailey, CFM
Flood Hazard Mapping Coordinator
MA DCR Flood Hazard Management Program
251 Causeway Street, Suite 800
Boston, MA 02114-2119
(617) 626-1446
A.Colleen.Bailey@state.ma.us

Appendix B: Example of New Mobile Home Building Code Requirements 2013

Date 8/12/2013

Permit # 2013-266

TOWN OF CARVER

Department of Inspectional Services

BUILDING PERMIT

This certifies that **John Fellini** holding CS Lic. # **100366** has permission to build **28'x56' mobile home, 12'x16' porch, 10'x12'shed** located at **43-4 South Meadow Village** provided that the person accepting this permit shall, in every respect, conform to the terms of the application on file in the building department and ordinances relating to the zoning, construction, alteration, and maintenance and occupancy of building in the Town Of Carver, and this permit shall be good six months from the date of issuance and prosecute the work thereon to a speedy completion. Any violation of any of the terms above noted shall result in immediate revocation of this permit.

This permit is granted subject to firm compliance with all federal and state laws, regulations and directives and is NOT TRANSFERABLE.

Building Department Approval *John D. Fellini*

THIS CARD MUST BE DISPLAYED IN A CONSPICUOUS PLACE ON THE PREMISE AND MUST BE RETURNED TO OFFICE WITH REQUIRED SIGNATURES TO OBTAIN CERTIFICATE OF OCCUPANCY

Work Shall not proceed until the inspector has approved the various stages of construction.

July 23, 2013

Steven Fishman
Capeway Aluminum
188 Court Street
Brockton, Ma 02302

STRUCTURAL ASSESSMENT

Subject: 26' x 12' carport with 16' x 12' sunroom on existing
Slab-on-Grade poured to specifications noted below:

Building Location: So. Meadow Village (cluster 43-4) – Carver, Ma

References: 1.) BOCA research report 94-68
2.) National Evaluation Report No. NER-619
3.) Fax from S. Fishman to A. Ketin

1. SLAB-ON-GRADE

Based on the review of the MSBC, extensive research on the subject of Slab-on-Grade foundations, technical evaluation and calculation and the present condition of the existing slab-on-grade I have concluded that the existing 8" thick slab is structurally adequate to safely carry the loads that will be imposed on it by the aluminum enclosure.

The basis for this assessment lies in the following facts:

- a.) There are no significant cracks, no bulging or differential deformations in the existing slab which was built as follows:
 - 1.) Virgin earth below with 12" compacted gravel to grade.
 - 2.) Slab is 6" thick continuously poured with welded wire mesh.This indicates that there was no frost heave under the slab in the past. This condition is most likely due to the fact that the soil under the sub-grade is non-frost susceptible.

- b.) There is no sign of water or dampness that has been observed in the slab. This indicates that water table is most likely more than 4' to 6' below grade.



D. Ketin

c.) There is a 12" layer of gravel under the concrete slab. Below this sub-grade there lies a uniform soil stratum. In order to frost heave can occur all of the following conditions must be present:

- 1.) A frost susceptible soil.
- 2.) Freezing temperatures penetrating the sub-grade and
- 3.) A supply of water.

The evidence shows that all of the three conditions do not prevail under the slab in question. Hence the requirement of MSBC section 3604.3.1 that the footing shall extend 4' below grade in order to prevent frost damage can be waived.

2.) THE ALUMINUM STRUCTURE

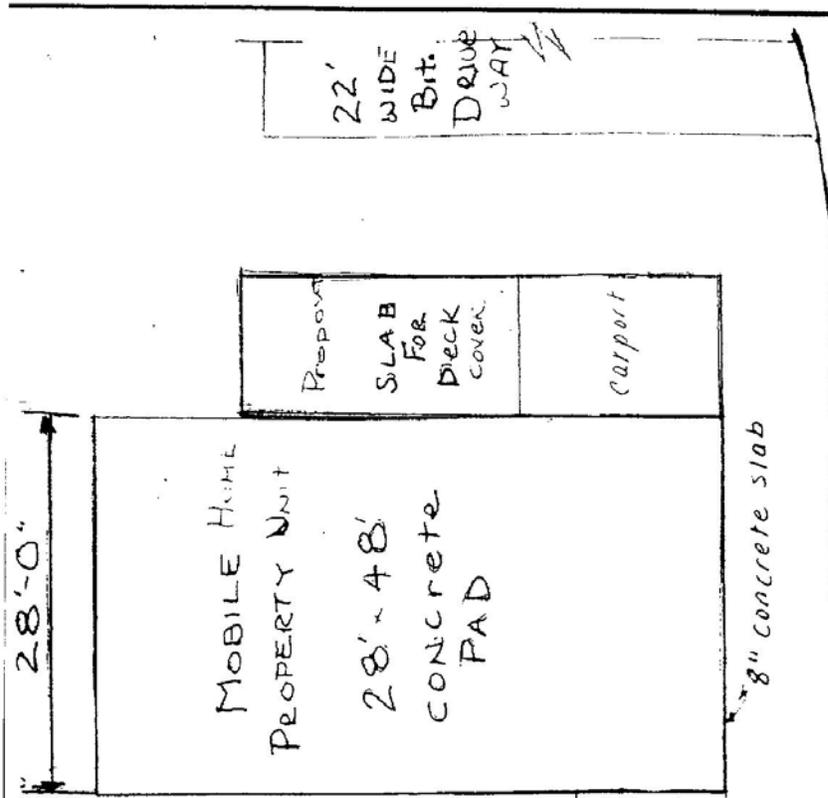
a.) The aluminum structure to be supported by the existing slab-on-grade shall be constructed per manufacturer's specifications and installation guidelines. The BOCA Research Report N. 94-68 provides allowable spans and design loads for the structural components of the enclosure building. Based on the data given in Table 5 of the report 3" thick Simple-Span Polystyrene Panels with 2" x 3" H-stiffeners shall be used, as needed per manufacturer's specifications.

If you have any questions about the above report please feel free to contact Steven Fishman at Capeway Aluminum & Vinyl, Inc. at (508) 588-3499.

Alan D. Ketin P.E.



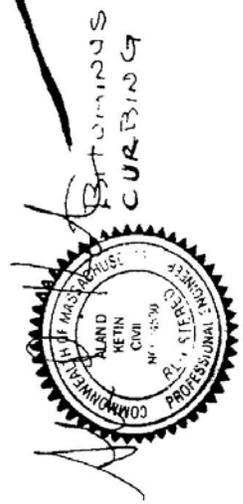
D. Ketin



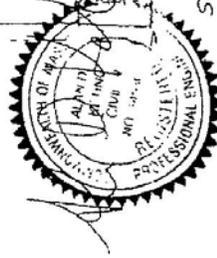
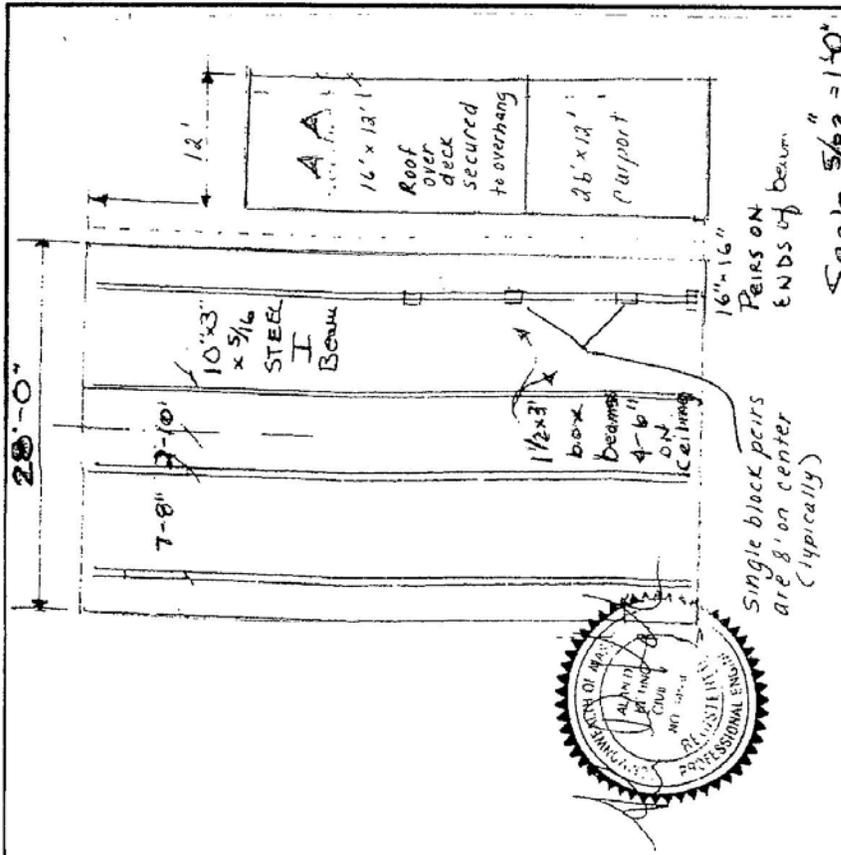
- 1.) 12" Compactor gravel under slab.
- 2.) Slab minimum 8" thick (all areas).
- 3.) Site sewer & water in site up out of ground ready for hook-up

20'
between homes

Scale 5/32" = 1'-0"



John Fellini	
43-4 So. meadow Lane - Carver MA 02330	
Date: July 22, 2013	Drawing Number:
	Drawn By: Steve
Concrete Slab + Site Layout	
Capeway Aluminum & Vinyl, Inc.	
188 Court Street - Brockton, Ma 02302	



John Fellini

43-4 So. meadow Village-Carver MA 02330

Drawing Number:

Steve

Date: July 22, 2013

Drawn By:

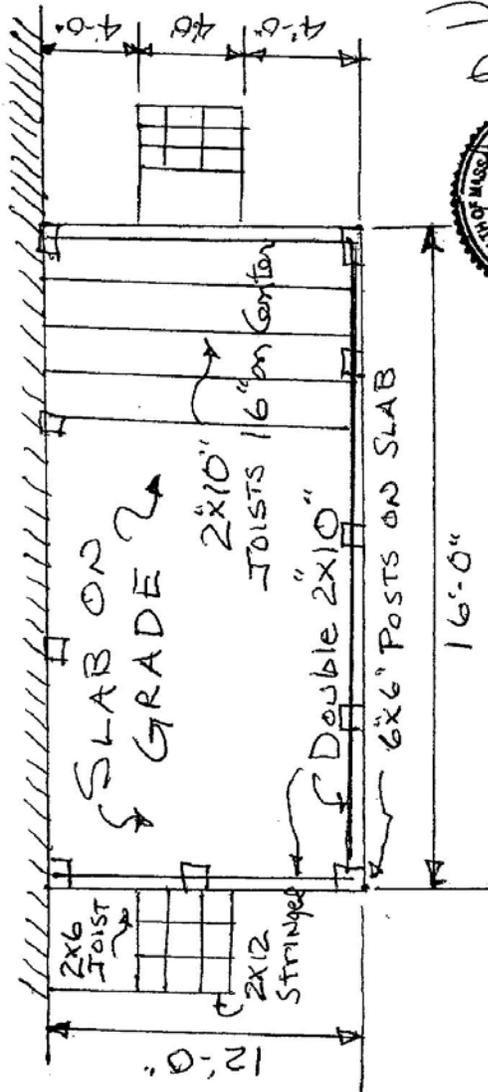
Beam + Block Layout
(per manufacture specifications)

Capeway Aluminum & Vinyl, Inc.

188 Court Street - Brockton, Ma 02302

- 1.) (4) 10" x 3" x 5/16 I-beams supports and are used for a 28' wide mobile home.
- 2.) Structural floor is secured to beams made out of 2x8 framing members and 3/4 decking.
- 3.) Floor has a perimeter of 2x8 configured into a box/platform deck.
- 4.) Beams are supported on slab with a 16" x 16" block pier to slab with a 2 x 8 x 16" piece of wood so steel doesn't contact concrete blocks.
- 5.) 1 1/2" x 3" box beams act as perkins to connect steel beams 4'-6" on center.
- 6.) Ends of beam are 12" from end of home.
- 7.) Beams are 32" from outside walls & floor is cantilever out over them.

New Mobile Home



Notes:

- 1.) All lumber to be pressure treated.
- 2.) See structural assessment for slab-on-grade
- 3.) Carport to be supported separately with footings.

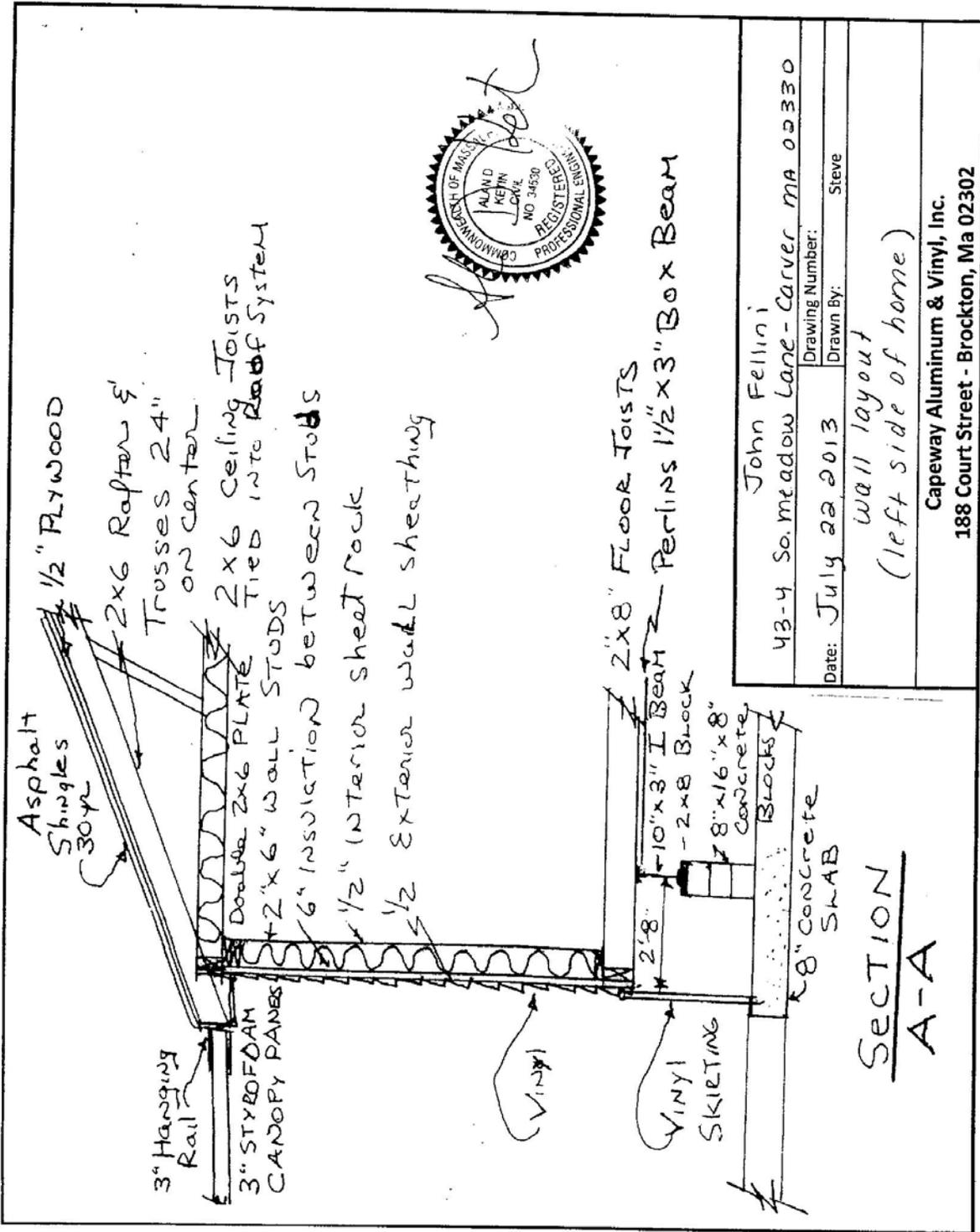
John Fellini

43-4 So. meadow Lane - Carver, MA 02330

Date: July 22, 2013
 Drawing Number: Steve
 Drawn By: Steve

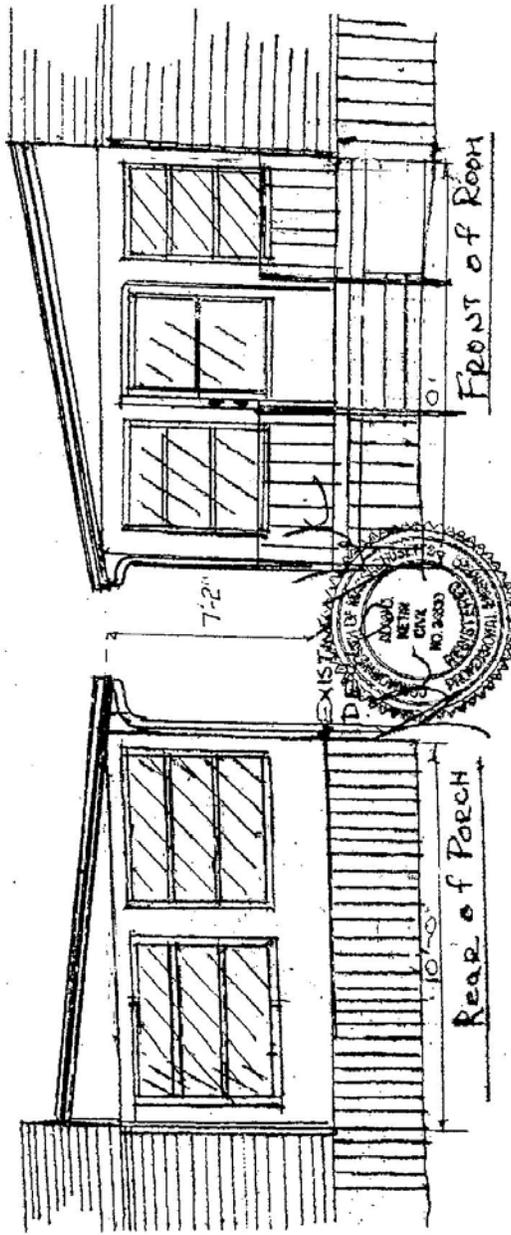
Deck
 Structural Drawing

Capeway Aluminum & Vinyl, Inc.
 188 Court Street - Brockton, Ma 02302



John Felli 43-4 So. meadow lane - Carver MA 02330	
Date: July 22 2013	Drawing Number:
Drawn By: Steve	
wall layout (left side of home)	
Capeway Aluminum & Vinyl, Inc. 188 Court Street - Brockton, Ma 02302	

SECTION
A-A

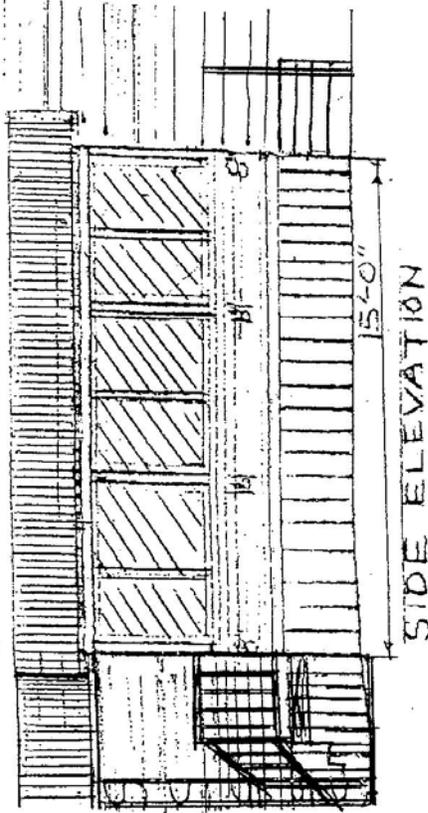


Front of Room

Rear of Porch

Note: The new wall structure is structurally adequate to support the roof provided it is built per "Betterview Patio Room" specifications provided by the manufacture (see attached).

John Fellini	
43-4 So. Meadow Lane - Carver, MA 02336	
Date: July 22, 2013	Drawing Number:
	Drawn By: Steve
Front + Back Views	
Capeway Aluminum & Vinyl, Inc.	
188 Court Street - Brockton, Ma 02302	



D. K. T.



John Fellini	
43-4 So. Meadow Lane - Carver, MA 02330	
Date: July 22, 2013	Drawing Number:
	Drawn By: Steve
Side Elevation	
Capeway Aluminum & Vinyl, Inc.	
188 Court Street - Brockton, Ma 02302	

NOTES FOR POLYSTYRENE PANEL LOAD TESTS

- 1
 - a) • = Allowable loads for panel spans of 8', 10', 12', 14', 16' and 18', based upon ASTM E-72-80 test results.
 - b) • = Allowable loads for panel spans of 9', 11', 13', 15' and 17', based upon interpolation of ASTM E-72-80 test results.
 - c) 3" EPS = 3" thick Expanded Polystyrene
 - d) H = One Thermally-broken H-stiffener per 36" of panel (one "H" @36")
 - e) 2H = Two Thermally-broken H-stiffener per 36" of panel (one "H" @18")
 - f) SKY = Skylight
 - g) CONFIG. = Configuration

- 2
 - a) Physical properties are based on published data or manufacturer specifications.
 - b) Fire testing performed by an independent testing facility.
 - c) COEF. TH. EXP. = Published coefficient of thermal expansion (IN/(IN-F°)).
 - d) R-FACTOR = Published thermal resistance (SQ.FT.-HR-°F/BTU)
 - e) FT = Feet
 - f) IN = Inch
 - g) PSI = Pounds per square inch
 - h) PSF = Pounds per square foot
 - i) PCF = Pounds per cubic foot
 - j) ULT. = Ultimate
 - k) AL = Aluminum
 - l) HC = Honeycomb
 - m) L = Longitudinal
 - n) T = Transverse

- 3
 - a) Test results are based on ASTM E-72-80 procedures using a uniform load.
 - b) Tests were performed by an independent testing laboratory.
 - c) Where H-stiffeners were used, they were fastened to the panel using silicone sealant.

- 4
 - a) Test results are based on ASTM E-72-80 procedures using a concentrated load.
 - b) Test were performed by an independent testing laboratory.



CONFORMANCE SPECIFICATIONS

GENERAL — CONSTRUCTION DETAILS AND CONFORMANCE SPECIFICATIONS THAT RECEIVED APPROVAL #73102 OF THE SOUTHERN BUILDING CODE CONGRESS INTERNATIONAL, INC., 3617 EIGHTH AVENUE, SOUTH, BIRMINGHAM, ALABAMA AND #68-6 OF THE BUILDING OFFICIALS CONFERENCE OF AMERICA, INC., 1313 EAST 80TH STREET, CHICAGO, ILLINOIS

PHYSICAL PROPERTIES OF HONEYCOMB PANELING AND ATTACHING EXTRUSIONS —
 FACING — A.S.T.M. 3003 H 18 ALUMINUM ALLOY TENSILE 28,000 P.S.I., YIELD STRENGTH 24,000 P.S.I., ELONGATION 1 TO 4%
 CORE — 99 LB. KRAFT PAPER, 3/4" CELL SIZE, 11% RESIN IMPREGNATION, DENSITY 1.86 LBS/CU FT. CRUSHING STRENGTH 85 P.S.I., STRONG PLANE SHEAR 42 P.S.I., WEAK PLANE SHEAR 23 P.S.I.
 FACING AND CORE ADHESIVE — A CONTACT ADHESIVE COMPOSED OF SYNTHETIC RUBBER RESINS AND SOLVENTS THAT MEETS THE DURABILITY AND STRENGTH CRITERIA OF A.S.T.M. D-1037.
 ATTACHING EXTRUSIONS — A.S.T.M. 6063 T-5 ALUMINUM ALLOY TENSILE 22,000 P.S.I., YIELD STRENGTH 16,000 P.S.I., ELONGATION 8%.

TRANSVERSE LOAD (ROOF LOADING DATA) TEST TO A.S.T.M. E 72-61 ON 3" THICK PANELS, UNIFORMLY DISTRIBUTED LOADING. TEST TO A.S.T.M. C-273 ON 1-3/4" THICK PANELS. SHEAR TEST IN FLATWIDE PLANE OF SANDWICH CORE SHOWS:
 B.O.C.A.'S RECOMMENDATION OF ALLOWABLE ROOF LOAD LBS/SQ.FT. 74.3 60.4 50.2 42.3 36.2 30.8
 *FOUNDED ON THE ULTIMATE ROOF LOAD WITH A FACTOR OF SAFETY OF 2 OR A ROLLING SHEAR STRESS ON THE ADHESIVE WITH A FACTOR OF SAFETY OF 2.5 WHICHEVER IS LESS.

ROOF SPAN	FEET	9	10	11	12	13	14
ULTIMATE ROOF LOAD (A.S.T.M. E72-61)	LBS/SQ.FT.	187.5	151.7	125.0	105.0	89.6	77.3
ROLLING SHEAR AT ULTIMATE ROOF LOAD (CALCULATED VA/18)	P.S.I.	23.7	21.3	19.3	17.7	16.3	15.2
DEFLECTION AT ALLOWABLE ROOF LOAD	INCHES	1.0	1.2	1.5	1.7	2.0	2.3
ADHESIVE ULTIMATE SHEAR STRESS (A.S.T.M. C-273)	P.S.I.	20.1	20.1	20.1	20.1	20.1	20.1
ALLOWABLE ROOF LOAD*	LBS/SQ.FT.	88.0	71.5	62.5	52.5	44.8	38.7
S.B.C.C.'S RECOMMENDATION OF ALLOWABLE ROOF LOAD	LBS/SQ.FT.	67.0	60.4	55.0	48.7	41.5	35.7
B.O.C.A.'S RECOMMENDATION OF ALLOWABLE ROOF LOAD	LBS/SQ.FT.	74.3	60.4	50.2	42.3	36.2	30.8

*FOUNDED ON THE ULTIMATE ROOF LOAD WITH A FACTOR OF SAFETY OF 2 OR A ROLLING SHEAR STRESS ON THE ADHESIVE WITH A FACTOR OF SAFETY OF 2.5 WHICHEVER IS LESS.

AXIAL COMPRESSIVE LOAD (WALL LOADING DATA) TEST TO A.S.T.M. E72-61 ON 1-3/4" THICK 3' x 8' PANEL AND A SPECIAL TEST ON AN 8 FOOT FRONT WALL SECTION INCLUDING A DOUBLE WINDOW CONSTRUCTION SHOWS:
 ULTIMATE WALL AXIAL LOAD (A.S.T.M. 72-61) 3998 LBS/LINEAL FEET OF PANEL WIDTH

FRONT WALL SECTION AXIAL LOAD (SPECIAL TEST)	IN EXCESS OF 720 LBS/LINEAL FT. WITHOUT APPARENT DEFECT
S.B.C.C.'S RECOMMENDATION OF ALLOWABLE WALL LOAD	1000 LBS/LINEAL FT. OF WALL AREA INCLUDING WINDOW AREA
B.O.C.A.'S RECOMMENDATION OF ALLOWABLE WALL LOAD	1999 LBS/LINEAL FT. OF SOLID PANEL WALL - DOUBLE WINDOW WALL CONSTRUCTION CAN CARRY ALLOWABLE ROOF LOADINGS ABOVE, EASILY

WIND LOAD (WALL WIND LOADING DATA) — A SPECIAL TEST ON AN 8 FOOT FRONT WALL SECTION INCLUDING A DOUBLE WINDOW CONSTRUCTION SHOWS:

ULTIMATE WALL WIND LOAD (SPECIAL TEST)	46.6 LBS/SQ.FT. OF FRONT WALL SECTION
ALLOWABLE WALL WIND LOAD*	31.0 LBS/SQ.FT. OF FRONT WALL SECTION

*FOUNDED ON THE ULTIMATE WALL WIND LOAD WITH A FACTOR OF SAFETY OF 2 AND ALLOWING FOR 33% OVER LOAD FOR SHORT TERM LOADING. THIS ALLOWABLE WIND LOAD IS CONSERVATIVELY ABOVE THE 20 LBS/SQ.FT. REQUIRED IN BOTH THE S.B.C.C. OR B.O.C.A. BASIC CODE FOR WIND LOADING.

RACKING LOAD (FRONT WALL RACKING LOAD DATA) TEST TO A.S.T.M. E72-61 ON 1-3/4" PANELS COMPOSED OF 2 - 3' x 8' PANEL SECTIONS, AND A SPECIAL TEST OF A 3 FT. WIDE SECTION OF A 14 FT. ROOF, A 7 FT. FRONT WALL JOINED AS IT IS ASSEMBLED AND ATTACHED TO EXISTING WALL AND FLOOR CONSTRUCTION SHOWN ON THIS DRAWING:
 ULTIMATE WALL RACKING LOAD (A.S.T.M. E72-61) — 2266 LBS. IND. CLEAR POINT OF FAILURE; RATHER, PROGRESSIVE DETERIORATION AT PANEL CORNERS DUE TO INDIVIDUAL ROTATION OF PANELS WITH RESPECT TO THEIR CENTERS)

ALLOWABLE WALL RACKING LOAD (A.S.T.M. E72-61)*	254 LBS/LINEAL FT. OF SOLID ROOF TO FLOOR PANELS
ULTIMATE WALL RACKING LOAD (SPECIAL TEST)	1026 LBS.
ALLOWABLE WALL RACKING LOAD (SPECIAL TEST)*	228 LBS/LINEAL FT. OF SOLID ROOF TO FLOOR PANELS

*FOUNDED ON THE ULTIMATE WALL RACKING LOAD WITH A FACTOR OF SAFETY OF 2, AND ALLOWING 33% OVERLOAD FOR A SHORT TERM LOADING. S.B.C.C. RECOMMENDATION — A RACKING SHEAR LOAD OF 152 LBS/FT. IS PERMISSIBLE FOR EACH FULL HEIGHT OF WALL PANEL HAVING A 3 FOOT MINIMUM WIDTH.

B.O.C.A. RECOMMENDATION — THIS TEST IS REPORTED TO ENHANCE THE OVERALL PICTURE OF THE STRUCTURE AND NOT TO PROVIDE CONFORMANCE TO REQUIRED STANDARDS.

RIVET LOADS (RIVET LOAD DATA) — SPECIAL TESTS ON STRIPS OF ALUMINUM ALLOYS, .024" THICK A.S.T.M. 3003 H 18 AND .060" THICK A.S.T.M. 6063 T5 USING ONE RIVET PER SPECIMEN OF 3/16" DIA. OPEN END DOMED HEAD POP TYPE

ULTIMATE RIVET SHEAR LOAD	332 LBS.
ALLOWABLE RIVET SHEAR LOAD*	166 LBS.
ULTIMATE RIVET PULL THROUGH LOAD	268 LBS.
ALLOWABLE RIVET PULL THROUGH LOAD*	134 LBS.

*ALLOWABLE VALUES ARE FOUNDED ON THE ULTIMATE VALUE WITH A FACTOR OF SAFETY OF 2.
 S.B.C.C. AND B.O.C.A. BOTH RECOMMENDED
 ALLOWABLE SHEAR LOAD 148 LBS.
 ALLOWABLE PULL THROUGH LOAD 119 LBS.

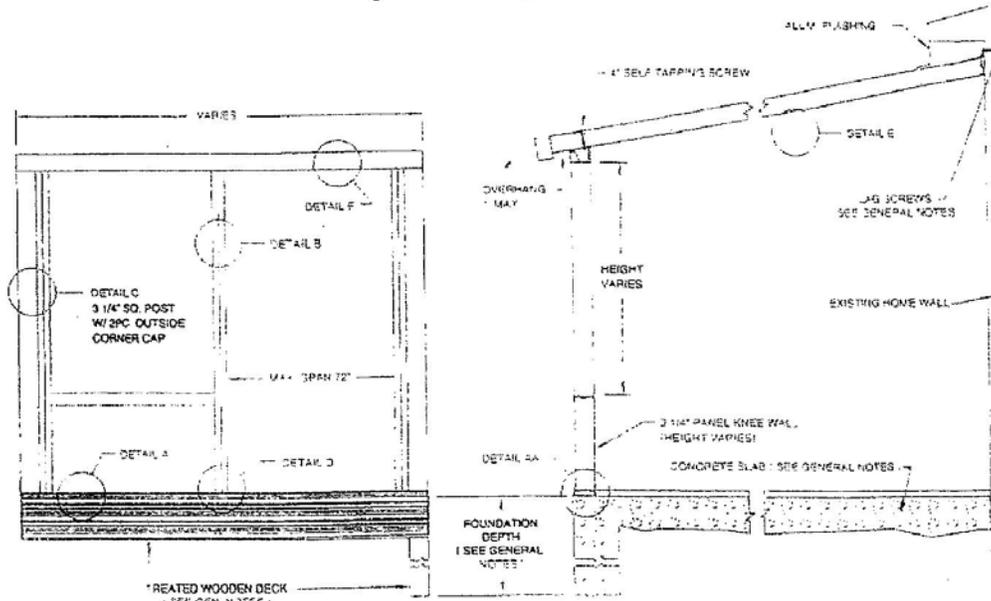


PANEL-CRAFT INSULATED ROOM ADDITION		
DATE - 1/5/69	DR BY S E G	Drawing # S11032A
SCALE - SHOWN	CHKD. BY D.S.	
B.O.C.A. RESEARCH #68-6		
S.B.C.C. RESEARCH #73102		

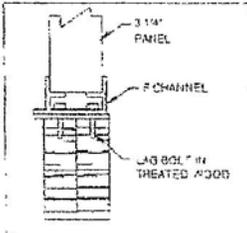


BetterView Patio Room

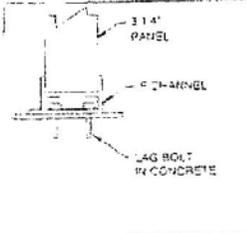
Building Code Compliance



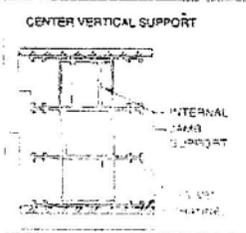
DETAIL A



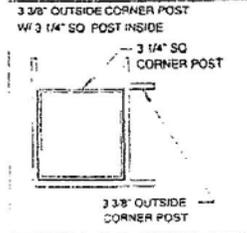
DETAIL AA



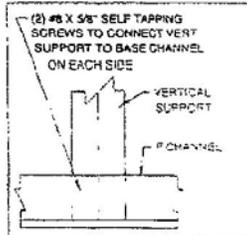
DETAIL B



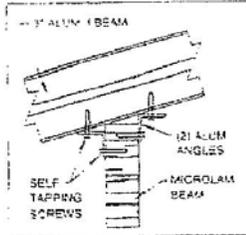
DETAIL C



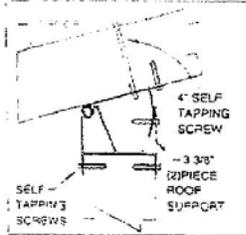
DETAIL D



DETAIL E

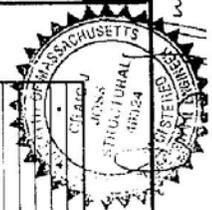


DETAIL F



ROOF SPAN DESIGN TABLES (POLYSTYRENE PANELS)^(1,2,3)
FOR LESSOR OF ULTIMATE LOAD/2.5 OR LOAD AT SPAN/120

PANEL SPAN (ft)	PANEL CONFIG.	ALLOWABLE LIVE ROOF LOADS FOR EXPANDED POLYSTYRENE (EPS) PANELS																	
		20 (psf)	25 (psf)	30 (psf)	35 (psf)	40 (psf)	45 (psf)	50 (psf)	55 (psf)	60 (psf)	65 (psf)	70 (psf)	75 (psf)	80 (psf)	85 (psf)	90 (psf)	95 (psf)	100 (psf)	
8	3" EPS	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
8	3" EPS + H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
8	3" EPS + 2H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
8	4.5" EPS	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
8	4.5" EPS + H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
8	4.5" EPS + 2H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
8	5" EPS	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
8	5" EPS + H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
8	6" EPS + 2H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
9	3" EPS	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
9	3" EPS + H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
9	3" EPS + 2H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
9	4.5" EPS	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
9	4.5" EPS + H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
9	4.5" EPS + 2H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
9	6" EPS	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
9	6" EPS + H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
9	6" EPS + 2H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10	3" EPS	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10	3" EPS + H + SKY	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10	3" EPS + H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10	3" EPS + 2H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10	4.5" EPS	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10	4.5" EPS + H + SKY	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10	4.5" EPS + H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10	4.5" EPS + 2H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10	6" EPS	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10	6" EPS + H + SKY	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10	6" EPS + H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10	6" EPS + 2H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11	3" EPS	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11	3" EPS + H + SKY	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11	3" EPS + H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11	3" EPS + 2H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11	4.5" EPS	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11	4.5" EPS + H + SKY	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11	4.5" EPS + H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11	4.5" EPS + 2H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11	6" EPS	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11	6" EPS + H + SKY	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11	6" EPS + H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11	6" EPS + 2H	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

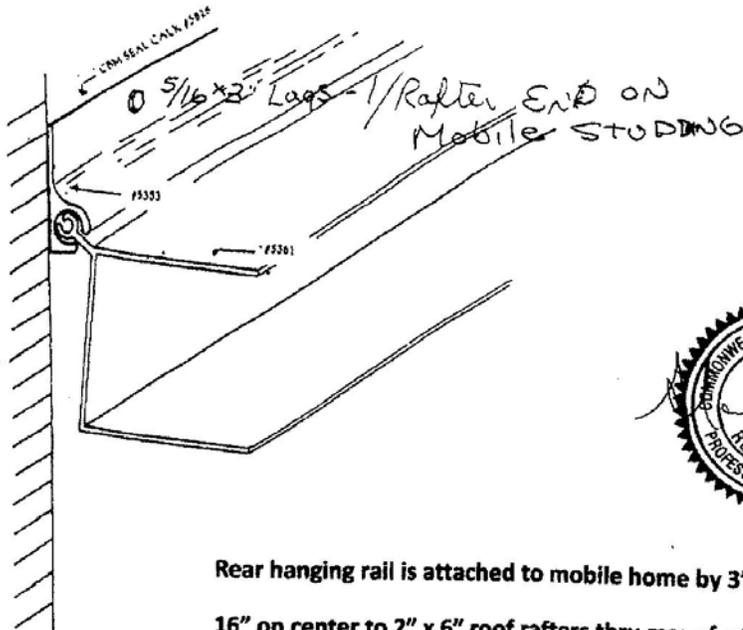


SEE NOTES ON PAGE 310



Now is a good time to determine where you want to install your roof hanging system. Get as close to height called for as possible. However, take into consideration the ideal spot to mount wall hanger even if you are a few inches one way or other ...

- A. Determine overall width of roof including overhangs.
- B. Cut wall hanging extrusions #5353 and #5361 to width of roof.
- C. Install extrusions to wall using screws 16" on center into studs.
(Extrusions #5353 and #5361 must be assembled before installation)



Rear hanging rail is attached to mobile home by 3" x 5/16" lag bolts, 16" on center to 2" x 6" roof rafters thru manufactures heavy duty hanging rail and a panel hanger which moves freely for any pitch or any movement from temperature change.

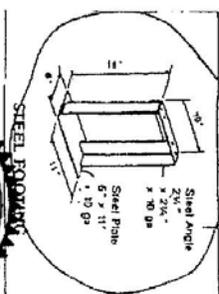
Use CBM seal caulk #5828 between wall hanger and wall.

Level panel hanger #5361 float in order to accept any pitch the roof will take.

Now go back to installing wall extrusions and walls.

COLUMN ACCESSORIES

FOR USE ON ATTACHED CARPORT / CANOPIES



DESCRIPTION	PRODUCT CODE	COLORS**	PCS PER STD. BOX	SHIPPING WT. PER BOX	PRICE PER STD. BOX	PRICE EACH
STEEL FOOTING (Dead Man Anchor) 6" x 11" The uplift capacity of the 1-1/2" sq x .032" roll-formed column is 810#	64-41-355-000		1	15#	\$46.00	\$46.00

COLUMN ACCESSORIES

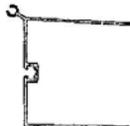
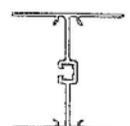
DESCRIPTION	PRODUCT CODE	COLORS**	PCS PER STD. BOX	SHIPPING WT. PER BOX	PRICE PER STD. BOX	PRICE EACH
FORMED SCROLLS	64-41-350-XXX	Pw: Polar White (630) W: Green Walnut Wdgmn (866) LW: Golden Oak Wdgmn (251) Al: Antique Ivory (007)	24	7#	\$118.32	\$4.93
HEADER-FOOT PLATE, 10"	64-41-360-XXX	Pw: Polar White (630) BR: Brown (066) TN: Tan (774) Al: Antique Ivory (007)	120	40#	729.60	6.08
OAK LEAF CASTING, 24"	64-41-365-000	Mt: Finish (000)	25	42#	776.75	31.07
HEADER-FOOT EXTRUSION X 11" x 10"	85-64-070-XXX	Pw: Polar White (630) BR: Brown (066) TN: Tan (774) Al: Antique Ivory (007)	4	16#	225.40	56.35



SCROLL COLUMN ACCESSORIES

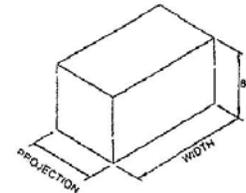
DESCRIPTION	PRODUCT CODE	COLORS**	PCS PER STD. BOX	SHIPPING WT. PER BOX	PRICE PER STD. BOX	PRICE EACH
1-1/2" EXTRUDED TUBING	64-15-225-630	Pw: Polar White (630)	15 PCS, 16' 2/40'	110#		\$1.80 EA
1-1/2" EXTRUDED TUBING	64-15-227-630	Pw: Polar White (630)	15 PCS, 20' 3/00'	135#		1.00 EA
SCROLL STOCK	75-64-055-XXX	Pw: Polar White (630) LW: Golden Oak Wdgmn (251) W: Green Walnut Wdgmn (866) Al: Antique Ivory (007)	100 PCS 4-2"	32#		4.22

3" Roof Cross-section Mass Properties

<p>Area: 0.837 Perimeter: 23.326 Bounding box: X -1.805, Y -2.452, X 1.863, Y 1.468 Centroid: X 0.000, Y 0.000 Moment of inertia: X 0.946, Y 1.545 Product of inertia: XY 0.104 Radii of gyration: X 1.063, Y 1.359</p> <p>Principle moments & X-Y directions about centroid I 0.929 Along [0.986 0.168] J 1.562 Along [-0.166 0.986]</p>  <p>PANEL HANGER</p>	<p>Area: 0.904 Perimeter: 21.885 Bounding box: X -1.504, Y -1.560, X 1.496, Y 1.560 Centroid: X 0.000, Y 0.000 Moment of inertia: X 1.385, Y 0.335 Product of inertia: XY 0.000 Radii of gyration: X 1.238, Y 0.609</p> <p>Principle moments & X-Y directions about centroid I 0.335 Along [0.000 -1.000] J 1.385 Along [1.000 0.000]</p>  <p>H-BEAMS BETWEEN PANELS</p>
<p>Area: 0.403 Perimeter: 14.643 Bounding box: X -0.410, Y -2.348, X 0.910, Y 1.892 Centroid: X 0.000, Y 0.000 Moment of inertia: X 0.856, Y 0.037 Product of inertia: XY -0.035 Radii of gyration: X 1.457, Y 0.302</p> <p>Principle moments & X-Y directions about centroid I 0.102 Along [0.000 -1.000] J 0.836 Along [1.000 0.000]</p>  <p>SIDE FASCIA / TRIM PC.</p>	<p>Area: 1.093 Perimeter: 26.596 Bounding box: X -1.682, Y -1.786, X 2.174, Y 2.344 Centroid: X 0.000, Y 0.000 Moment of inertia: X 2.323, Y 1.971 Product of inertia: XY -0.135 Radii of gyration: X 1.458, Y 1.343</p> <p>Principle moments & X-Y directions about centroid I 0.102 Along [0.000 -1.000] J 0.836 Along [1.000 0.000]</p>  <p>GUTTERED FRONT FASCIA</p>

GRANDVIEW / BETTERTVIEW PATIO ROOM .

WIND SPEED	PROJECTION	MINIMUM BLDG. WIDTH
70 MPH	15 FT.	8'-8"
80 MPH	15 FT.	11'-1"
90 MPH	15 FT.	14'-0"
70 MPH	14 FT.	8'-8"
80 MPH	14 FT.	10'-4"
90 MPH	14 FT.	13'-1"
70 MPH	13 FT.	8'-8"
80 MPH	13 FT.	9'-6"
90 MPH	13 FT.	12'-2"
70 MPH	12 FT.	8'-8"
80 MPH	12 FT.	8'-11"
90 MPH	12 FT.	11'-2"
70 MPH	11 FT.	8'-8"
80 MPH	11 FT.	8'-8"
90 MPH	11 FT.	10'-3"
70 MPH	10 FT.	8'-8"
80 MPH	10 FT.	8'-8"
90 MPH	10 FT.	9'-4"



NOTE: THIS TESTING IS BASED ON SHEAR DIAPHRAGM TESTING FOR WIND LOAD ONLY (SEE FET TEST REPORT T227-99 FOR MATERIALS AND SETUP REQUIREMENTS). THIS TABLE IS ALSO BASED ON DESIGN WIND LOADS FROM BOCA 1996, EXPOSURE CATEGORY C, IMPORTANCE FACTOR 1, TRIBUTARY AREA OF 50 SQ. FT., MEAN ROOF HT. OF 7' MAX. STRUCTURE IS NOT WITHIN 100 MILES OF HURRICANE OCEANLINE.

EE 7

Appendix C: Illicit Connections and Discharges to the Municipal Storm Drain System Bylaw and Funding for Implementation



Cranberry Land U.S.A

Town Clerk

Lynn A. Doyle

Notary Public

lynn.doyle@carverma.org

108 Main Street

Carver, Massachusetts 02330

Tel: 508-866-3403 • Fax: 508-866-3408

September 18, 2013

TO WHOM IT MAY CONCERN:

THIS IS TO CERTIFY that at the Continuation of the Annual Town Meeting of the Inhabitants of the Town of Carver was held on Tuesday, June 14, 2011 at the Carver High School Auditorium at 7:00 P.M., pursuant to a Warrant of the Board of Selectmen dated May 16, 2011. The meeting was called to order by the Moderator, John S. Murray, there being a quorum 75 present. The total registered voters at this time were 132. The following Article was voted on:

Article 40. Upon motion duly made and seconded and motion made by John H. Angley, Chairman, Board of Selectmen, it was So-Passed by Majority vote for the Town to amend Chapter 9 of the Town of Carver bylaws by adding the following: Illicit Connections and Discharges to the Municipal Storm Drain System Bylaw as Section 9.6:

Section 1. Purpose:

Increased and contaminated stormwater run-off are major causes of:

1. impairment of water quality and flow in lakes, ponds, streams, rivers, wetlands and groundwater;
2. contamination of drinking water supplies;
3. alteration or destruction of aquatic and wildlife habitat; and
4. flooding.

Regulation of illicit connections and discharges to the municipal storm drain system is necessary for the protection of Carver's water bodies and groundwater, and to safeguard the public health, safety, welfare, and the environment.

The objectives of this by-law are:

1. to prevent pollutants from entering Carver's municipal separate storm sewer system or municipal storm drain system (MS4);
2. to prohibit illicit connections and unauthorized discharges to the MS4;
3. to require the removal of all such illicit connections;

4. to comply with state and federal statutes and regulations relating to stormwater discharges; and
5. to establish the legal authority to ensure compliance with the provisions of this by-law through inspection, monitoring, and enforcement.

Section 2. Definitions:

For the purposes of this by-law, the following shall mean:

Authorized Enforcement Agency: The Department of Public Works, its employees, or agents designated to enforce this by-law.

Best Management Practices (BMPs): Activities, prohibitions of practices, general good housekeeping practices, structural and non-structural controls, pollution prevention and educational practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants directly or indirectly to stormwater, receiving waters, or stormwater conveyance systems. BMPs also include treatment practices, operating procedures, and practices to control site runoff, spillage or leaks, sludge, or waste disposal, or drainage from raw materials storage.

Clean Water Act: The Federal Water Pollution Control Act (33 U.S.C. § 1251 *et seq.*) as hereafter amended

Discharge of Pollutants: The addition from any source of any pollutant or combination of pollutants into the municipal storm drain system or into the waters of the United States or Commonwealth from any source.

Groundwater: All water beneath the surface of the ground.

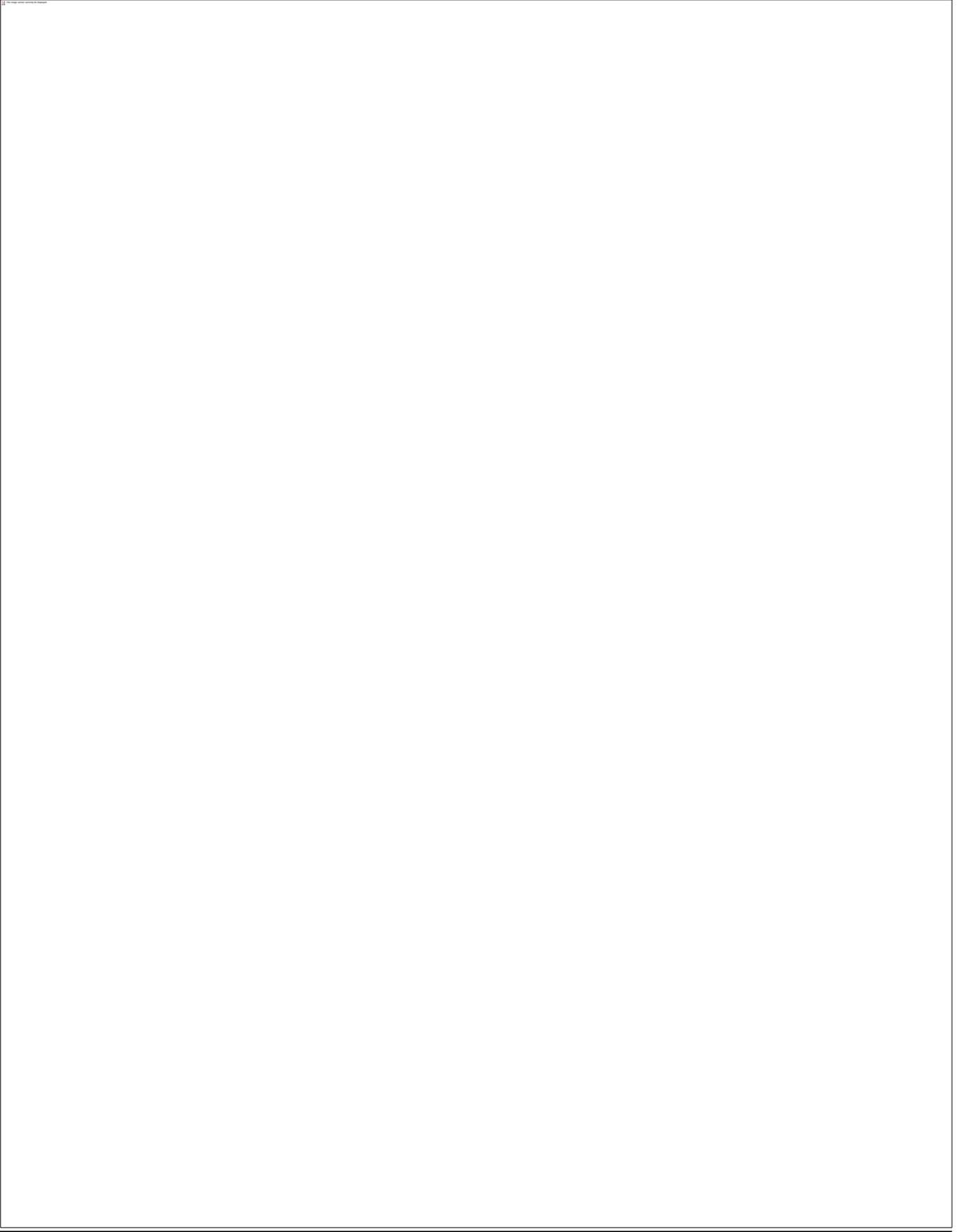
Illegal Discharge: Any direct or indirect non-stormwater discharge to the municipal storm drain system, except as specifically exempted in Section 6, subsection 4, of this by-law. The term does not include a discharge in compliance with an NPDES Storm Water Discharge Permit or resulting from fire-fighting activities exempted pursuant to Section 6, subsection 4, of this by-law.

Illicit Connection: Any surface or subsurface drain or conveyance that allows an illegal discharge into the municipal storm drain system. Illicit connections include conveyances that allow a non-stormwater discharge to the municipal storm drain system including sewage, process wastewater or wash water, and any connections from indoor drains sinks, or toilets, regardless of whether said connection was previously allowed, permitted, or approved before the effective date of this by-law.

Impervious Surface: Any material or structure on or above the ground that prevents water from infiltrating the underlying soil.

Municipal separate storm sewer system (MS4) or municipal storm drain system: The system of conveyances designed or used for collecting or conveying stormwater, including any road with a drainage system, street, gutter, curb, inlet, piped storm drain, pumping facility, retention or detention basin, natural or man-made or altered drainage channel, reservoir, and other drainage structure that together comprise the storm drainage system owned or operated by the Town of Carver.

National Pollutant Discharge Elimination System (NPDES) Storm Water Discharge Permit: A permit issued by United States Environmental Protection Agency or jointly with the State that authorizes the discharge of pollutants to waters of the United States.



Section 3. Applicability:

This by-law shall apply to flows entering the municipally-owned storm drainage system.

Section 4. Responsibility for Administration:

The Department of Public Works shall administer, implement, and enforce this bylaw. Any powers granted to or duties imposed upon the Department of Public Works may be delegated in writing by the Superintendent of Public Works to employees or agents of the Department of Public Works.

Section 5. Regulations:

The Department of Public Works may promulgate rules and regulations to effectuate the purposes of this by-Law. Failure by the Department of Public Works to promulgate such rules and regulations shall not have the effect of suspending or invalidating this bylaw.

Section 6. Prohibited Activities:

1. Illegal Discharges

No person shall dump, discharge, cause or allow to be discharged any pollutant or non-stormwater discharge into the municipal storm drain system, watercourse, or into the waters of the Commonwealth.

2. Illicit Connections

No person shall construct, use, allow, maintain, or continue any illicit connection to the municipal storm drain system, regardless of whether the connection was permissible under applicable law, regulation, or custom at the time of connection.

3. Obstruction of Municipal Storm Drain System

No person shall obstruct or interfere with the normal flow of stormwater into or out of the municipal storm drain system without prior approval from the Department of Public Works.

4. Exemptions

This section shall not apply to discharges or flows resulting from fire-fighting activities, nor to any of the following non-stormwater discharges or flows provided that the source is not a significant contributor of a pollutant to the municipal storm drain system:

- (1) Waterline flushing;
- (2) Flows from potable water sources;
- (3) Springs;
- (4) Natural flows from riparian habitats and wetlands;
- (5) Diverted stream flows;
- (6) Rising groundwaters;
- (7) Uncontaminated groundwater infiltration as defined in 40 CFR 35.2005(20), or uncontaminated pumped groundwater;

- (8) Water from exterior foundation drains, footing drains (not including active groundwater dewatering systems), crawl space pumps, or air conditioning condensation;
- (9) Discharges from landscape irrigation or lawn watering;
- (10) Water from individual residential car washing;
- (11) Discharges from de-chlorinated swimming pool water (less than one ppm chlorine) provided it is allowed to stand for one week prior to draining and the pool is drained in such a way as not to cause a nuisance;
- (12) Discharges from street sweeping;
- (13) Dye testing, provided verbal notification is given to the Department of Public Works prior to the time of the test;
- (14) Non-stormwater discharges permitted under an NPDES permit, waiver, or waste discharge order administered under the authority of the United States Environmental Protection Agency, provided that the discharge is in full compliance with the requirements of the permit, waiver, or order and applicable laws and regulations; and
- (15) Discharges for which advanced written approval is received from the Department of Public Works if necessary to protect public health, safety, welfare, or the environment.

Section 7. Emergency Suspension of Storm Drainage System Access:

The Department of Public Works may suspend municipal storm drain system access to any person or property without prior written notice when such suspension is necessary to stop an actual or threatened illegal discharge that presents or may present imminent risk of harm to the public health, safety, welfare, or the environment. In the event any person fails to comply with an emergency suspension order, the Authorized Enforcement Agency may take all reasonable steps to prevent or minimize harm to the public health, safety, welfare, or the environment.

Section 8. Notification of Spills:

Notwithstanding any other requirements of local, state, or federal law, as soon as any person responsible for a facility or operation, or responsible for emergency response for a facility or operation has information of any known or suspected release of materials at that facility or operation that is resulting or may result in illegal discharge of pollutants, that person shall take all necessary steps to ensure containment and cleanup of the release. In the event of a release of oil or hazardous materials, the person shall immediately notify the Fire Department, the Police Department, the Department of Public Works, and the Conservation Commission. In the event of a release of non-hazardous material, said person shall notify the Authorized Enforcement Agency no later than the next business day. Written confirmation of all telephone, facsimile, e-mail, or in-person notifications shall be provided to the Authorized Enforcement Agency within three business days thereafter. If the discharge of prohibited materials is from a commercial or industrial facility, the facility owner or operator of the facility shall retain on-site a written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least three years.

Section 9. Enforcement:

1. The Department of Public Works, or an authorized agent of the Department of Public Works (as designated by the Superintendent of Public Works) shall enforce this bylaw, and the regulations promulgated thereunder, as well as the terms and conditions of all permits, notices, and orders, and may pursue all civil and criminal remedies for such violations.

2. Civil Relief:

If anyone violates the provisions of this bylaw, regulations, permit, notice, or order issued thereunder, the Department of Public Works may seek injunctive relief in a court of competent jurisdiction to restrain the person from activities that would create further violations or compelling the person to abate or remediate the violation.

3. Orders:

The Department of Public Works may issue a written order to enforce the provisions of this by-law or the regulations thereunder, that may include: (a) elimination of illicit connections or discharges to the storm drainage system; (b) termination of access to the storm drainage system; c) performance of monitoring, analyses, and reporting; (d) cessation of unlawful discharges, practices, or operations; and (e) remediation of contamination in connection therewith. If the Department of Public Works determines that abatement or remediation of contamination is required, the order shall set forth a deadline for completion of the abatement or remediation.

4. Criminal and Civil Penalties:

Any person who violates any provision of this by-law, valid regulation, or the terms or conditions in any permit or order prescribed or issued thereunder, shall be subject to a fine not to exceed \$300.00 for each day such violation occurs or continues or subject to a civil penalty not to exceed \$300.00 for each day such violation occurs or continues, which may be assessed in an action brought on behalf of the Town of Carver in any court of competent jurisdiction.

5. Non-Criminal Disposition:

As an alternative to criminal prosecution or civil action, the Town of Carver may elect to use the non-criminal disposition procedure set forth in G.L. Ch.. 40, §21Dand Section 10.4 of the Town of Carver by-Laws, in which case the Department of Public Works or its Superintendent of Public Works or other authorized agent of the Town of Carver shall be the enforcing person. The penalty for the 1st violation shall be \$50.00. The penalty for the 2nd violation shall be \$150.00. The penalty for the 3rd and subsequent violations shall be \$ 300.00. Each day or part thereof that such violation occurs or continues shall constitute a separate offense.

6. Entry to Perform Duties Under this By-Law:

To the extent permitted by state law, or if authorized by the owner or other party in control of the property, the Department of Public Works, its agents, officers, and employees may enter upon privately-owned property for the purpose of performing their duties under this bylaw and regulations and may make or cause to be made such examinations, surveys, or sampling as the Department of Public Works deems reasonably necessary

7. Appeals:

The decisions or orders of the Department of Public Works shall be final. Further relief shall be to a court of competent jurisdiction.

8. Remedies Not Exclusive:

The remedies listed in this by-law are not exclusive of any other remedies available under any applicable federal, state or local law.

Section 10. Severability:

If any provision, paragraph, sentence, or clause, of this by-law shall be held invalid for any reason, all other provisions shall continue in full force and effect.

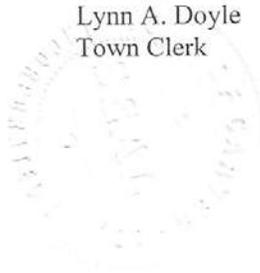
Section 11. Transitional Provisions:

Residential property owners shall have 60 days from the effective date of the bylaw to comply with its provisions provided good cause is shown for the failure to comply with the bylaw during that period.

IN TESTIMONY WHEREOF I have hereunto set my hand and the official seal of the Town of Carver on this 18th day of September 2013.



Lynn A. Doyle
Town Clerk





Cranberry Land U.S.A

Town Clerk

Lynn A. Doyle

Notary Public

lynn.doyle@carverma.org

108 Main Street

Carver, Massachusetts 02330

Tel: 508-866-3403 • Fax: 508-866-3408

September 18, 2013

TO WHOM IT MAY CONCERN:

THIS IS TO CERTIFY that at the Annual Town Meeting of the Inhabitants of the Town of Carver was held on Monday, June 4, 2012 at the Carver High School Auditorium at 7:00 P.M., pursuant to a Warrant of the Board of Selectmen dated May 23, 2012. The meeting was called to order by the Moderator, Robert E. Bentley, there being a quorum 75 present. The total registered voters at this time were 300. The following Article was voted on:

Article 19: Upon motion duly made and seconded and motion made by Peter Donnelly, Dept. of Public Works, it was Unanimously Voted for the Town to take from Free Cash an amount not to exceed Twenty-Five Thousand (\$25,000.00) Dollars to implement the "Illicit Connections and Discharges to the Municipal Storm Drain System Bylaw" by developing the following: A written program to detect and eliminate illicit discharges; written operation and maintenance procedures for all Town-owned facilities; a report of all impervious areas in the municipal storm drain system (MS4); an inventory of all Town-owned facilities and floor drains, a program to repair and rehabilitate all storm drain infrastructure that is regulated; a Stormwater Pollution Prevention Plan for maintenance garages, other Department of Public Works facilities, and waste handling facilities; and a permittee-specific stormwater monitoring program.

IN TESTIMONY WHEREOF I have hereunto set my hand and the official seal of the Town of Carver on this 18th day of September 2013.

Lynn A. Doyle
Lynn A. Doyle
Town Clerk



Appendix D: New State Building Code Hazard Mitigation Requirements, 2013



TOWN OF CARVER
INSPECTION DEPARTMENT
MAIN STREET CARVER, MA. 02330

Tel. (508) 866-3405 FAX: (508) 866- 3430

The following Massachusetts State Building Codes and Regulations have been promulgated in the last years to heighten requirements for Hazard Mitigation.

New design criteria on wind speed exceed 100 miles per hour.

R301.2.1 Wind limitations. Buildings and portions thereof shall be limited by wind speed, as defined in Table R301.2(1) and construction methods in accordance with this code. Basic wind speeds shall be determined from Figure R301.2(4). Where different construction methods and structural materials are used for various portions of a building, the applicable requirements of this section for each portion shall apply. Where loads for wall coverings, curtain walls, roof coverings, exterior windows, skylights, garage doors and exterior doors are not otherwise specified, the loads listed in Table R301.2(2) adjusted for height and exposure using Table R301.2(3) shall be used to determine design load performance requirements for wall coverings, curtain walls, roof coverings, exterior windows, skylights, garage doors and exterior doors. Asphalt shingles shall be designed for wind speeds in accordance with Section R905.2.6.

R301.2.1.1 Design criteria. In regions where the basic wind speeds from Figure R301.2(4) equal or exceed 100 miles per hour (45m/s) in hurricane-prone regions, or 110 miles per hour (49m/s) elsewhere, the design of buildings shall be in accordance with one of the following methods. The elements of design not addressed by those documents in Items 1 through 4 shall be in accordance with this code.

1. American Forest and Paper Association (AF&PA) Wood Frame Construction Manual For One and Two Family Dwellings (WFCM)

Flood Plain Regulations

R109.1.3 Floodplain inspections. For construction in areas prone to flooding as established by Table R301.2(1), upon placement of the lowest floor, including

basement, and prior to further vertical construction, the building official shall require submission of documentation, prepared and sealed by a registered design professional, of the elevation of the lowest floor, including basement, required in Section R322,

New concrete foundation anchorage and nailing patterns.

A206.1 Reinforced concrete and reinforced masonry wall anchorage. Concrete and masonry walls shall be anchored to all floors and roofs that provide lateral support for the wall. The anchorage shall provide a positive direct connection between the wall and floor or roof construction capable of resisting 75 percent of the horizontal forces specified in Section 1613 of the International Building Code.

A206.2 Special requirements for wall anchorage systems. The steel elements of the wall anchorage system shall be designed in accordance with the building code without the use of the 1.33 short duration allowable stress increase when using allowable stress design.

Wall anchors shall be provided to resist out-of-plane forces, independent of existing shear anchors.

A206.3 Development of anchor loads into the diaphragm. Development of anchor loads into roof and floor diaphragms shall comply with Section 1613 of the International Building Code using horizontal forces that are 75 percent of those used for new construction.

In wood diaphragms, anchorage shall not be accomplished by use of toenails or nails subject to withdrawal. Wood ledgers, top plates or framing shall not be used in cross-grain bending or cross-grain tension. The continuous ties required in Section 1613 of the International Building Code shall be in addition to the diaphragm sheathing.

New nailing patterns on structural sheathing fastening and installation.

R602.10.4.1 Continuous sheathing braced wall panels. Continuous sheathing methods require structural panel sheathing to be used on all sheathable surfaces on one side of a braced wall line including areas above and below openings and gable end walls. Braced wall panels shall be constructed in accordance with one of the methods listed in Table R602.10.4.1. Different bracing methods, other than those listed in Table R602.10.4.1, shall not be permitted along a braced wall line with continuous sheathing.

R602.10.4.4 Continuously sheathed braced wall panel location and corner construction. For all continuous sheathing methods, full-height braced wall panels complying with the length requirements of Table R602.10.4.2 shall be located at each end of a braced wall line with continuous sheathing and at least every 25 feet (7620 mm) on center. A minimum 24 inch (610mm) wood structural panel corner return shall be provided at both ends of a braced wall line with continuous sheathing in accordance with Figures R602.10.4.4(1) and R602.10.4.4(2). In lieu of the corner return, a hold-down device with a minimum uplift design value of 800 pounds (3560 N) shall be fastened to the corner stud and to the foundation or framing below in accordance with Figure R602.10.4.4(3).

New requirements on windows.

R612.5 Performance. Exterior windows and doors shall be designed to resist the design wind loads specified in Table R301.2(2) adjusted for height and exposure per Table R301.2(3).

R612.6 Testing and labeling. Exterior windows and sliding doors shall be tested by an approved independent laboratory, and bear a label identifying manufacturer, performance characteristics and approved inspection agency to indicate compliance with AAMA/WDMA/CSA 101/I.S.2/A440. Exterior side-hinged doors shall be tested and labeled as conforming to AAMA/WDMA/CSA 101/I.S.2/A440 or comply with Section R612.8.

R301.2.1.2 Protection of openings. Windows in buildings located in windborne debris regions shall have glazed openings protected from windborne debris. Glazed opening protection for windborne debris shall meet the requirements of the Large Missile Test of ASTM E 1996 and ASTM E 1886 referenced therein. Garage door glazed opening protection for windborne debris shall meet the requirements of an approved impact resisting standard or ANSI/DASMA 115.

***CARVER EMERGENCY
MANAGEMENT
HURRICANE DISASTER
INFORMATION
PACKAGE***

For more information contact

**Thomas M. Walsh
Emergency Management Director**

508-866-5219

CARVER EMERGENCY MANAGEMENT HURRICANE BULLETIN

What you should do:

Before the Storm

The best way to protect yourself and your family from the effects of a hurricane is to be prepared. .

Make arrangements for pets. You may want to contact animal boarding facilities or hotels for emergency information. If necessary, cats and dogs will be accepted at Carver's shelter but all food and other pet care supplies must be provided by the pet owner. Protect your windows. Permanent shutters are the best protection, but plywood panels will also work. Purchase flood insurance. Develop an emergency communication plan. If family members get separated during a disaster it is helpful to have a friend or relative, outside the impacted area, who can be contacted and told everyone is ok.

Prepare a Hurricane Disaster Kit. (See Hurricane Supply List Bulletin)

During a Watch

Listen to radio and television for hurricane reports.

Check emergency supplies

Fuel car.

Bring in objects such as toys or patio furniture. Anchor objects that cannot be brought inside.

Secure windows with shutters, boards or tape.

Store drinking water in clean bathtubs, jugs, bottles, etc.

Review evacuation plan.

Moor boats securely or remove them from the water.

During a Warning

Listen constantly to radio or television for updates and instructions.

If in a mobile home, evacuate immediately.

Store valuables in waterproof containers on high levels to avoid water damage from flooding.

Elevate furniture to protect it from water damage.

Stay inside, away from windows, skylights and glass doors.

If Evacuation is Necessary

- Leave as soon as possible.
- Avoid flooded roads and watch for washed-out bridges.
- Secure your home by unplugging appliances and turning off electricity and the main water valve.
- Bring pre-assembled emergency supplies kit and warm protective clothing.
- Lock up home and leave.

After the Storm

- Stay tuned to local radio and television stations for information on returning to your home.
- Return home only after authority's advice that it is safe to do so.
- Help injured or trapped people.
- Avoid loose or dangling power lines. Report them immediately to utility companies, police or the fire department.
- Enter your home with caution.
- Beware of animals, insects and snakes that may have entered your home in flood water.
- Open windows and doors to ventilate and dry your home.
- Check refrigerated foods for spoilage.
- Take pictures of the house and damaged goods for insurance claims.
- Drive only if necessary, rescue and maintenance crews need to be able to travel freely.
- Use the telephone only for emergency calls.

For more information contact: Thomas M. Walsh, Emergency Management Director at 508-866-5219

SUGGESTED HURRICANE SUPPLY LIST

- Canned goods and nonperishable foods that do not need cooking, such as:
 - Canned meats and fish
 - Canned fruits and vegetables
 - Canned soups and puddings
 - Canned fruit juices
 - Dried fruit
 - Bread, cookies and crackers
 - Peanut butter and jelly
 - Coffee and tea
 - Bottled water
- Manual can opener
- Bottled water (1 gallon per person/per day)
- Prescription medication (2 week supply)
- Pet food
- Water purification tablets (halazone)
- Disposable plates, cups, and utensils
- Infant care items:
 - Disposable diapers
 - Baby wipes
 - Baby food
 - Formula
- First aid supplies
- Masking and duct tape
- Flashlight or lantern, with extra batteries
- Battery operated radio, with extra batteries
- Watch or battery operated clock
- Ice chest
- Matches
- Canned heat (sterno)
- Portable outdoor camping stove or grill with fuel supply
- Plastic trash bags
- Plastic sheeting or drop cloth
- Chlorinated bleach
- Personal hygiene items
- Other useful items:
 - Work gloves
 - Sun lotion
 - Insect repellent
 - Hammer
 - Screwdriver
 - Pliers
 - Wrenches
 - Handsaw
 - Razor knife
 - Ax or chainsaw
 - Rope caulking
 - Nails and screws
 - Rope and wire
 - Broom, mop and bucket
 - All-purpose cleaner
 - Ladder
 - Sandbags
 - Portable generator
 - Tree pruner
 - Shovel, rake and wheelbarrow
 - Sheets of plywood

NOTICE

Everyone living in a Mobile Home should plan on evacuating when it appears that a hurricane will impact Carver.

Please plan your evacuation in advance with family and friends and plan for the care of all pets. If necessary, cats and dogs will be accepted at Carver's shelter. Pet food, leashes, cages etc. must be provided by the pet owner.

Pets will be kept in a separate area from the general population and each pet owner must be prepared to care for their pet.

Carver Emergency Management

Carver Hurricane Shelter

Carver High School

Please confirm with authorities the Hurricane Shelter is open during an emergency before going to the shelter.



Homeland Security

Family Communications Plan

Your family may not be together when disaster strikes, so plan how you will contact one another and review what you will do in different situations.

Out-of-Town Contact Name: _____ Telephone Number: _____
Email: _____ Telephone Number: _____

Fill out the following information for each family member and keep it up to date.

Name: _____	Social Security Number: _____
Date of Birth: _____	Important Medical Information: _____
Name: _____	Social Security Number: _____
Date of Birth: _____	Important Medical Information: _____
Name: _____	Social Security Number: _____
Date of Birth: _____	Important Medical Information: _____
Name: _____	Social Security Number: _____
Date of Birth: _____	Important Medical Information: _____
Name: _____	Social Security Number: _____
Date of Birth: _____	Important Medical Information: _____

Where to go in an emergency. Write down where your family spends the most time: work, school and other places you frequent. Schools, daycare providers, workplaces and apartment buildings should all have site-specific emergency plans.

Home Address: _____ Phone Number: _____ Neighborhood Meeting Place: _____ Regional Meeting Place: _____	Work Address: _____ Phone Number: _____ Evacuation Location: _____
School Address: _____ Phone Number: _____ Evacuation Location: _____	Work Address: _____ Phone Number: _____ Evacuation Location: _____
School Address: _____ Phone Number: _____ Evacuation Location: _____	Other place you frequent: Address: _____ Phone Number: _____ Evacuation Location: _____
School Address: _____ Phone Number: _____ Evacuation Location: _____	Other place you frequent: Address: _____ Phone Number: _____ Evacuation Location: _____

Important Information	Name	Telephone #	Policy #
Doctors:	_____	_____	_____
Other:	_____	_____	_____
Pharmacist:	_____	_____	_____
Medical Insurance:	_____	_____	_____
Homeowner/Rental Insurance:	_____	_____	_____
Veterinarian/Kennel (for pets):	_____	_____	_____

Other useful phone numbers: **9-1-1** for emergencies. Police Non-Emergency Phone #: _____

Every family member should carry a copy of this important information:

Other Important Phone Numbers & Information:

Family Communications Plan

Contact Name: _____
Telephone: _____

Out-of-Town Contact Name: _____
Telephone: _____

Neighborhood Meeting Place: _____
Meeting Place Telephone: _____

Dial 9-1-1 for Emergencies!

Other Important Phone Numbers & Information:

Family Communications Plan

Contact Name: _____
Telephone: _____

Out-of-Town Contact Name: _____
Telephone: _____

Neighborhood Meeting Place: _____
Meeting Place Telephone: _____

Dial 9-1-1 for Emergencies!

FOLD
HERE



Other Important Phone Numbers & Information:

Family Communications Plan

Contact Name: _____
Telephone: _____

Out-of-Town Contact Name: _____
Telephone: _____

Neighborhood Meeting Place: _____
Meeting Place Telephone: _____

Dial 9-1-1 for Emergencies!

Other Important Phone Numbers & Information:

Family Communications Plan

Contact Name: _____
Telephone: _____

Out-of-Town Contact Name: _____
Telephone: _____

Neighborhood Meeting Place: _____
Meeting Place Telephone: _____

Dial 9-1-1 for Emergencies!

FOLD
HERE



Appendix F: Review and Comments by Regional Agencies:

Southeastern Regional Planning and Economic Development District (SRPEDD) and the **Taunton River Stewardship Council** (Members: the Towns of Berkeley, Bridgewater, Dighton, Freetown, Halifax, Middleborough, Raynham, and Somerset; the Cities of Fall River and Taunton; the Dighton Inter-Tribal Council; the National Park Service; and The Nature Conservancy.)



Southeastern Regional Planning & Economic Development District

◀ 88 Broadway ▼ Phone (508)824-1367 ▼ FAX (508)823-1803 ▼ ssmith@srpedd.org ▼ Taunton, MA 02780 ▶

November 24, 2013

Sarah Hewins
Town Hall
108 Main Street
Carver, MA 02330

RE: Town of Carver, 2013 Carver Mitigation Plan Update

Dear Ms. Hewins:

Southeastern Regional Planning and Economic Development District's (SRPEDD) planning staff has recently completed a review of the Town of Carver's update of their Mitigation (PDM) Plan.

The plan is consistent with SRPEDD's regional goals and objectives and appears to be in general compliance with FEMA's Planning Requirements. The plan reflects the time, effort and research put into it by the Town's officials, volunteers, and municipal staff. The Action Plans accurately convey community needs and issues of concern, as well as an acute awareness of the town's place in the regional landscape. The town's conservation and planning staff continue to work diligently with partners such as SRPEDD, the Wildlands Trust, The Nature Conservancy, and officials from neighboring towns to promote responsible long-range conservation and land use planning, including forestry management, cultural and water resource protection. The town has also continued its ongoing work with the Plymouth-Carver Aquifer Advisory Committee, planning for the protection of the Sole Source Aquifer that is so important to the town and its immediate neighbors. Overall, we see the updated Carver PDM working well with other regional and sub-regional planning documents developed in recent years.

SRPEDD recommends and supports local adoption and federal certification of the Carver Mitigation Plan. If you have any questions regarding our comments, please do not hesitate to contact Bill Napolitano, our Environmental Program Director.

Respectfully,

Stephen C. Smith
Executive Director



November 23, 2013

Sarah G. Hewins
Town Hall, 1st Floor
108 Main Street
Carver, MA 02330

RE: 2013 Pre – Disaster Mitigation (PDM) Plan Update, Town of Carver, MA

Dear Ms. Hewins:

On behalf of the Taunton River Stewardship Council, I am writing to inform you of our recently completed review of the above-referenced plan. As locally appointed stewards of the federally-designated Wild & Scenic Taunton River, the Stewardship Council is the means by which the ten (10) main-stem communities (Bridgewater, Halifax, Middleborough,, Raynham, Taunton, Berkley, Dighton, Freetown, Fall River, and Somerset), in conjunction with federal, state, regional, and non-profit organizations (MA Department of Fish & Game, the National Park Service, SRPEDD, Save The Bay, The Nature Conservancy, the Dighton Intertribal Indian Council, the Wildlands Trust, and the Taunton River Watershed Alliance), work cooperatively to protect the resources of the Taunton River, including its watershed and its tributaries.

The Stewardship Council strongly supports the local and federal certification of the updated PDM Plan. The plan not only reflects the hard work of your local committee, but an awareness of the environmental and public safety issues that challenge all of us on a regional basis. The Stewardship Council has been very active in dam removal and river restoration efforts in the watershed, as well as on tributaries contributing to the watershed. As pointed out in your PDM Plan, dam function, coupled with potential storm and drought scenarios, will continue to be a concern in terms of stream flow, water quality, transportation safety, and emergency preparedness for years to come.

Thank you for including us in the review of this important planning document and for your consideration of our comments. We look forward to the opportunity to work with you on other stewardship efforts in and around the Taunton River Watershed.

Respectfully,

Louis A. Bousquet

Louis A. Bousquet, Chairman
Taunton River Stewardship Council

Taunton River Stewardship Council c/o SRPEDD 88 Broadway Taunton, MA 02780

APPENDIX G: Certificate of Adoption of Local Hazard Mitigation Plan Template



BOARD OF SELECTMEN

Michael R. Milanoski
Town Administrator

Elaine M. Weston
Ass't. to the Town Administrator

108 Main Street
Carver, MA 02330
Telephone: 508-866-3401/Fax: 508-866-4213

CERTIFICATE OF ADOPTION BOARD OF SELECTMEN, Carver, Massachusetts

A RESOLUTION ADOPTING THE 2015 Hazard Mitigation Plan, Carver, MA

WHEREAS, the Town of Carver, Massachusetts established a Committee to prepare the Hazard Mitigation Plan; and

WHEREAS, the Town of Carver, Massachusetts participated in the development of the 2015 Hazard Mitigation Plan; and

WHEREAS, the 2015 Carver, Massachusetts, Hazard Mitigation Plan contains several potential future projects to mitigate potential impacts from natural hazards in the Town of Carver; and

WHEREAS, a duly-noticed public meeting was held by the CARVER BOARD OF SELECTMEN on _____, 2015, for the public and municipality to review prior to consideration of this resolution; and

WHEREAS, the Town of Carver authorizes responsible departments and/or agencies to execute their responsibilities demonstrated in the Plan; and

NOW, THEREFORE, BE IT RESOLVED that the Town of Carver, Massachusetts BOARD OF SELECTMEN formally approves and adopts the 2015 Carver, Massachusetts, Hazard Mitigation Plan in accordance with M. G. L c. 40

ADOPTED AND SIGNED this _____
Month Day Year

ATTEST:

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