

Town of Dennis

Multi-Hazard Mitigation Plan

Adopted July 26, 2011

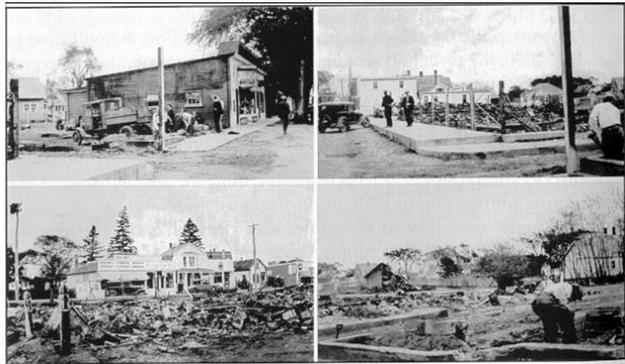


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Section 1: Introduction

1.1 Hazard Mitigation

Hazard mitigation is commonly defined as any sustained action to reduce or eliminate the long-term risk to human life from natural hazards and their effects.

For the Local Multi-Hazard Mitigation (MHM) Plan hazard refers to an extreme natural event that poses a risk to people, infrastructure, or resources. Risk can be defined as “hazard; danger; peril; exposure to loss, injury, or destruction” or “the possibility of suffering harm or loss.” The Town’s hazard risk assessment determines which areas of Town may be affected by a natural hazard, how likely it is that a given hazard may occur, and how intense that hazard might be.

Vulnerability can be defined as “susceptibility to injury or attack.” Vulnerability indicates what is likely to be damaged by the identified hazards and how severe the damage might be. For example, if an area is determined to be at risk of flooding, vulnerability estimates could include potential residential property losses, impacts to the tax base and damages to public infrastructure in that area.

Hazard mitigation planning is the process that the Town of Dennis is undertaking to continuously analyze our Town’s risk from natural hazards, to coordinate available resources, and to develop a strategy to implement actions to eliminate risk.

1.2 Plan Purpose and Benefits

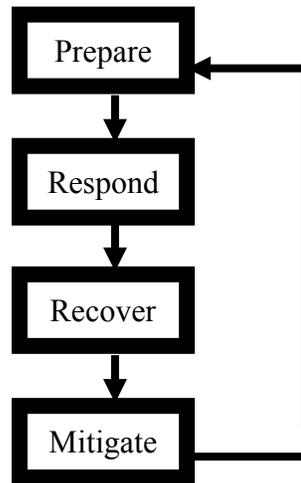
The purpose of this plan is to fulfill the federal regulations for the *Federal Emergency Management Agency’s (FEMA) Mitigation Planning*, under the Code of Federal Regulations (CFR) Title 44 Part 201. All cities and towns are required to adopt local multiple-hazard mitigation plan in order to remain eligible for the Federal Emergency Management Agency (FEMA) Hazard Mitigation Grant funds (available after a disaster is declared) and to be eligible for other federal hazard mitigation funds. The plan attempts to provide a process for the Town of Dennis to accomplish the following:

- Identify risks
- Assess the town’s vulnerability
- Reduce future damages
- Meet community needs
- Achieve multiple objectives
- Promote public participation
- Increase funding eligibility
- Provide a guide post for disaster recovery
- Promote cooperation

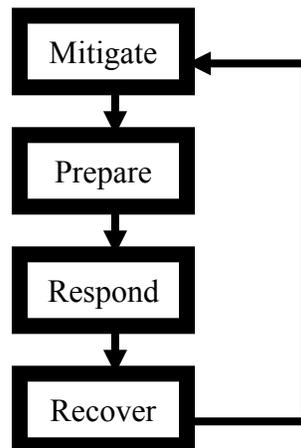
A Planning Team has been created within the town which included Management Level staff from the Dennis Planning, Health, Police, Fire, Engineering, Public Works, Natural Resources, Beach, Harbor and Building Departments. Public involvement was solicited in numerous fashions, with the plan being developed within the public realm through the use of WordPress and other publicly available information dissemination medium, Public Hearings being held by the Board of Selectmen and Dennis Planning Board, and regular press releases on the planning process. Benefits available to the Town of Dennis by creating, adopting, and implementing a hazard plan and are listed below.

- Make funding available for initiatives that would otherwise not be available.
- Support pre-disaster and post-disaster decision making efforts in times of crisis.
- Educate residents and officials on vulnerable areas.
- Connect hazard mitigation planning to community planning and the Dennis Local Comprehensive Plan where possible.

Before the Disaster Mitigation Act of 2000 the following reflected the thinking of state and local officials to emergency planning for natural disasters:



Since the Act, this process has been revised to the following:



The Town of Dennis chose to participate in the Regional Multi-Hazard Mitigation planning initiative as coordinated by the Cape Cod Commission (Commission). The Commission convened a regional Multi-Hazard Community Planning Team to advise on the regional Multi-Hazard Mitigation Plan (MHM) and to provide planning assistance to local communities in development of local MHM plans.

1.3 Planning Process

The Dennis Town Planner was assigned the task of developing the Dennis Multi-Hazard Mitigation Plan and for coordinating among town departments and boards including the Dennis Engineering, Health, Fire, Police, Harbor, Beach and Recreation and Natural Resources Departments. Together these departments and Boards comprised the Dennis Pre-Disaster Hazard Planning Team. The team met, with other Town of Dennis Department heads on a weekly basis as part of the Dennis Department Heads Meeting. These meetings allowed for interaction with all town agencies and kept all significant departments involved in the process. Public participation was solicited through-out the process with a community hazard assessment provided on the Dennis Planning Department Blog and made available to the general public. All draft documents were made available as soon as initially prepared to allow for public involvement at the earliest possible stages.

As part of the planning process the Town Planner and Health Director participated in the Regional MHM planning process and also served as a liaison for the town.

Public information was made available to residents through a number of venues. These included the use of a Weblog through WordPress. The weblog included posting draft documents and exchanging discussions with residents and property owners of Dennis. Public forums were held through-out the planning process to garner early, mid-way and final input on the work effort. A draft plan was presented at a public hearing held on December 7, 2009, that was advertised in local newspapers and posted in Town Hall and posted on the Town's website for a thirty day formal comment period. Public comment was reviewed, considered, and incorporated into the plan. The final draft was presented to the Board of Selectmen on July 26, 2011 at a public meeting, for their review and comment. The Board of Selectmen adopted the plan on July 26, 2011.

1.4 Existing Town plans goals that support hazard mitigation

While hazard mitigation is not specifically mentioned in either the Dennis Local Comprehensive Plan (adopted in September 2002) and the Open Space and Recreation Plan (completed July 2009), significant elements of a hazard mitigation planning strategy are found in these documents. In addition, the basic town data necessary for producing this document are drawn from these two plans.

Both the Local Comprehensive Plan and the Opens Space and Recreation Plan identify the need to limit new development within areas prone to flooding. The Local Comprehensive Plan establishes the following goal and performance standards for the town to pursue relative to flooding:

2.2.2 Goal: To limit development in areas subject to coastal storm flowage, particularly high hazard areas, in order to minimize the loss of life and structures and the environmental damage resulting from storms, flooding, erosion and relative sea level rise

MINIMUM PERFORMANCE STANDARDS

2.2.2.1 Except as specified in Section 2.2.2.5, no development or redevelopment shall be permitted within FEMA V-flood zones. Existing structures may be reconstructed or renovated provided there is no increase in floor area or intensity of use. As an exception, where there is no feasible alternative, water-dependent structures and uses may be permitted subject to the approval of all permitting authorities.

2.2.2.2 In order to accommodate possible relative sea level rise and possible increased storm intensity, ensure human health and safety, and protect the integrity of coastal landforms and natural resources, all new buildings, including replacements, or substantial improvements to existing structures within FEMA A-zones shall be designed to accommodate the documented relative sea level rise rate in Massachusetts of at least one foot per 100 years, except as provided in Section 2.2.2.11, and in V-zones shall be designed to accommodate a relative sea level rise rate of two feet per 100 years

2.2.2.3 Except as specified in Section 2.2.2.5, no new development or redevelopment shall be permitted on barrier beaches and/or coastal dunes as defined by the Wetlands Protection Act and associated regulations and policies. Existing structures may be reconstructed or renovated, provided there is no increase in floor area or intensity of use, or conversion from seasonal to year round use.

A. If the reconstruction/renovation is greater than 50% of the replacement value of a structure, and is located in the A-zone, the lowest floor shall be elevated at least one foot above the 100 year flood elevation, except as provided in Section 2.2.2.11. If the reconstruction/renovation is greater than 50% of the replacement value of a structure, and is located in the V-zone, the lowest floor shall be elevated at least two-feet above the 100

year flood elevation, except as provided in Section 2.2.2.11. On a barrier beach or coastal dune and in either the V or A-zone, the structure shall be on open pilings, to allow for storm flowage and beach and dune migration. B. If the structure is on a barrier beach or dune and is outside the 100 year coastal floodplain, and is proposed to be reconstructed/renovated greater than 50% of its replacement value before reconstruction, it shall be elevated at least two feet above grade on open pilings to allow dune migration.

Water-dependent public recreational facilities in these locations may be developed providing that it can be demonstrated that the proposed development will not compromise the integrity of coastal resources, and is appropriately elevated on pilings or floodproofed.

2.2.2.4 Development and redevelopment on or within 100 feet landward of a coastal bank or dune shall be designed to have no adverse effect on the height, stability, or the use of the bank or dune as a natural sediment source. In areas where banks or dunes are eroding, the setback for all new buildings and septic systems to the top of the coastal bank or dune crest shall be at least 30 times the average annual erosion rate of the bank or dune. This rate shall be determined by averaging the erosion over the previous 30-year period at a minimum. In instances where shoreline erosion rates are indicative of bank/dune erosion rates, MCZM shoreline change maps may be used in determining the setback

2.2.2.5 Where fire, storm, or similar disaster has caused damage to or loss of buildings in FEMA A- and V-zones, on barrier beaches, coastal banks or coastal dunes of greater than 50 percent of their market value, all reconstruction shall be in compliance with current applicable regulations and shall be designed in accordance with Sections. 2.1.1.4, 2.2.2.2, 2.2.2.4, 2.2.3.1, and 2.2.3.2. Any reconstruction shall not enlarge or expand the use of an existing structure.

2.2.2.6 Except as provided in Section 2.2.2.11, no new public infrastructure or expansion of existing infrastructure shall be made in flood hazard zones (FEMA A- and V-zones) unless it is shown that there is an overriding public benefit provided, and provided that such infrastructure will not promote new growth and development in flood hazard areas.

2.2.2.7 Where land subject to coastal storm flowage is significant to the interests of flood control and storm damage prevention, no activity shall increase the elevation or velocity of flood waters or increase flows due to a change in drainage or flowage characteristics on the subject site, adjacent properties, or any public or private way.

2.2.2.8 Within the 10-year floodplain, no activity shall impede the landward migration of other resource areas within this area of the floodplain. Relative sea level rise and the landward migration of resource areas in response to relative sea level rise shall be incorporated into the design, construction, and location of structures and other activities proposed.

2.2.2.9 New structures, additions to existing structures, solid foundations, new or proposed expansions of roads, driveways or parking lots, or impermeable paving of existing ways, new or proposed expansions of coastal engineering structures, and new septic systems shall be prohibited within the V-zone of a beach, dune, barrier beach, or coastal bank where they will result in alterations to vegetative cover, interruptions in the supply of sediment to other wetland resources, and/or changes to the form or volume of a dune or beach.

2.2.2.10 Notwithstanding Sections 2.2.2.6, 2.2.2.7, 2.2.2.8 and 2.2.2.9, the following activities may be permitted provided the applicant demonstrates that best available measures are utilized to minimize adverse impacts on all critical characteristics of land subject to coastal storm flowage, and provided that all other performance standards for underlying resource areas are met: beach, dune, and bank nourishment and restoration projects, including fencing and other devices to increase dune development and plantings compatible with natural vegetative cover; elevated pedestrian walkways and elevated decks with appropriate height and spacing between planks to allow sufficient sunlight penetration; boat launching facilities, navigational aids, piers, docks, wharves and moorings; improvements necessary to maintain the structural integrity/stability of existing coastal engineering structures; projects that will restore, rehabilitate or create a saltmarsh or freshwater wetlands; projects that are approved, in writing, or conducted by the Division of Marine Fisheries that are specifically intended to increase the productivity of land containing shellfish, including aquaculture, or to maintain or enhance marine fisheries, and projects that are approved, in writing, or conducted by the Division of Fisheries and Wildlife that are specifically intended to enhance or increase wildlife habitat.

2.2.2.11 In order to allow alternative means of reducing flood hazard risks in areas where there are serious concerns about protecting the character of historic villages, the following shall apply in certified Village Growth/Activity centers located in FEMA A-zones for which a flood Hazard Mitigation Plan has been prepared and adopted by the town and has been found by the Cape Cod Commission to be consistent with state coastal policies and regulations. Notwithstanding Sections 2.1.2.5, 2.2.2.2, 2.2.2.3A and 2.2.2.6, the following standards shall apply to such certified Village Growth/Activity centers located within FEMA A-zones:

- a. Development and redevelopment shall be subject to the requirements of the adopted Flood Hazard Mitigation Plan and any related policies and regulations.
- b. Public infrastructure and private sewage treatment facilities (PSTFs) may be constructed in FEMA A-zones (but not within a V- or an AO-zone) provided that these facilities are consistent with the Flood Hazard Mitigation Plan and the certified Local Comprehensive Plan; further

provided that the infrastructure is itself flood-resistant; and provided that such infrastructure will not promote new growth and development outside such certified Growth/Activity center.

c. All new buildings or substantial improvements to existing structures in the FEMA A-zone shall comply with FEMA and State Building Code regulations for elevation and flood-proofing

Since the adoption of these recommendations, the State Building Code has been amended to require a two-foot clearance above Base Flood Elevation. The Town of Dennis actively pursues consistency in construction with the State Building Code.

In addition to flooding, other significant natural hazards have become evident that have severely impacted local services and residents. These hazards include blizzards, wind, fire, etc.

1.5 **Community Goal(s) for Hazard Mitigation**

- **Goal #1:** Reduce the loss of life, property, infrastructure, and environmental and cultural resources in the Town from natural disasters.
- **Goal #2:** Coordinate our local hazard mitigation planning and activities with those of Barnstable County and neighboring towns.
- **Goal #3:** Seek for and take advantage of funding opportunities to implement the Multi-Hazard Mitigation Plan.
- **Goal #4:** Mitigate potential financial losses incurred by municipal, residential and commercial establishments due to disaster.
- **Goal #5:** Develop and conduct hazard awareness information and educational programs for the public.

1.6 **Plan Implementation**

The Town of Dennis Planning Board and Board of Selectmen will be responsible for adopting the Dennis MHMP and all future updates or changes. These governing bodies have the authority to promote sound public policy regarding hazards. The Dennis MHMP will be assimilated into other town plans and documents as they come up for review according to each plan's review schedule.

1.7 **Monitoring, Evaluating and Updating the Plan**

Section §201.6(c)(4)(i) of the mitigation planning regulation requires that the plan maintenance process shall include a section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

Monitoring the Plan

The Dennis Town Planner, Town Administrator, Board of Selectmen and Planning Board are responsible for monitoring the plan. On an annual basis these entities will seek a report from the agencies and departments responsible for implementing the mitigation projects in the plan. The compiled report will be provided to the Board of Selectmen and Planning Board as information and noticed to the public. A report outlining all five years of the plan monitoring will be included in the plan update.

Evaluating the Plan

The Town Planner will evaluate the plan during the five-year cycle of the plan. On an annual basis, concurrent with the report above the evaluation should assess, among other things, whether:

- The goals and objectives address current and expected conditions.
- The nature, magnitude and/or types of risks have changed.
- The current resources are appropriate for implementing the mitigation projects in the plan.
- There are implementation problems, such as technical, political, legal or coordination issues with other agencies.
- The outcomes have occurred as expected (a demonstration of progress).
- The agencies and other partners participated as originally proposed.

Updating the Plan

The mitigation planning regulations at §201.6(d)(3) direct the update of Mitigation Plans. Plans must be updated and resubmitted to FEMA for approval every five years in order to continue eligibility for FEMA hazard mitigation assistance programs. Plan updates must demonstrate that progress has been made in the past five years to fulfill commitments outlined in the previously approved plan. This involves a comprehensive review and update of each section of the plan and a discussion of the results of evaluation and monitoring activities described above. Plan updates may validate the information in the previously approved plan or may involve a major plan rewrite. A plan update may not be an annex to this plan; it must stand on its own as a complete and current plan.

Table 1. Continued Plan Development

Hazard	Status	Hazard Identification Completion Date	Vulnerability Assessment Completion Date
Severe Weather – Hurricane	Completed	2009	2009
Floods	Completed	2009	2009
Sea Level Rise	Completed	2009	2009
Severe Weather – Blizzard	Completed	2009	2009
Earthquake	Completed	2009	2009
Fire – Wild Fire	Completed	2009	2009
Fire - Urban	Completed	2009	2009

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Wind Completed 2009 2009

Continued Public Involvement

The following methods will be used for continued public involvement.

A copy of the MHMP will be put online at the Dennis Planning Department Weblog (<http://dennismapanningdept.wordpress.com/mhm-plan/>) and the Town of Dennis Website (<http://www.town.dennis.ma.us>).

Places where the hazard plan will be kept:

- Planning Office
- Fire Department Headquarters
- Public Works Department
- Town Clerk's Office
- Dennis Public Library

On an annual basis the town will review the plan, which will be advertised to the public using the same method established under the public involvement section of this plan. The public will be involved in the process described in the above section on Monitoring, Evaluating and Updating the Plan.

Section 2: Hazard Analysis and Risk Assessment

Section 201.6(C)(2) of the regulations requires the Town of Dennis to provide a hazard and risk assessment. This process will include a description of the town, a discussion of “at-risk” communities and an analysis of relative risk. The town has relied upon several area analysis to identify methods to guide this discussion. These source materials are cited as needed in the document.

The following Community Description has been drawn from the 2008 Town of Dennis Open Space and Recreation Plan. It provides information on the town’s population characteristics, historical development and past and present land use patterns. Dennis, as with most of Cape Cod, developed along the water’s edge. As the discussion will illustrate, it is this history that makes addressing Multi-Hazard Mitigation Planning so challenging.

2.1 Community Description

A. Regional Context

Located in the middle or "bicep" of Thoreau's "bare and bended arm" of Cape Cod, Dennis is located 85 (road travel) miles from Boston and 260 miles from New York City. The town covers seven and a half miles north to south and ranges one and a half miles to four miles in width. The ninth largest-area town (of 15) on Cape Cod, Dennis encompasses 20.66 square miles of land area, or 13,645 acres, and is bounded on the north by Cape Cod Bay, on the east by the Towns of Brewster and Harwich, on the south by Nantucket Sound, and on the west by the Town of Yarmouth. Dennis is one of only three Cape towns (Barnstable and Yarmouth, the others) which retains its original "shore to shore" boundaries between Cape Cod Bay and Nantucket Sound. The significance of this, from an emergency management perspective is that the town has two exposed



borders, both of which could require evacuation in a coastal storm event. The two coastlines also tends to weaken the town’s response to a storm event in that the town needs to prepare for a storm on two front lines.

The town is bisected by Route 6 has a total of 22.24 square miles and a land area of 20.61 square miles.

The average high temperature in January is 37 degrees and 78 degrees in July. The normal annual precipitation is about 43 inches.

The coastline is regular and unprotected. Development along the coast is mostly residential and recreational with some commercial development in Dennisport.

B. History of the Community

Archaeological studies in Dennis have uncovered finds rich in Native American artifacts along the Bass River in South Dennis and other water oriented areas of town. Among the artifacts are Mounds indicating the extensive use of shellfish and its importance for subsistence to the earliest inhabitants. Major Native trails followed the riverbanks north and south (on what is now Mayfair Road, the southern end of Old Bass River Road, Main Street through South Dennis) and east-west through town along what is now Route 6A and Setucket Road.¹ The Quivet Neck/Crowe's Pasture area has also been identified as an area of significant Native American cultural resources. A 1698 Survey by John Thacher references "Indian graves" as part of a survey of the boundaries of the land leading to Cole's Pond in East Dennis. Over the years this area has had many Native relics uncovered by hikers and residents.

Dennis was colonized by Europeans in 1639 as a part of Yarmouth within Plymouth Colony. Incorporated as its own town in 1793, Dennis was named for the first pastor of its meetinghouse, the Reverend Josiah Dennis. Dennis had been first settled by English families seeking an escape from religious intolerance characteristic of seventeenth-century England.

The history of the town shows us that the "settlement was usually strung out around the harbor and along the roads that led to it with only a moderate commercial and institutional core at the center."^{1A} This statement pertaining to Cape Cod in general certainly applied to colonial Dennis. In Dennis' case, the harbor was actually the tidal creek landings along the Northside (Sesuit Creek, Chase Garden Creek at Bass Hole, and Quivett Creek). The road was the King's Highway (now Route 6A) and small linear cores arose in Dennis Village and East Dennis.

Along with Sandwich and Barnstable, Dennis (as part of Yarmouth) is one of the Cape's oldest towns. The Old Kings Highway Regional Historic District and the South Dennis

¹ Massachusetts Historical Commission, town map files, Contact Period overlay.

^{1A} Massachusetts Historical Commission, Historic and Archaeological Resources of Cape Cod and the Islands, 1987, p. 90.

Historic District were two of the first approved on the Cape in the 1970s, indicating the affection Dennis citizens have for their gloried past.

Like the rest of early Cape Codders, Dennis settlers were farmers first and fishermen on the side. But as the population grew, and the soils became depleted by forest clearing and windborne erosion, more and more Dennis citizens looked to the sea for sustenance and profit. In the 1700s, Dennis men helped to develop the whale fishery, first alongshore and then far offshore. By 1795, commercial fishing became the dominant industry in town. "The fertile Atlantic and other waters have furnished broad maritime fields of labor in which Dennis has increased its wealth and importance more than in agriculture..."² In the 1800s, a full scale, multi-faceted maritime economy developed in Dennis. Northside sailing packets communicated almost daily with Boston, ferrying Cape livestock and produce, and wharves were built along the Bass River and Sesuit Creek where boatbuilding commenced. Bass River, along with Hyannis and Chatham, were the major Southside ports of the Cape in the early 1800s period.³ Trading brigs sailed between the town and the British West Indies and Dennis sea captains were world-renowned:

Untouched through lack of water-power, by the industrial revolution; neglected alike by foreign commerce and railroad; producing but a fraction of its own food; Barnstable County increased in population and in wealth solely by the skill of its people in farming the sea.^{3A}

By 1840, Massachusetts provided half of the fishery products of the United States⁴ and Dennis was part of that effort, particularly in the cod and mackerel fisheries. By 1863, however, changes in fishing technology favored large cities with packing plants and the last of the Bass River offshore fishing fleet had been sold.⁵ Except for an inshore fishery, Dennis retired from the sea, in league with other Cape Cod towns, whose economy and populations declined through the latter half of the nineteenth century. Downturns in coastal trade, collapse of the whaling industry, and post-Civil War recession were responsible for emigration. Representing yet another early connection between Dennis and its coastline, the town was not only a leader in Cape Cod salt-making (using evaporated sea water to manufacture glauber's and epsom salts) in the 1800s, but had actually "invented" the business in East Dennis in 1776 by Capt. John Sears' innovations.⁶ By century's end, though, that business fell off when inland salt mines in Pennsylvania were developed.

² Simeon L. Deyo, History of Barnstable County, Massachusetts, 1890, p. 515.

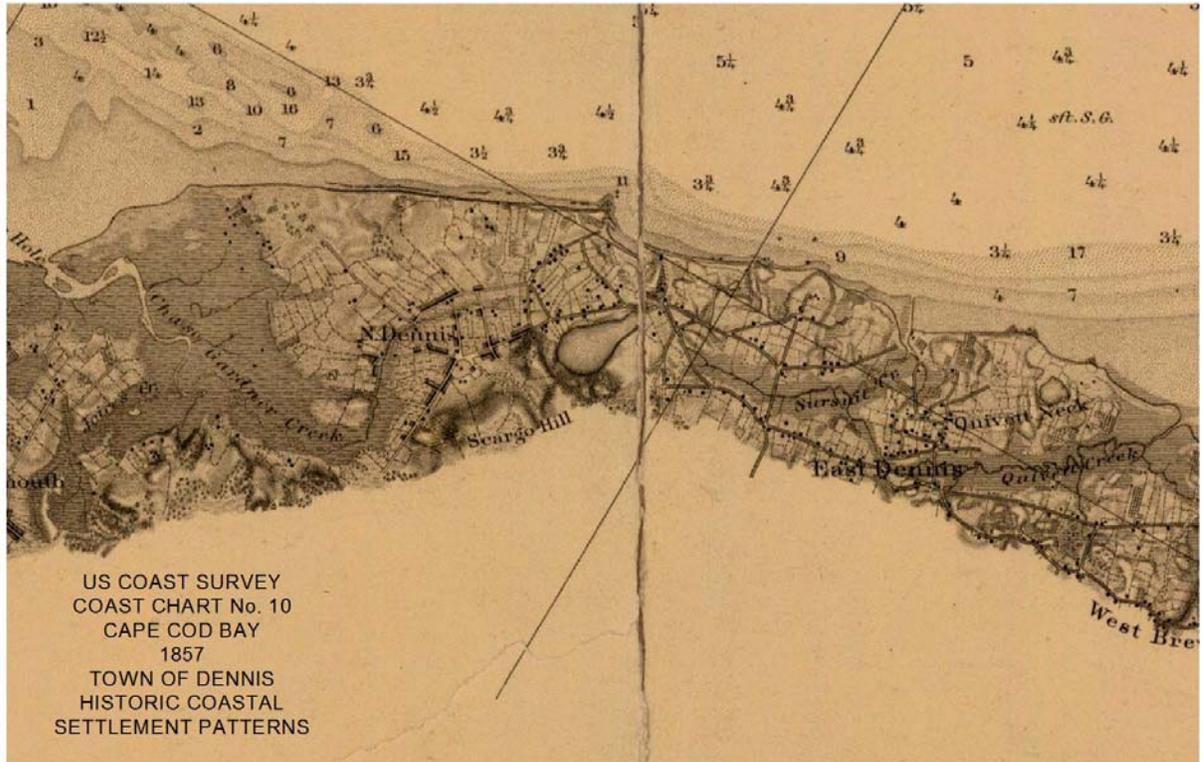
³ Massachusetts Historical Commission, Historic and Archaeological Resources of Cape Cod and the Islands, 1987, p. 96.

^{3A} Samuel Eliot Morison, The Maritime History of Massachusetts, 1783-1860, (1921, 1979), p. 300.

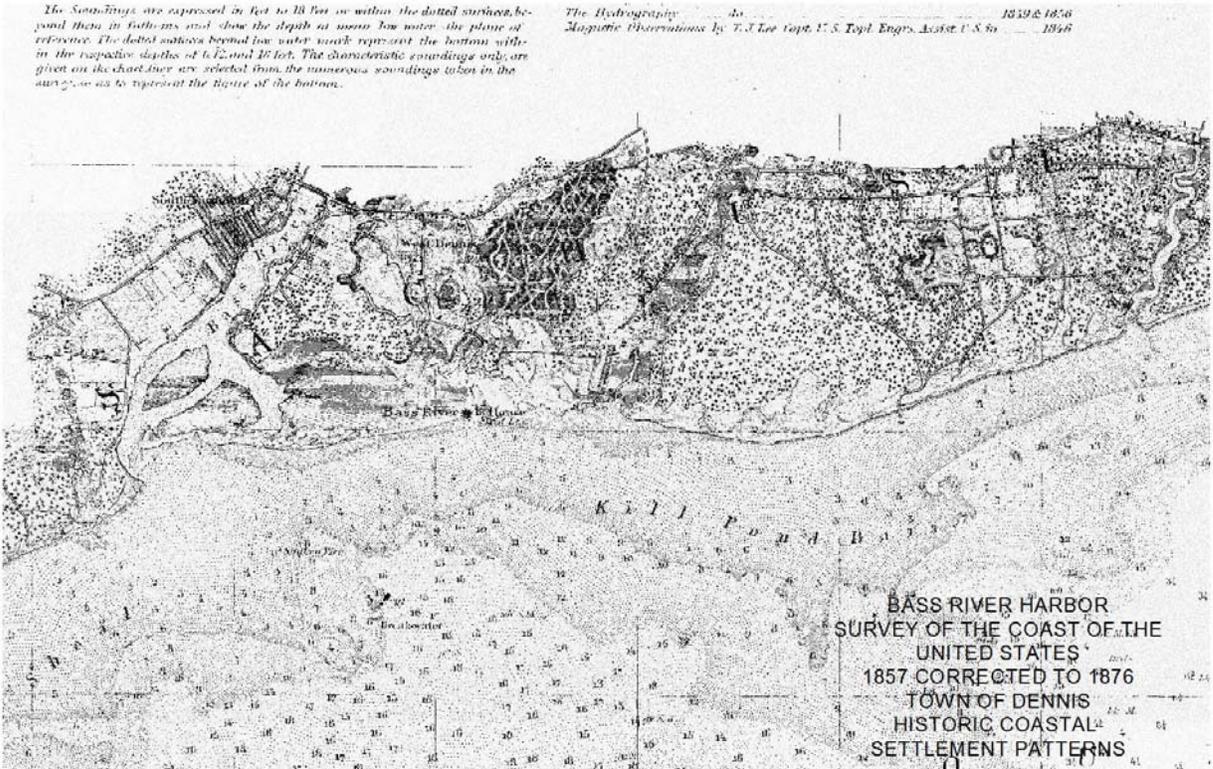
⁴ Simeon L. Deyo, History of Barnstable County, Massachusetts, 1890, p. 138.

⁵ Frederick Freeman, The History of Cape Cod, 1862, Vol. II, p. 179.

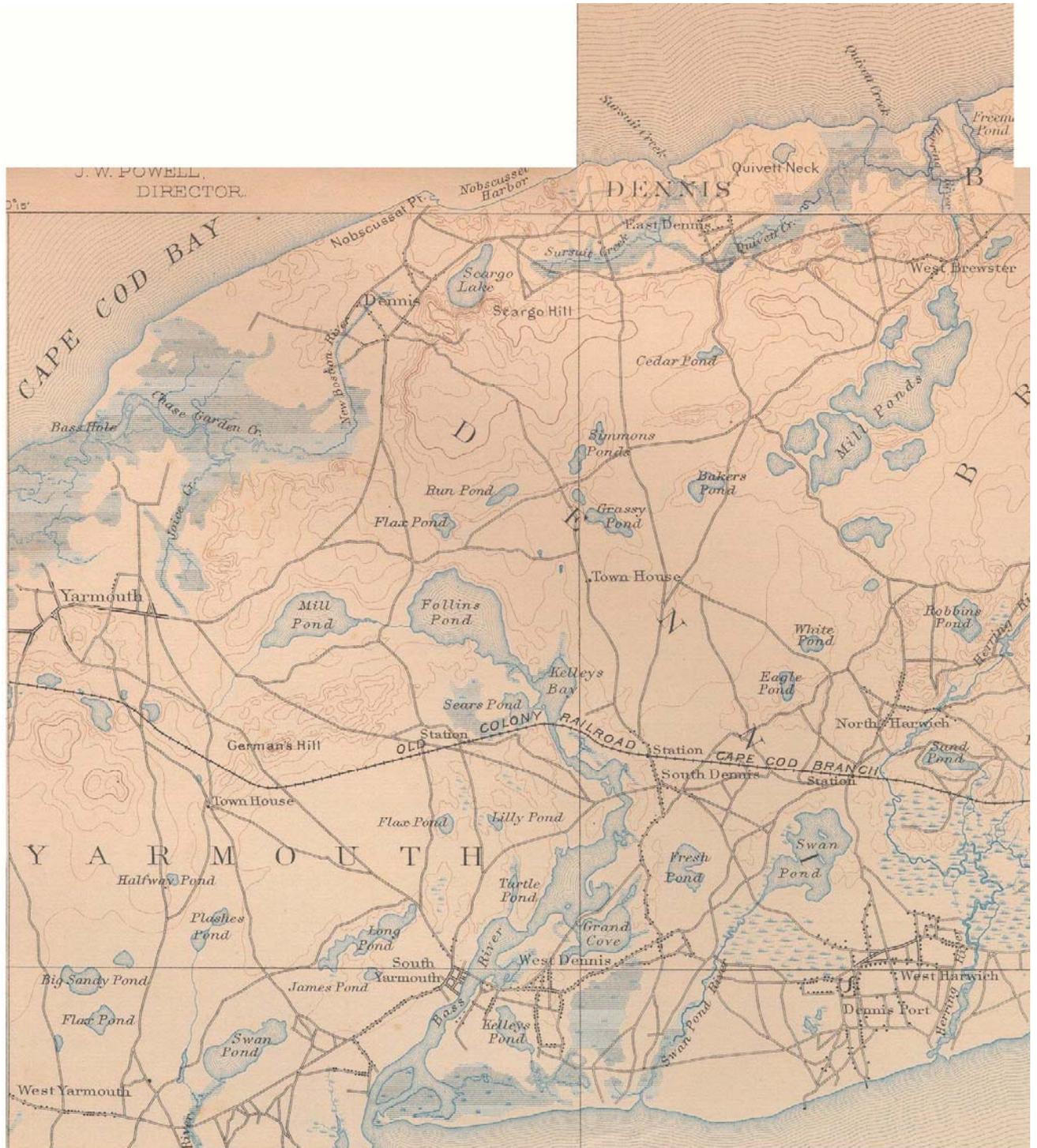
⁶ Deyo, 1890, p. 145 and Freeman, 1862, p. 695.



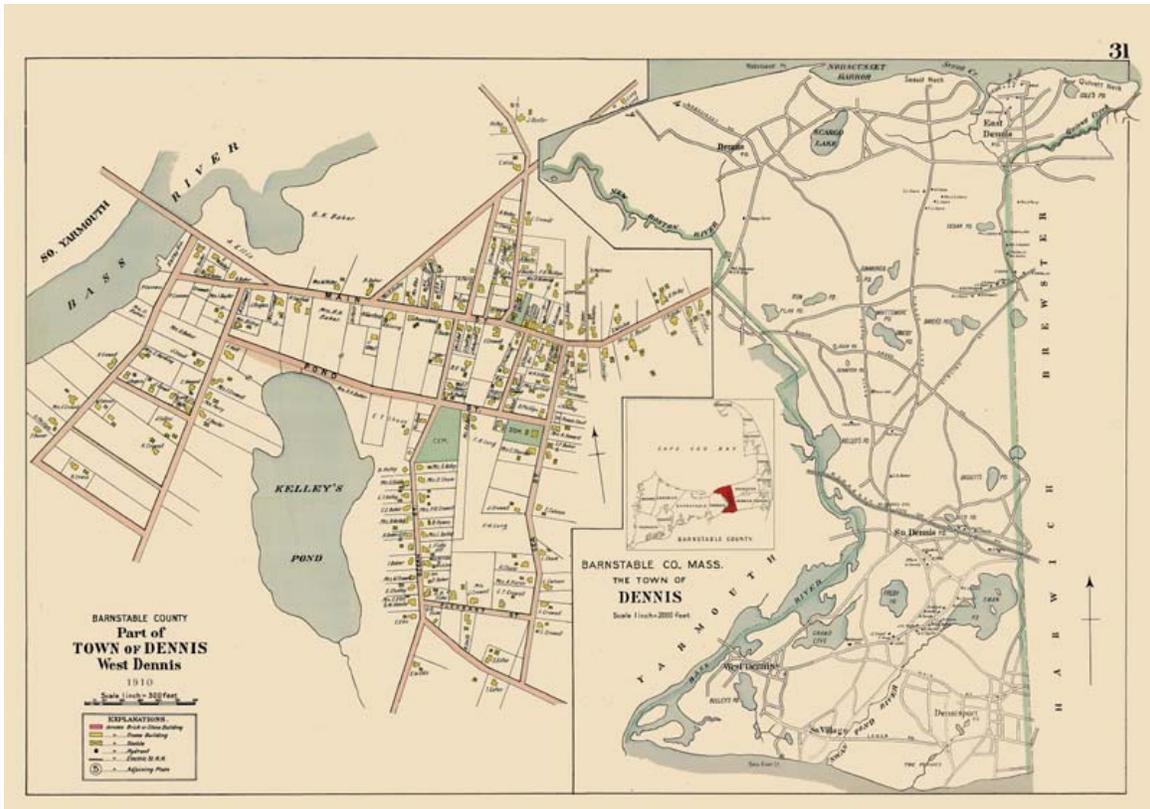
1857 Town of Dennis North Side Settlement Patterns



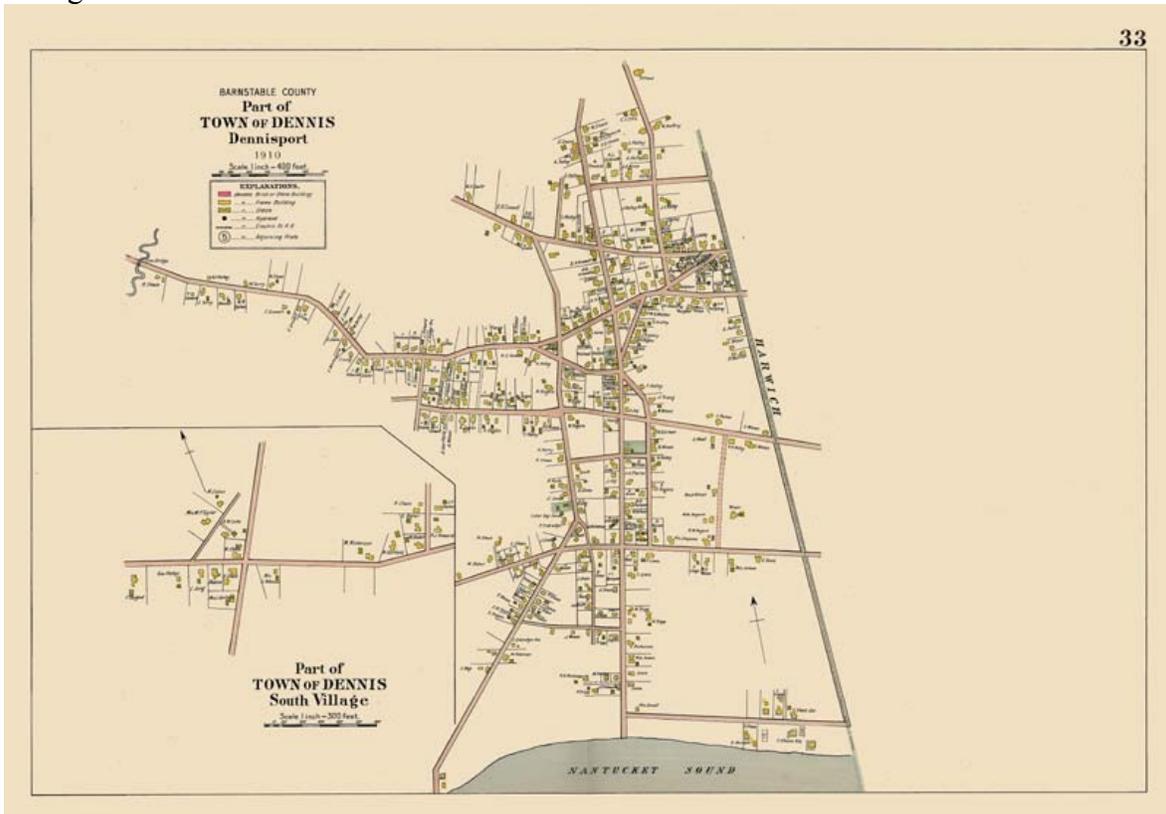
1876 Town of Dennis South Side Settlement Patterns



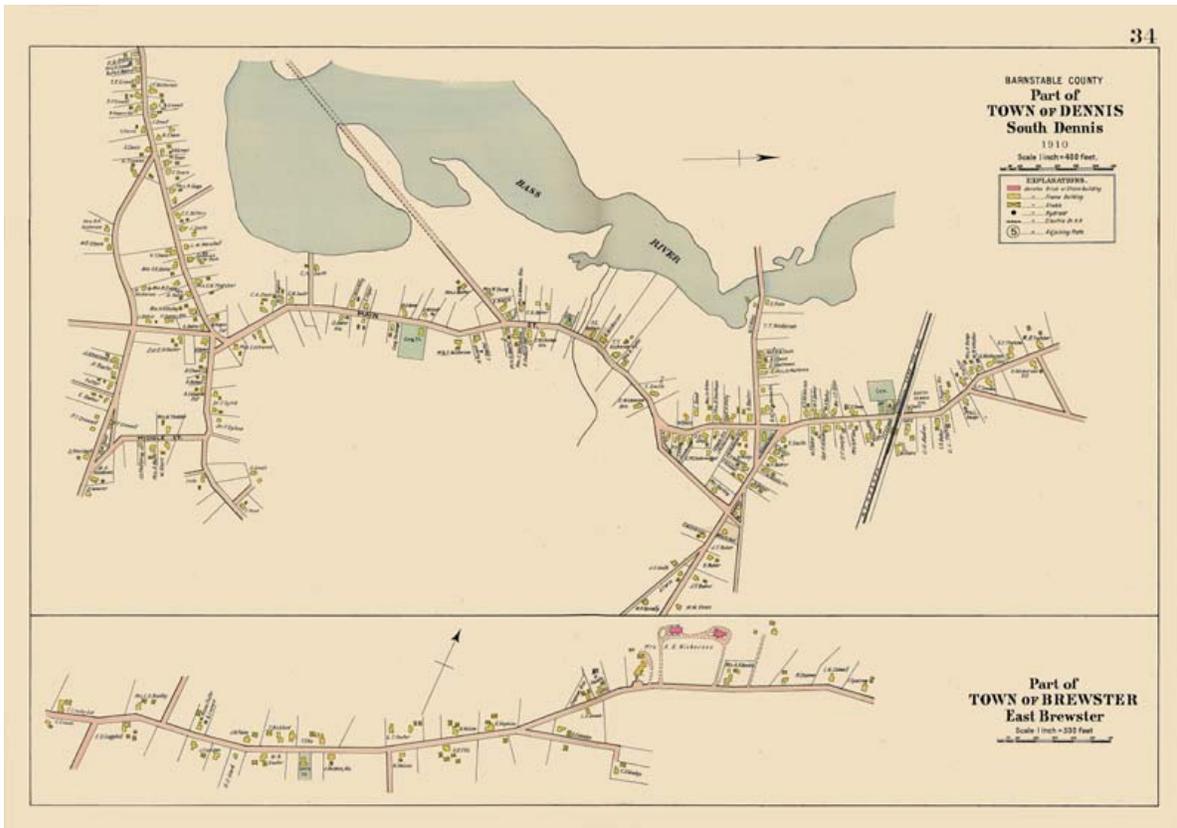
1893 USGS Map of Dennis, care of UNH Historic Map Library



Village of West Dennis 1910



Village of Dennisport 1910



South Dennis Village 1910

Dennis turned back to the land for economic pursuits – pursuits that continued to require Dennis residents to physically occupy the low-lying lands of the town. Cranberrying was introduced at this time as a labor-intensive agricultural enterprise capable of employing sailors and civil war veterans. The 1850s and 1860s were a time of "Cranberry Fever" in Massachusetts and Dennis' 50 acres of planted bogs in 1855 (more than any other Cape town) grew rapidly to as many as 359 acres planted by 1889.⁷ Throughout the nineteenth century, Dennis consistently placed in the top three of Cape towns in cranberry acreage and/or production. "Every known variety [of cranberry] is indigenous to the soil of the Cape, from which the fruit receives an excellence so peculiarly marked as to render the Cape Cod berries the most valuable in market," said an 1890 historian.⁸ Cranberrying altered the environment in many ways: cedar swamps and other wetlands were displaced to make working bogs, dikes were used to impound streams, adjacent banks were mined for sand, and isolated ponds were given artificial outlets and their water levels manipulated with flumes. Very few cranberry bogs remain in Dennis today, compared with its neighbors in Yarmouth and Harwich.

⁷ Joseph D. Thomas, Editor, Cranberry Harvest: A History of Cranberry Growing in Massachusetts, (Spinner Publications, New Bedford MA, 1990); and, Simeon L. Deyo, History of Barnstable County, Massachusetts, 1890, p. 152.

⁸ Simeon L. Deyo, History of Barnstable County, Massachusetts, 1890, p. 149.

By 1858, the Southside of town had a larger population and more business than the Northside. Numerous wharves appeared on the Nantucket Sound shore at Dennisport (then called Crocker's Neck). The railroad extended to Yarmouth by 1854 and ten years later, on through town to Orleans, supplanting sailing as the primary means of transport regionally. Significantly, the railroad, which ran primarily through the Northside of the towns of Sandwich, Barnstable and Yarmouth, arched south through Dennis, perhaps reflecting the commercial importance of the Southside in the town by this time.

For fifty years after the Civil War, Dennis, like the rest of Cape Cod, experienced an economic collapse. Fishing and whaling continued their decline, midwestern farms dominated the national markets and net migration of the population was off-Cape. The permanent population of Cape Cod dropped 20 percent between 1885 and 1895.⁹

The advent of the automobile brought about subtle, but inevitable change. By 1920, Dennis' population began its rebound from nineteenth century decline, as the idea of Cape Cod as a summer *coastal* resort, which was only a germ of a vision to that point, took firm hold:

Fifty years ago only a comparatively small number of persons seeking rest and recreation had discovered the attractiveness of Cape Cod for summer residence...It is only within a score of years, as a result of the introduction of the automobile, the summer population has become so great as to render "the entertainment of summer visitors" an important industry of the Cape.¹⁰

Men found jobs building homes in developments along the southern coastal areas, and the foundation of the tourist economy took shape. By the 1950s, spurred by the post-World War II boom, Dennis' character as a seaside resort was entrenched. Beachfront motels and cottage colonies blanketed the Southside, where warm waters and sandy shores provided excellent swimming and sunning conditions. Route 28 firmly supplanted Route 6A as the town's new linear commercial core, since there was more room for businesses to grow there and it was proximate to the resorts.

Over the past 40 years, many of the former summer tourists have purchased homes and retired to Dennis, producing the largest user group of the Cape's service economy.¹¹ This large and still growing retirement community has produced a greater awareness about "quality of life" issues in Dennis and on the Cape.

⁹ Massachusetts Department of Natural Resources, The Outdoor Recreational Resources of Barnstable County, Massachusetts, 1963, p. 15.

¹⁰ Massachusetts Department of Natural Resources, The Outdoor Recreational Resources of Barnstable County, Massachusetts, 1963, p. 15.

¹¹ Cape Cod Commission, "CapeTrends: Demographic and Economic Characteristics and Trends, Barnstable County - Cape Cod, 2nd Ed.," 1996, p. 8.

C. Population Characteristics

Dennis hosts about seven percent of the county's population (2006 Census Estimates) on five percent of the land in the county. Growth in Dennis, as on the rest of Cape Cod, has been dramatic in the past 45 years. However, using US Census Estimates, the beginning of the 21st century saw a period of stagnant growth in the town. This can largely be attributed to the national economic downturn of this time period and the higher than normal housing costs on Cape Cod due to the large second home market located here.

At the turn of the 20th century, Dennis was home to 2,333 people and fewer than that in 1920 as the off-Cape migration, associated with diminished Cape economic opportunities, continued. As Dennis reputation as a summer resort since 1920 grew, so did its population. Though the town's year round population exploded between 1950 and 1990 (2,499 to 13,864), most of that growth was during the '60s and '70s, not the 1980s when most of the Cape experienced its most recent rapid development boom. In the 1960s and in the 1970s, Dennis grew at a rate almost double that of the Cape as a whole. In the 1980s, Dennis grew at a rate only half that of the rest of the Cape. To some degree, Dennis land boom before 1980 left little land left to develop in the 1980s. Regardless, diminishing private open space and a simultaneous increased demand for year-round outdoor recreation continues to challenge Dennis. In the 1990's, the town's population growth rate once again jumped up to being nearly equivalent to the rest of the Cape. The increase in the 1990's was 15.1% compared to 19% for all of Barnstable County. In real numbers, Dennis exceeded the population growth experienced in both Harwich and Brewster during the 1990's. Much of this growth resulted from the conversion of seasonal housing to year-round homes. This is illustrated in the Census Data for Dennis which illustrates that the total number of housing units actually decreased between 1990 and 2000 (by about 400 units) while year-round occupied housing units increased by about 1,300 units.

In absolute numbers, Dennis summer population swells more than most other Cape towns; the increase is more than four times the year-round population (15,691 to an estimated 62,900).¹² The neighboring town of Yarmouth, for example, grows in summer only two and a half times its winter size. Except for towns within the Cape Cod National Seashore, Dennis experiences the greatest rate of change between winter and summer populations of any town on Cape Cod. This dramatic summer population increase is housed mostly within the areas which would be most at risk should a major storm event occur.

Dennis year-round population (from which the remaining comparisons are drawn)¹³ is predominantly middle-aged, its median age growing significantly between 1990 and 2000 (rising from 44.5 to 49.4 years old). This median age is also older relative to the rest of

¹² Cape Cod Commission, "CapeTrends: Demographic and Economic Characteristics and Trends, Barnstable County - Cape Cod, 2nd Ed.," 1996, p. 19.

¹³ Cape Cod Commission, "CapeTrends," 1996, p. 30.

the Cape's median (44.6 years) and the Commonwealth's (36.5 years). The fastest growing segments of the Dennis population, for growth rates, for the period 1970-2000 are between the 35-44 and 45-54 age brackets. These age groups grew by over 200% in that thirty year period. However, the 65+ age bracket is the fastest growing segment of the population in real numbers, having increased by more than 3,000 people over the last thirty years. Children make up a smaller portion of the overall population than in the past.

The implications of this aged population factor for Multi-Hazard Mitigation Planning are significant. The older population will bring many special needs in the event of forced evacuation. Emergency planning needs to consider supporting many life threatening conditions – provision of emergency generator services for those on respirators or prescriptions requiring refrigeration. Many have converted seasonal properties built long before current flood zone restrictions into year-round housing, placing them, the most vulnerable population, in harm's way.

In addition to having an older population than other Cape towns, Dennis continues to be poorer. Household income in 2000 was \$41,598 for Dennis, the fourth lowest of the 15 towns on Cape Cod. In 2007, 12.6% of Dennis families lived below the poverty level compared to 12.8% in Barnstable County. However, (in 1999 since 2007 estimates are not available) 11.4% of all Dennis residents under age 18 lived in poverty. And, 16.6% of those age 5 and under are living in poverty. Implications of the town's demographics include the need to provide shelters for a diverse population both the very young and the expanding elderly population.

Looking at these numbers in a different way, in 2007 39.8% of the households living in the town of Dennis are considered as either low or very low income households. These households would qualify for subsidized housing under MGL Chapter 40B. In comparison on the county wide basis 38.2% of the households are so classified. Such high numbers of people living in poverty suggest that the town will face a large population in need of shelter. These people will not be able to easily leave their homes and afford to stay in a hotel room for an extended period of time.

The economy of Dennis is still largely dependent upon the tourist trade and servicing retirees. In 2006, the town had 594 businesses, with annual total wages of \$151,008,940, annual employment of 4,760 people and an average weekly wage of \$610. Nearly 42% of those employed in Dennis in 2006 were employed in either retail trade or the accommodations and food services industry. Reflecting the nature of the local economy, health care and social assistance ranked as the third largest employment industry. Stop and Shop continues to be the largest employer in Dennis, the second largest being the Cape Cod Regional Transit Authority, followed by Dennisport Culinary, Eagle Pond Rehabilitation Center, Elder Services of Cape Cod and the Dennis/Yarmouth School System.¹⁶

¹⁶ Massachusetts Executive Office Labor and Workforce Development 2006.

In the past the town has not supported its tourist trade, especially as it relates to its expansion. However, there is growing sentiment that the lack of attention to the needs of the tourist industry is hurting local businesses. This has led to revived interest in determining actions that the town could take to, at least, stabilize the local tourist economy. These actions include looking at ways to modernize the existing tourist accommodations, and to determine whether increase tourist activities can be accommodated without denigrating the natural environment that is held so dear.

People are attracted to Dennis because of its proximity to the water, the views that this proximity provides and recreational opportunities. While the town beaches accommodate a great number of tourists these same beaches will create a significant issue should a rapid evacuation be necessary.

D. Growth and Development Patterns

"You can't kill Cape Cod, and it may be that henceforth we are to see a growth in enterprise and population which will astonish us."

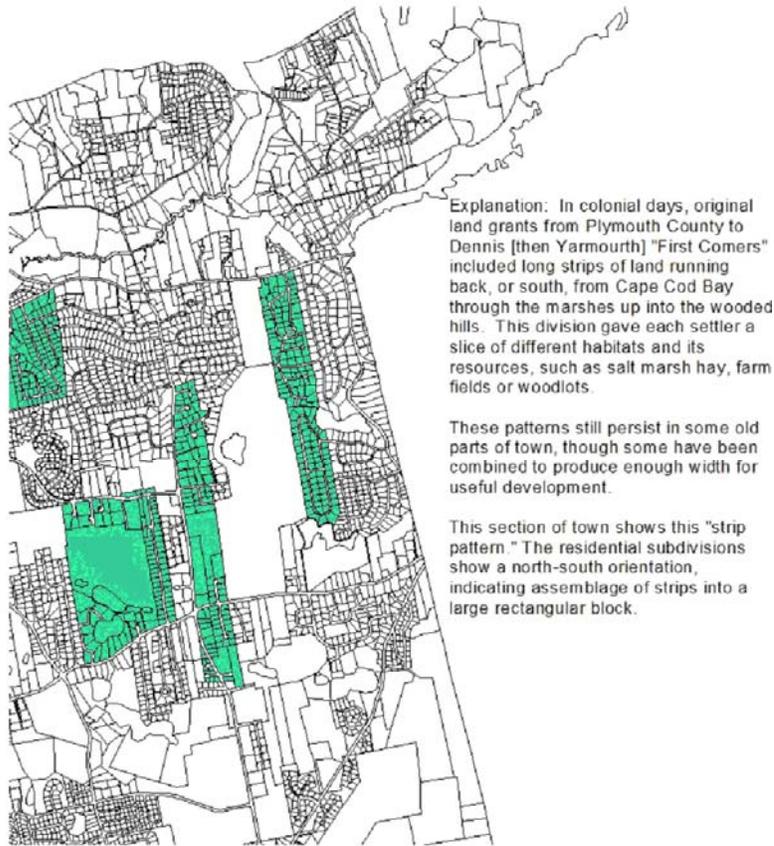
- - George A. Marden, Treasurer, Commonwealth of Massachusetts, 1889¹⁷

Dennis colonists originally divided their settlement into common property and private farming lands. The salt marshes were originally commons used for grazing cattle. Private land typically ran in north-south strips (called "long lots") from the beach back to the moraine ridges. This pattern enabled each colonist to have a slice of different habitat for various land uses: meadows for English hay in the richer soil near the shore, homes and yard gardens along the King's Highway, then pastures and woodlots in the poorer soils and rugged terrain south of the highway.¹⁸ This north-south strip pattern is still relict today in some areas along the Northside.

Year-round, Dennis is a densely developed town, with 766 permanent residents per square mile. In high season, however, Dennis is far and away the most densely populated town on the Cape, as the motels, cottage colonies and second-homes, particularly on the Southside, fill up with "summer folk," guests and tourists. In summer, Dennis "boasts" over 3,000 people per square mile, while its nearest competitor

¹⁷ quoted in "The Celebration of the Two Hundred and Fiftieth Anniversary of the Founding of Old Yarmouth, Massachusetts, September 1889" (Yarmouth, 1889).

¹⁸ Samuel D. Hannah, The Proprietary Lands of Plymouth Colony and Cape Cod, (Hyannis MA, 1980), p. 64.



Explanation: In colonial days, original land grants from Plymouth County to Dennis [then Yarmouth] "First Comers" included long strips of land running back, or south, from Cape Cod Bay through the marshes up into the wooded hills. This division gave each settler a slice of different habitats and its resources, such as salt marsh hay, farm fields or woodlots.

These patterns still persist in some old parts of town, though some have been combined to produce enough width for useful development.

This section of town shows this "strip pattern." The residential subdivisions show a north-south orientation, indicating assemblage of strips into a large rectangular block.

SETTLEMENT PATTERNS

(Yarmouth) hosts less than 2,400.^{19a} Owing to municipal foresight, there are large areas of protected undeveloped land, more so than enjoyed in most Cape Cod towns. About thirty percent (4,065 acres) of the town's land mass has been set aside as protected open space for wellfields, conservation land and beaches.²⁰ The town continues to vigorously pursue opportunities to purchase open land, since the adoption of the 2003 Open Space and Recreation Plan the town has acquired an additional 121.89 acres of open space through private donations, Community Preservation Funds, and State Self Help and Urban Self Help funds. Dennis made Cape Cod conservation history in 1967 by getting the first townwide land acquisition program approved overwhelmingly by town voters.

The Town of Dennis has worked aggressively to protect its small town atmosphere while recognizing the need for economic growth. The town has undertaken a number of zoning initiatives to promote a balanced growth that addresses protecting natural, historic and

^{19a} Cape Cod Commission, "CapeTrends: Demographic and Economic Characteristics and Trends, Barnstable County - Cape Cod, 3rd Ed.," 1996, p. 42 & 19.

²⁰ Analysis for this report by The Compact of Cape Cod Conservation Trusts, Inc.; see Section 5 for inventory

cultural resources, while recognizing the need for job, housing and tax base growth. Examples of these initiatives include the significant down-zoning that occurred within the Crowe's Pasture area as part of the town's District of Critical Planning Concern effort, down-zoning a portion of the West Dennis Village Center waterfront area to protect the area for recreational and water oriented land uses, the creation of two mixed use village development districts and restrictions on formula businesses to protect community cultural characteristics over national standardization.

In terms of existing infrastructure, there is no sewer service in Dennis. While the town is in the process of developing its Comprehensive Waste Water Management Plan, the timing of this effort makes it unlikely that any sewer services will be in place during the five-year scope of this plan. All septage is pumped and transported to the treatment facility built in Yarmouth in 1992. The Dennis town landfill has been closed. This land mass sits as open land that may meet future town recreation needs as a golf course or similar type of use. A solid waste transfer station continues to operate, sending trash to the SEMASS waste-to-energy plant in Rochester, Mass.

Town roads connect most areas and their long-established pattern leaves few areas of Dennis far from public roadways, so there are very few "landlocked" parcels. Dennis cannot rely on inadequate roads to prevent growth; and the roads will only suffer more traffic.

Town water service extends throughout town and all but a small portion of the homes in town are served by public water lines. Since Dennis relies on ground water for all of its drinking water supply, there is anxiety about this issue in the town. Expanding the quantity of the water supply is not as much a problem in Dennis as is assuring the continued high quality of the water. Rising nitrogen levels have been found in some wells, indicating that overdevelopment of some parts of town has caused water quality to deteriorate.²¹ The town could use a nitrogen loading formula to determine development impacts on receiving waters, but no moratorium or cap on building permits has ever been implemented. At present, strong local Board of Health and Conservation Commission regulations are in place to help address water quality issues but these regulations are dependent upon state technology approvals for nitrogen treatment. The town is in the environmental permitting process of developing a water treatment facility.

Most of the town is zoned for residential use with a minimum lot size of 40,000 square feet (a "builder's acre") except for long-settled areas, such as along the Dennisport shore, where many smaller lots are still buildable owing to the zoning protection known as "grandfathering". Two-thirds of the land north of Route 6A is zoned for larger lots (60,000 square-foot minimum), reflecting the still-rural flavor of the area and its historic integrity. At the start of 2008 there were about 14,549 housing units in Dennis (2000 census figure plus new dwelling units added less demolitions permitted by the Building Department). If the town were to fully build-out by zoning standards, Dennis could have

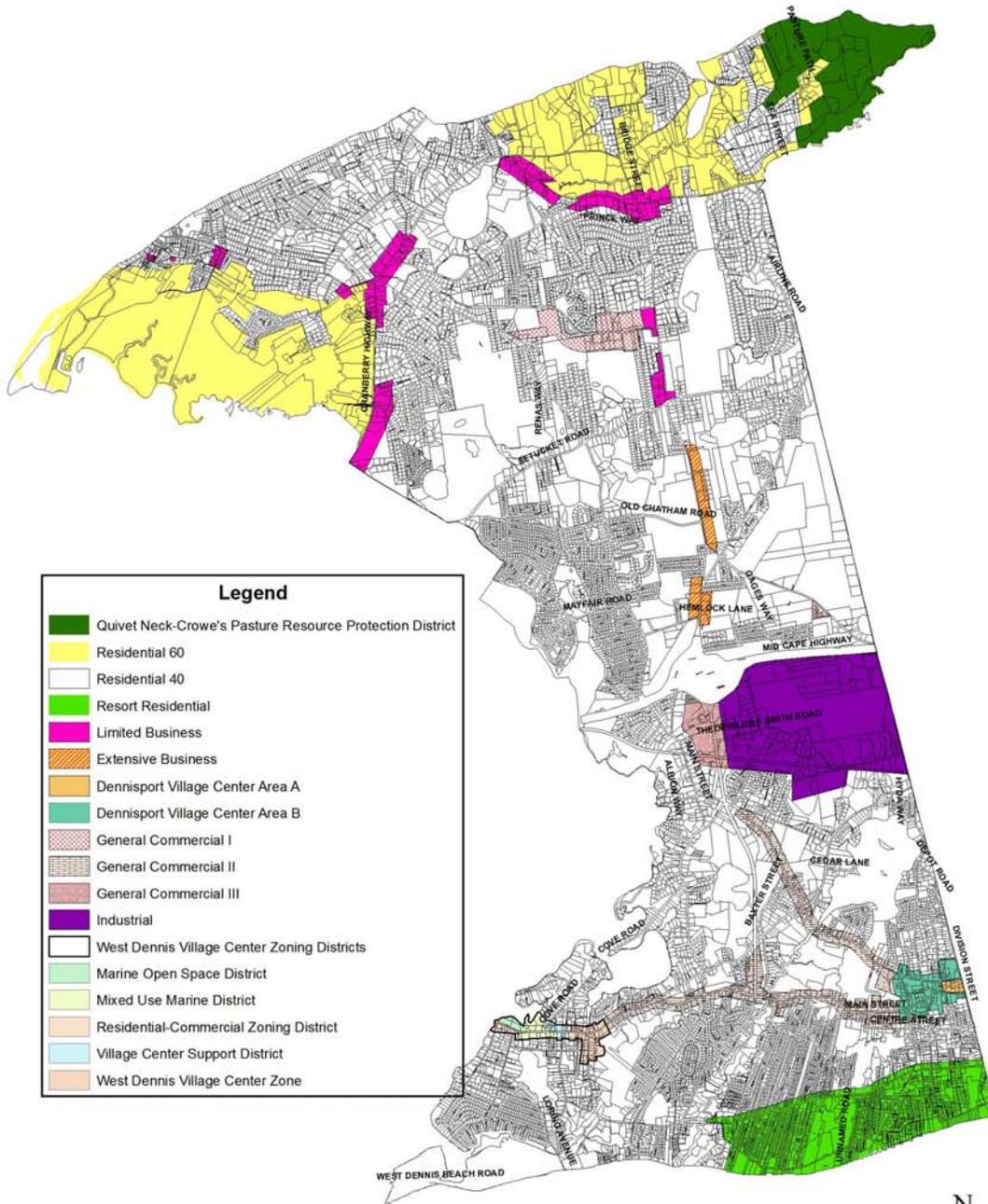
²¹ Cape Cod Commission, Monomoy Capacity Study: Summary Report, July 1996, p. 52.

14,882 units.^{21a} (Other towns in the Monomoy Lens study area are only 65 to 75 percent "built-out," while Dennis has already achieved 97 percent or more of its residential development potential.)

The industrial zone, which includes the town landfill, extends south of Route 6, east of Route 134 and north of Great Western Road. This location removes it from residential areas, but, intrudes into the virgin woodlands around Eagle Pond. Much of the recharge area to Public Supply Well #13 by Swan Pond is overlain by the industrial zone and the landfill and this well has been abandoned, eliminating the last public water supply source south of Route 6 in Dennis. The Dennis industrial district contains a variety of uses, including mining, solid waste disposal, resource reclamation, contractor's businesses, warehousing and intensive recreational uses. In the past the Open Space and Recreation Plan has noted that the town had an inordinately large capability to accommodate more industrial development relative to other towns in the Monomoy Lens study area (Dennis to Orleans). The plan noted that only ten percent of its three million square feet of industrial build-out potential had been used so far.^{21b} However, this statistic is misleading. A significant land mass is inaccessible, between the Town of Dennis Land Fill and Route 6, and much of the land fronting on Great Western Road is used at it maximum intensity, albeit in a non-structural fashion. The land use map illustrates that in fact nearly half of the non-town owned land in the Dennis Industrial Zone is used for commercial purposes, and nearly 80% of the industrial land with roadway frontage is so used.

^{21a} Cape Cod Commission, Monomoy Capacity Study: Summary Report, July 1996, Fig. III-4.

^{21b} Cape Cod Commission, Monomoy Capacity Study: Summary Report, July 1996, Fig. III-4.

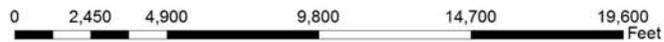


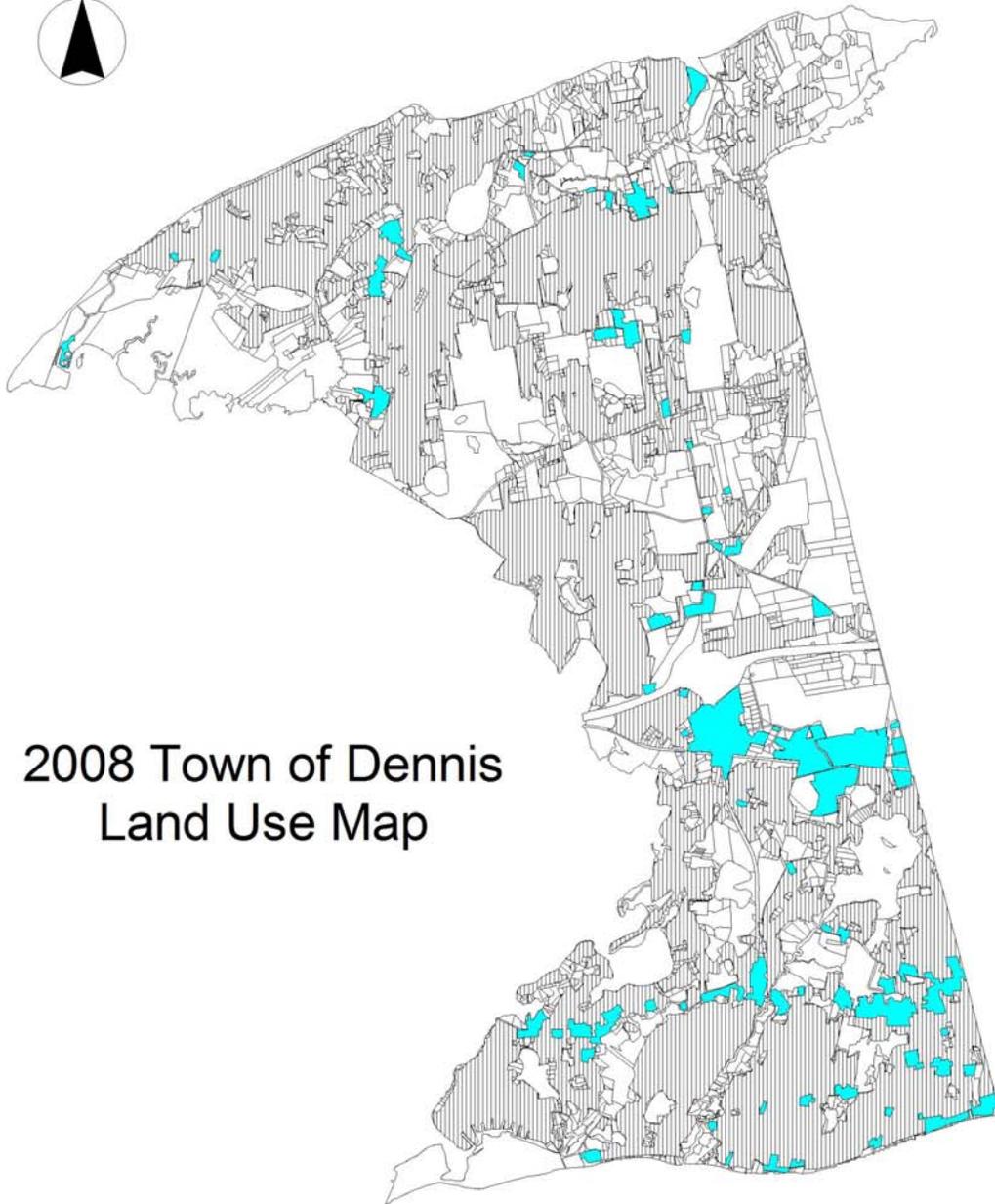
Town of Dennis Zoning Map

September 24, 2007



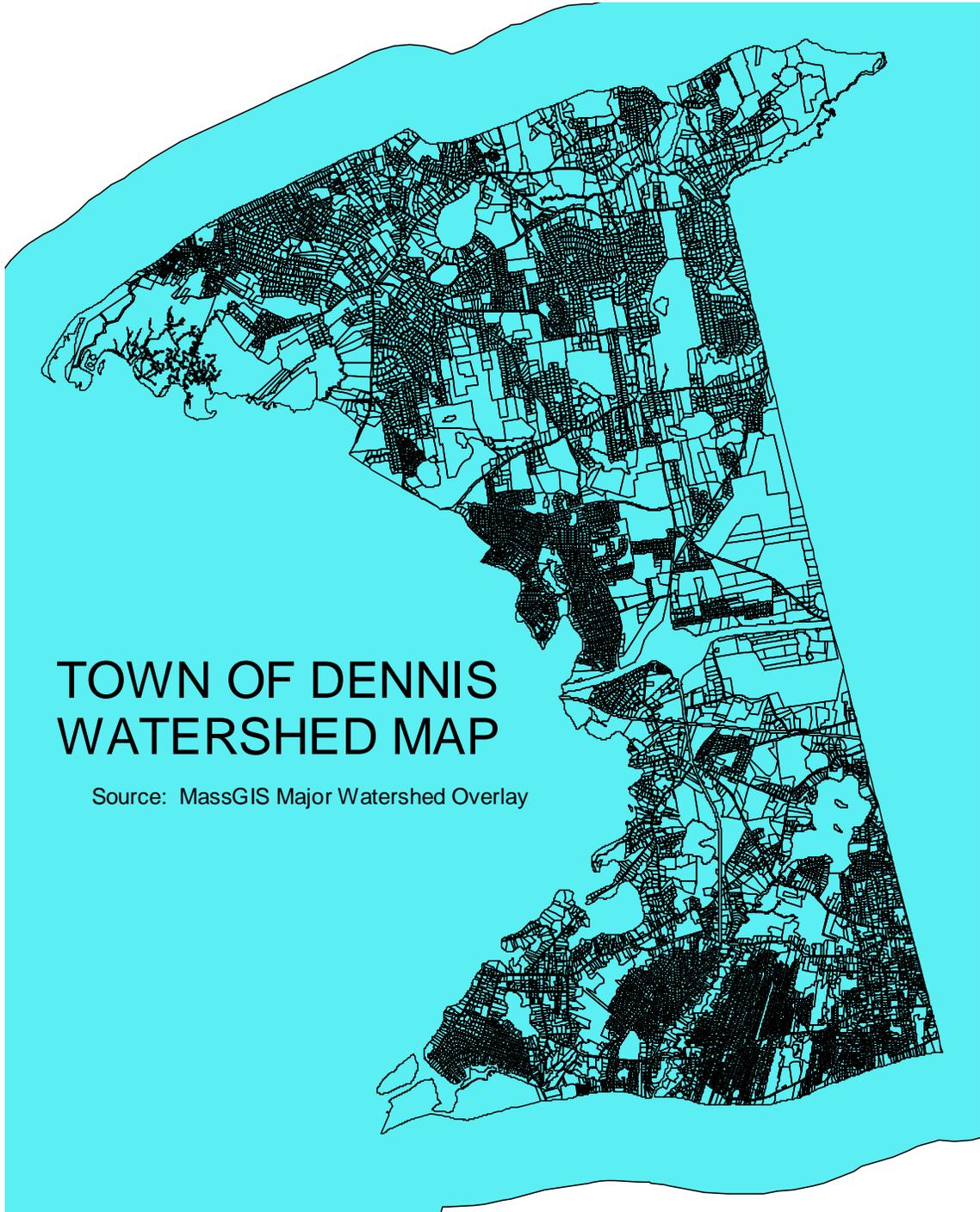
As Amended At The October 16, 2007 Special Town Meeting





2008 Town of Dennis Land Use Map





TOWN OF DENNIS WATERSHED MAP

Source: MassGIS Major Watershed Overlay

-  Parcel Lines
-  Cape Cod Watershed



Business and commercial zones follow Route 28, parts of Route 6A and Hokum Rock Road, and portions of Route 134. As of 2008, approximately 665 acres of land are developed for commercial or industrial land uses and 6,091 acres are developed for residential uses. These 665 acres of commercial and industrial land contain, according to the Dennis Tax Assessor's Office, about 2.1 million sf of floor space, about 200,000 sf of this developed over the past 10 years. At full build-out of the commercial zones there could be 5.5 million square feet.^{21c}

There are few places immune to development in Dennis, except wetlands, and even here emerging septic technologies may threaten them. The town must assume, therefore, that development will continue to consume open spaces throughout town. Since physical impediments no longer remain as a limiting factor, community planning and strong community actions must be used to manage growth.

One result of development's spread throughout town is that at least everyone is aware of it. People feel more threatened by the foundation being poured next door than the twenty units hidden in the woods over on the far side of town. Fueled by the anxiety over open space loss in the last two decades, Dennis voters have approved many town purchases of open space and has adopted, first, the Cape Cod Land Bank and now the Community Preservation Act to fund the acquisition of priority open areas.

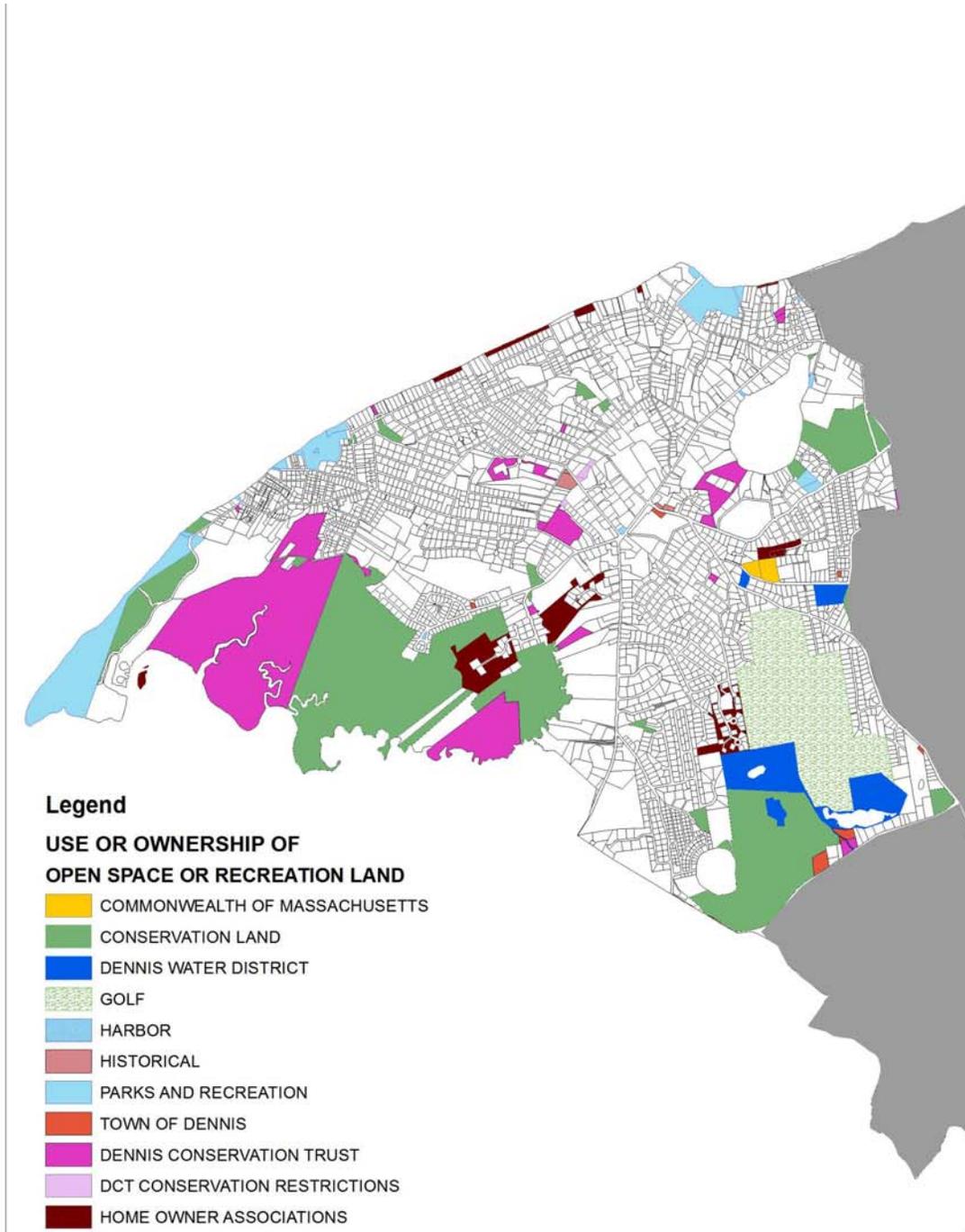
In addition to town-wide growth patterns, it is useful to analyze village development trends because Dennis is a large town in area and facilities that may serve the needs of one village may simply be too distant to be readily available to use by residents of other villages. Dennisport, except for one large tract that had been used for a private recreational facility, has few tracts remaining for development and can be considered essentially "built-out" relative to the rest of town. This particular parcel, known as Sea View Park, was recently acquired by the town. As the last major piece of open space in Dennisport, this parcel became a priority to the town for protection. Sea View Park includes lands within the Velocity Zone at Metcalf Beach as well as lands that are of significant importance for flood control located within the A Zone. The town, upon acquiring this property removed significant impervious areas on the site, thereby reducing site run-off and increasing the sites ability to serve as a flood protection area. In addition to Sea View Park the town and the Dennis Land Trust have acquired many flood prone properties located along the Swan River. These areas serve both as prime habitat areas as well as for flood storage.

West Dennis likewise has few remaining large tracts except for undevelopable Weir Creek wetland parcels; some Grand Cove estates could be broken up into smaller building lots. Both Southside villages, developed into tiny lots during the first wave of growth between 1950 and 1970, nevertheless have pockets of historic homes and whole streets exhibit a quiet ambiance during the winter when many homes are empty. The town has recently acquired several waterfront parcels in West Dennis. The most

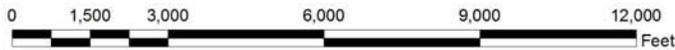
^{21c} Cape Cod Commission, Monomoy Capacity Study: Summary Report, July 1996, Fig. III-4.

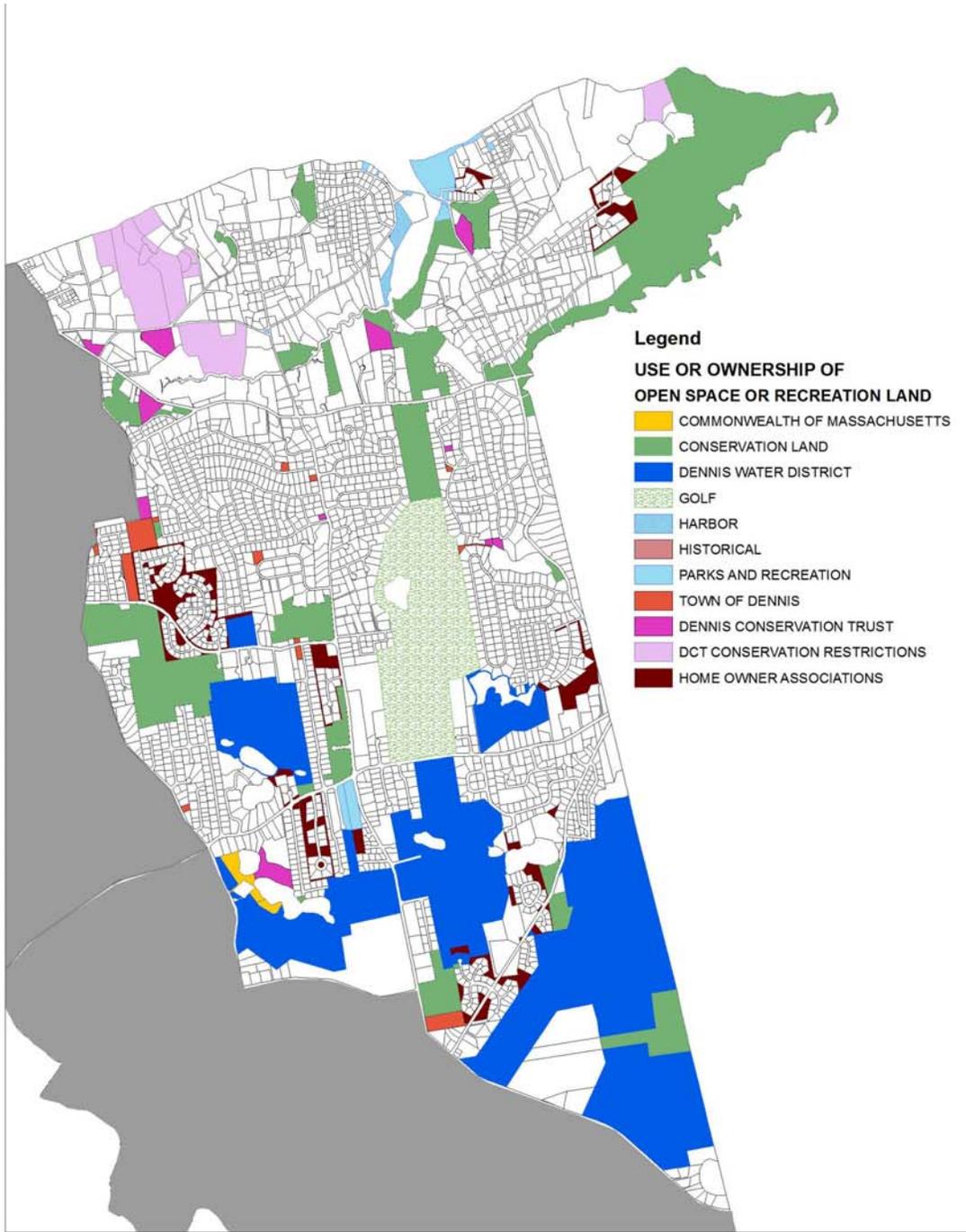
significant town parcel in West Dennis continues to be the West Dennis Beach property. This barrier beach provides significant protection to residential properties located in the “Fingers” section of West Dennis. The town also has many parcels along the Bass River including Bass River Park, another example of town actions to remove development from within the flood zone and to restore the site to more natural, pervious conditions.

Heavily developed along its western perimeter, South Dennis contains the greatest potential for more large subdivisions, as soon as title and access problems are clarified to the interior woodlands east of Route 134. Land protection for the woodland backdrop to the historic homes along the streets in the South Dennis Village Historic District should be a priority. In this regard, the Dennis Conservation Trust purchased two wooded commercial lots in 1995, which were visible from Liberty Hall. The Open Space Maps in this section illustrate significant waterfront land holdings in all the villages, South Dennis is no exception, even though it has the least amount of flood prone lands, it provides major waterfront areas such as the Indian Lands, lands around Fresh Pond and Grand Cove.



Town of Dennis Public and Quasi-Public Lands Dennis Village

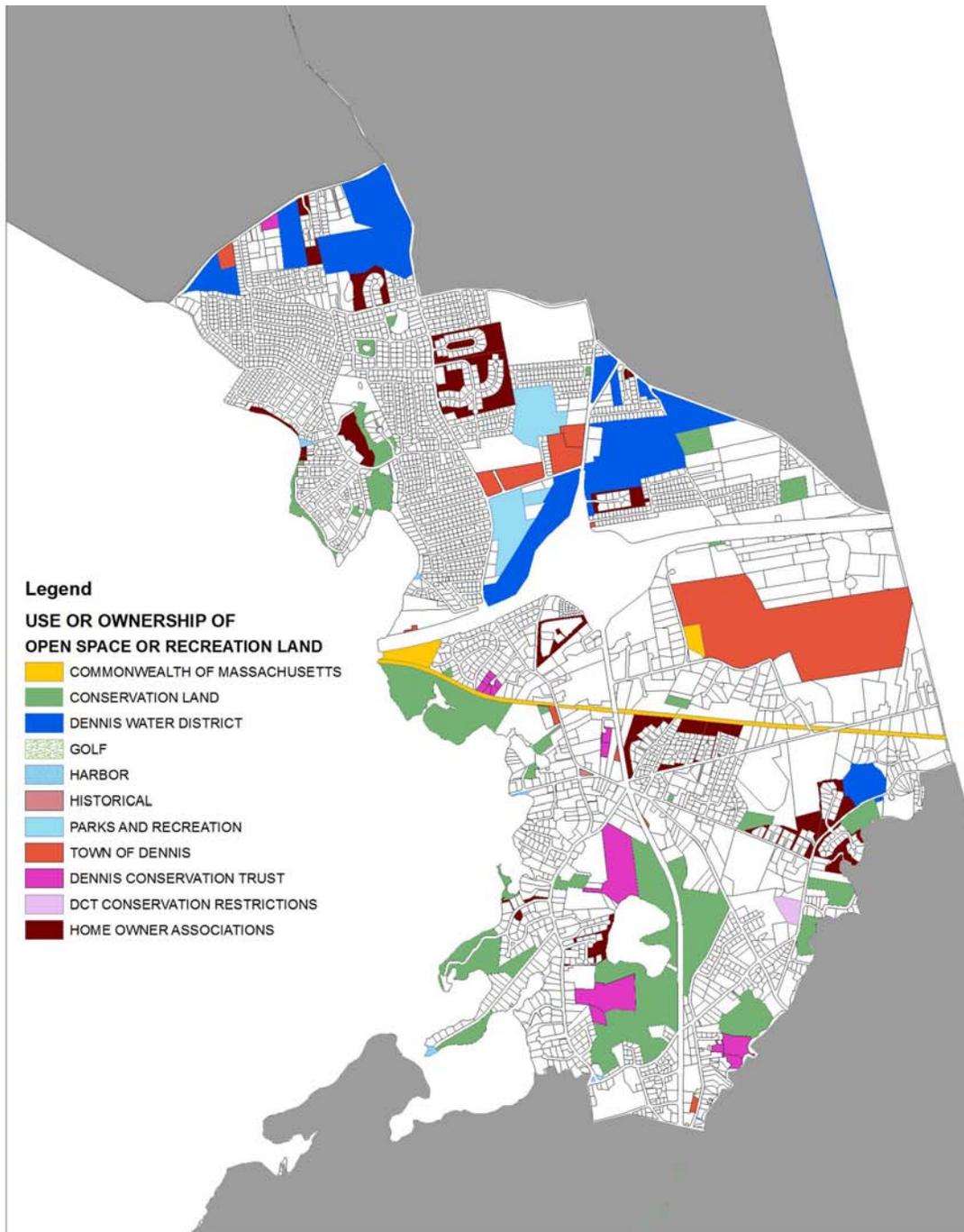




Town of Dennis Public and Quasi-Public Lands East Dennis Village

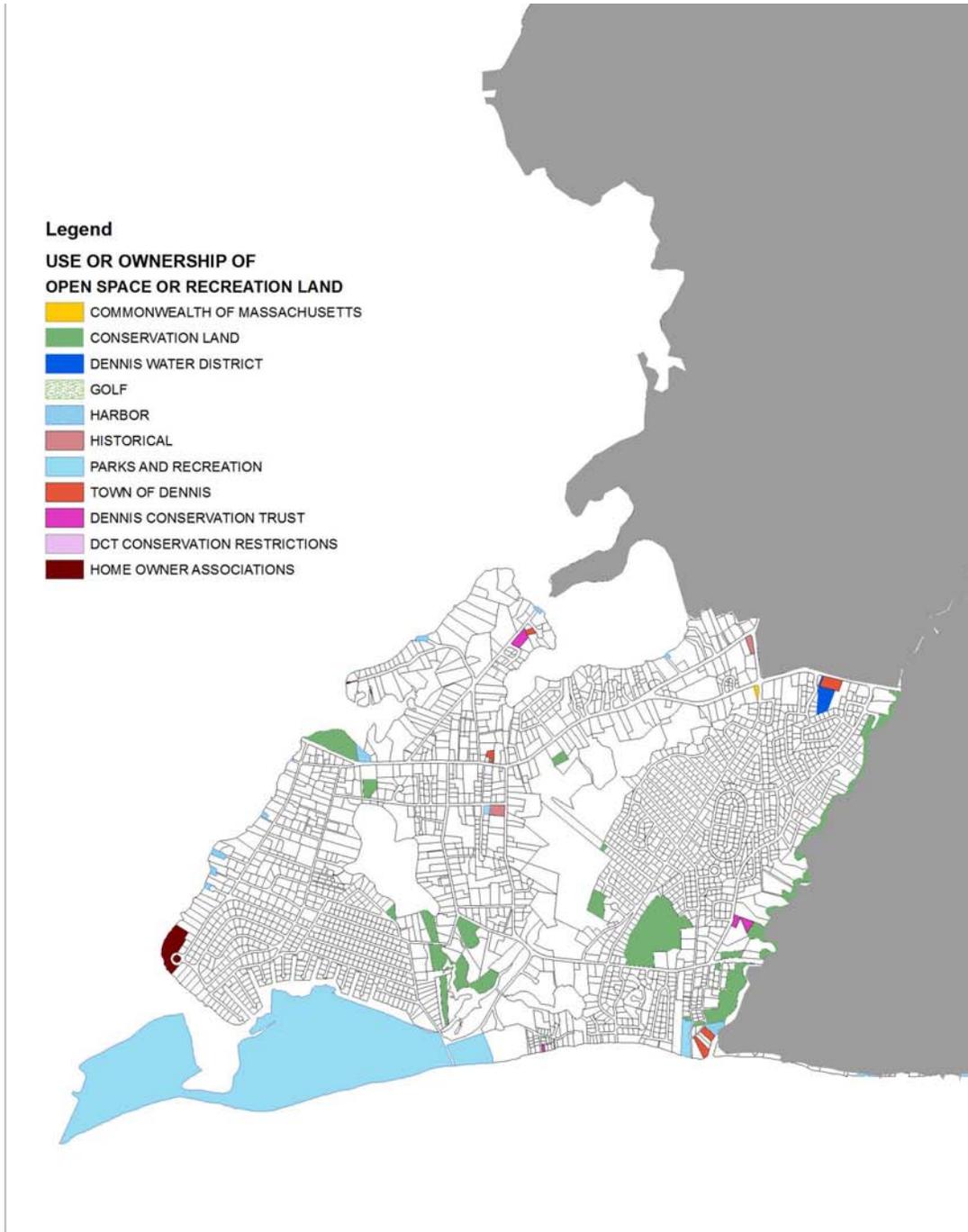
0 1,400 2,800 5,600 8,400 11,200 Feet



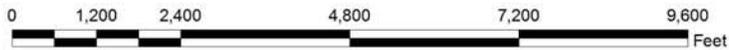


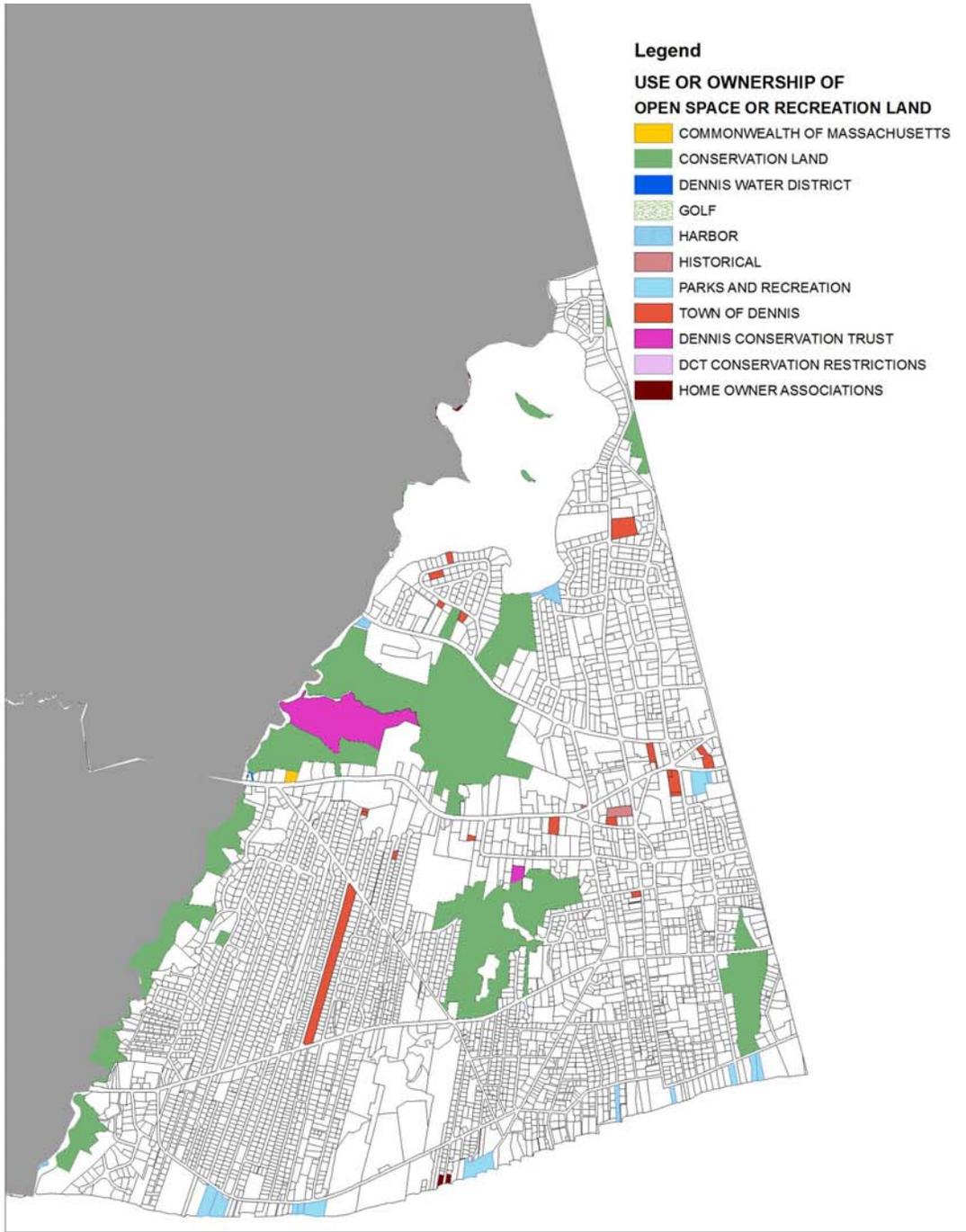
Town of Dennis Public and Quasi-Public Lands South Dennis Village



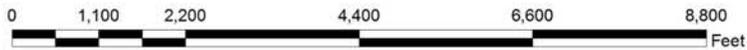


Town of Dennis Public and Quasi-Public Lands West Dennis Village





Town of Dennis Public and Quasi-Public Lands Dennisport Village



The Northside villages (Dennis and East Dennis) exhibit both some of the most rural patterns of development (large estates on Sesuit and Quivett Necks) and some of the most suburban patterns (acre-lot, grid subdivisions popular in the 1970s, such as near Black Ball Hill and Scargo Heights). The fate of the Northside depends on the retention of enough large estates to retain the rural character of the area. Within the Northside villages, the town and the Conservation Trust have also protected large, fragile sites. Sites, which are prone to flooding, erosion and wave action. Vast areas of the Chase Garden Creek marsh area has been permanently protected, many coastal beaches across the north side are also under town control, major protected land holdings have also been acquired along Sesuit Creek and the town (with state and Conservation Trust assistance) more recently has acquired significant land holdings within the Crowe’s Pasture coastal area.

The population in the five planning districts should, eventually, tend to be more equivalent, as the Northside continues to grow and West Dennis finishes up in its development, though Dennisport will probably always lead in density.

Table 2 **Housing, 1990 - 2000, by Village** ²²

	1990	2000
Dennisport	3,773	4,103
West Dennis	2,634	2,510
South Dennis	2,423	2,626
Dennis	2,247	2,457
East Dennis	2,007	2,409

Beyond the spatial considerations of development in Dennis, there is also a temporal component. The fact is that in each decade since 1960, housing units in Dennis are becoming increasingly used year-round. Factors accounting for this use expansion have not been documented, though anecdotally it would appear that more people are now retiring year-round to what was their Dennis *summer* home. Also, more people are able to support themselves year-round on the Cape as the economy becomes more year-round. And, finally, online services and their companion advances in communications technology enable some people to "telecommute" year-round from what was their summer home.

Whatever the cause(s), summer-only occupied housing units in Dennis have declined from 79 percent in 1960 to 48 percent in 1990, and 42.7% in 2000, even as the raw number of units has grown steadily. Since Dennis is mostly “built-out” now, the more crucial impacts on storm water management, flood control and emergency evacuation are as likely to come from seasonal to year-round conversion of existing housing stock as from more development in general. Currently, the town regulates the conversion of cottage colonies (three or more seasonally occupied units) by requiring they be

²² Cape Cod Commission, "CapeTrends: Demographic and Economic Characteristics and Trends, Barnstable County - Cape Cod, 3rd Ed.," 1996, p. 42. (The census tracts used for this table do not perfectly coincide with the village boundaries used by the Town of Dennis, but the differences are statistically insignificant.)

supported by 40,000 sf per unit before conversion to year round housing is allowed. These cottage colonies represent only a fraction of the seasonal housing in Dennis. The conversion of existing seasonal homes on individual parcels could double the population of town, without any increase in land consumption – except perhaps larger building footprints and more impervious surfaces. However, this population change would dramatically increase the demand for town services – especially in the event of a hazard, without generating any increased tax revenue.

Table 3: Population

1990 Census	2000 Census	2007 Census Est.	2000-2007 Difference	% Change	Population Projections
13,864	15,973	15,473	- 500	-3.13%	2010 – 17,695* 2020 – 19,811*

* Projections taken from the Massachusetts Institute for Social and Economic Research.

Table 4: Dennis Land Use Percentages*

• Open Space/Conservation	• 4,065 acres (29.8%)
• Residential	• 6,091 acres (44.6%)
• Commercial/Industrial	• 665 acres (4.9%)
• Other (Wet, Undeveloped, Undevelopable)	• 2,824 acres (20.7%)
• Total Acres	• 13,645 acres

Area calculations taken from the Town of Dennis GIS datalayers as maintained by the Dennis Planning Department, Dennis Board of Assessors and other available data sources.

The terrain of the town consists of rolling land, with elevations varying from sea level along the coast to approximately 160 feet the highest land point on the mid-cape. The highest points are found on Scargo Hill.

2.2 Historical damage and natural events:

Because of Dennis's location on the ocean between Cape Cod Bay, and Nantucket Sound, it is at high risk for hurricanes and other types of severe storms which carry high winds and heavy precipitation; especially coastal storms. This, combined with the fact that over 25% of Dennis's land area is low-lying makes it also highly vulnerable to flooding. Storm events, weather hurricane or blizzard are the most likely natural hazards facing Dennis. These types of events are far more “predictable” however, than other natural hazards. For instance, tornadic activity provides far less warning, so while the likelihood of a water spout off of West Dennis Beach may be minimal, the potential for loss of life could be far greater.

Flooding

Dennis participates in the National Flood Insurance Program, which requires that new shorefront development meet engineering standards for floodproofing, but does not prohibit development. Flood velocity zones, or V-zones, are land areas where storm surge or direct wave action occurs. A 1988 analysis by the Massachusetts Coastal Zone Management Office found that in the 1970s, Dennis had more structures built in the velocity zone than any other Cape Cod town except Bourne and Falmouth. About 124 buildings are clearly located in the V-zone (looking at the 2005 aerial photograph and the latest FEMA flood zone mapping), primarily between West Dennis Beach and the Swan River, portions of Dennisport and Chapin Beach. In addition to these homes, several hotel structures also appear to be located within the Velocity Zones. Hurricane Bob and the 1991 Halloween Storm damaged some houses along the Southside. State and local wetlands protection legislation should help prevent future development in this high hazard area.

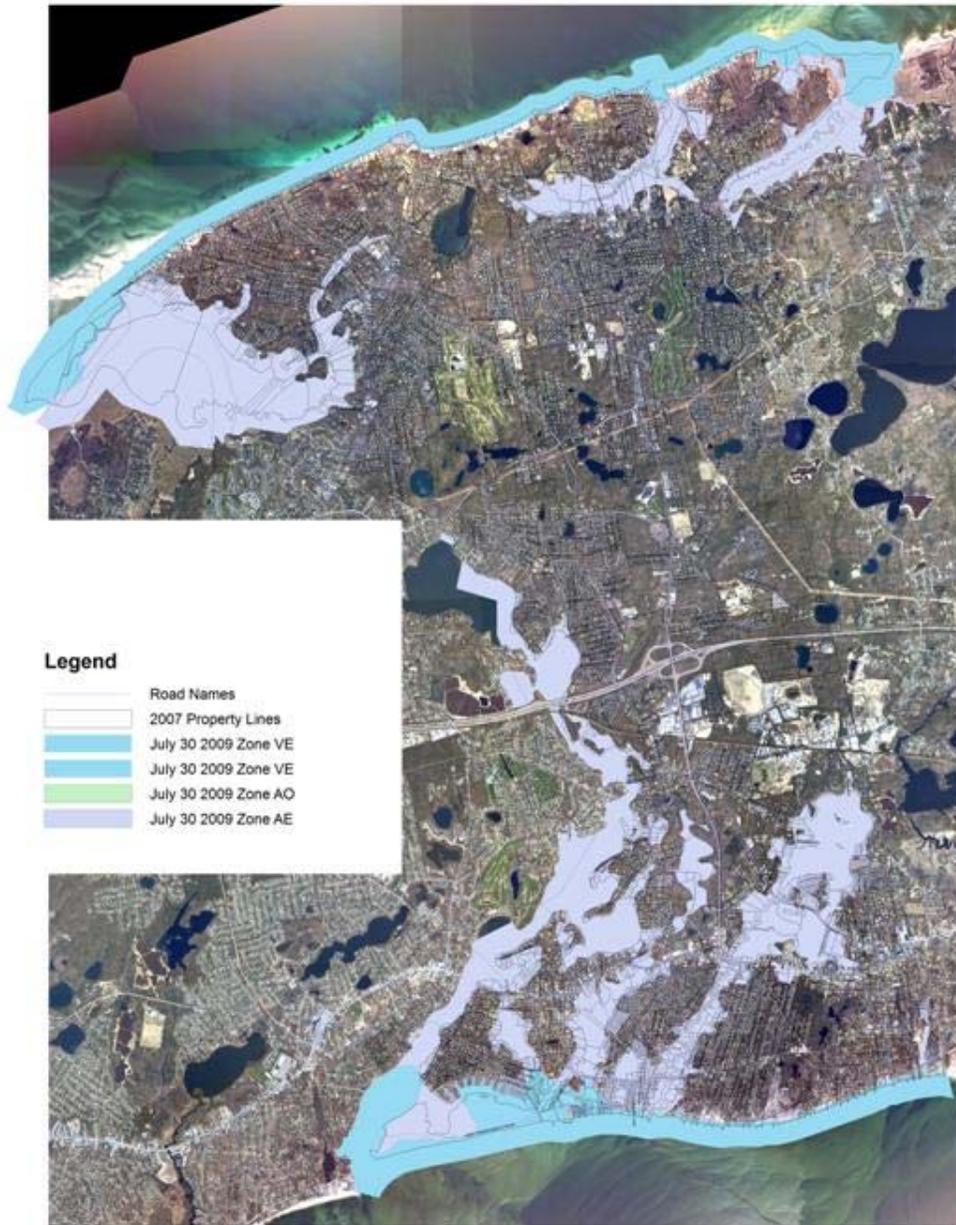
Landward of the velocity zones are other flood-prone areas (A-Zones) in which standing waters can be expected during 100-year storm events. These areas consist mostly of salt marshes and shorefront uplands up to about the 13-foot contour. Both commercial and residential developed areas, including portions of Route 28, occur in the A-Zone.

Looking at the 2000 US Census, the Town of Dennis had approximately 360 people living within the V Zone. The Census data also reveals that there were approximately 4,727 people living within the A Zones in Dennis in 2000. This places about 5,087 year-round residents at risk of flood impacts in the event of a one-hundred year storm. As these flood areas are predominantly representative of the portions of Dennis with seasonal populations (Dennisport and West Dennis) the impacts of a summer-time storm even will be even more severe. In these two villages, over 60% of the structures reported in the Census were listed as seasonal properties. Extrapolating from this figure places a seasonal (non-hotel) population at as high as 13,190 people living in privately owned housing within the flood-prone areas.

From a land mass perspective, there are about 1,076 acres of land located within the V Zones. Significant portions of these areas are currently under various forms of protection as conservation areas (Crowe's Pasture Area for instance) or public beaches (West Dennis Beach, Chapin's Beach, etc). Slightly over 1,900 acres of land are found within Flood Zone A, despite the population numbers noted above, much of this area is also protected, with the largest areas being along Chase Garden Creek, Sesuit Creek and Swan Pond River. Other, large expanses of land, in these areas are considered to be wetland resource areas and have been provided extra protections under the Dennis Wetland By-law. These two figures suggest that there is about 3,000 acres of land in Dennis that could be considered at risk of flooding in a 1% storm event.

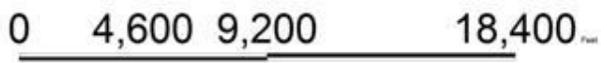
The Federal Emergency Management Administration is in the process of updating the Flood Insurance Rate Maps for Dennis. New, interim maps will go into effect in the summer of 2010. During the development process of these maps, large land areas were

initially identified as being potentially at-risk of flood damage. These areas have been targeted for additional study. It is quite likely that much of the area identified in the May 12, 2009 Preliminary Flood Insurance Rate Maps will be added to the flood zones within the next 3-5 years. These changes identify nearly 600 additional parcels of land at-risk of flooding, and as many as 1,000 – 1,500 residential units. Particularly, the cottage colony areas of Dennisport are illustrated in the May 12, 2009 maps as being in harm's way. These structures are amongst the most poorly constructed facilities in Dennis, and they are most fully occupied during the summer, prime hurricane season. The potential for these properties to be flooded in a storm is significant. The area clearly needs to be identified as a high risk area for property damage and personal casualty in a flood event.

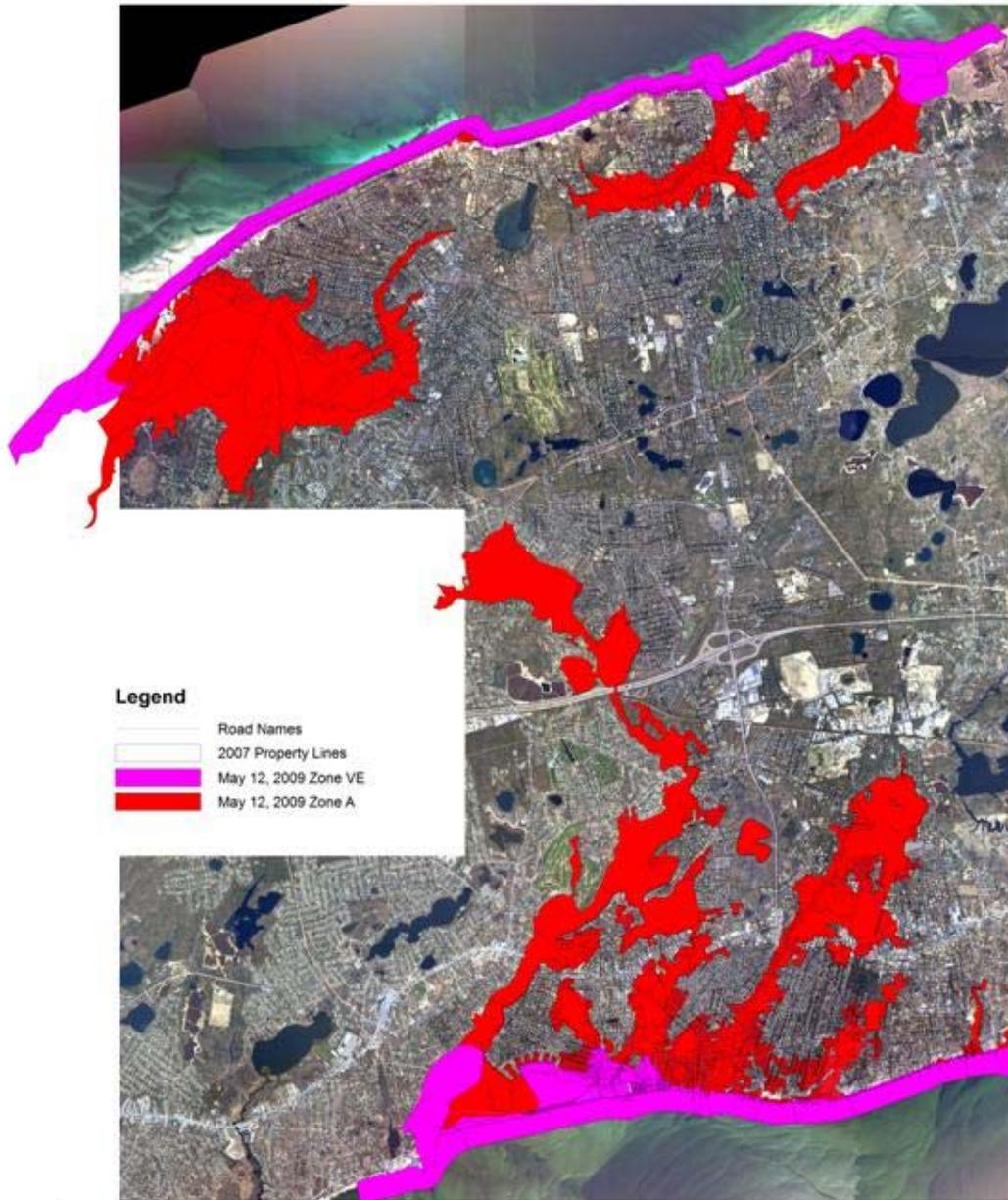


Legend

- Road Names
- 2007 Property Lines
- July 30 2009 Zone VE
- July 30 2009 Zone AE
- July 30 2009 Zone AO



FLOOD ZONE CHANGES
EXPANSION TO
A AND VE ZONES
AS OF JULY 30, 2009



FLOOD ZONE AT RISK AREAS
MAY 12, 2009

0 4,600 9,200 18,400 feet

These flood zone issues are not the only “flooding” problems faced by Dennis. The town has its share of poor drainage areas where much smaller, typical summer thunder-storm events lead to flooding problems. It is not uncommon for the area to experience a quick inch or two of rain falling in a one hour time frame. These storm events lead to flooding concerns of a more localized street and urban type flooding problems. Low lying areas with poor drainage are of particular concern. These events are often exacerbated by the amount of impervious surface in a particular location.

In coming decades, flooding and erosion will be increasingly exacerbated due to relative sea level rise. This phenomenon, the result of land subsidence and ocean expansion from global warming, could result in the loss of between 113 and 394 acres of upland in Dennis between the years 1980 and 2025. These areas will basically coincide with the 100 year floodplain. Sea level rise will also mean an increase in the severity of storm damage. Owing to its low-lying coastline that intrudes far inland, Dennis can expect to experience a shoreline retreat (as a percentage of its land mass) worse than any other Cape Cod town.

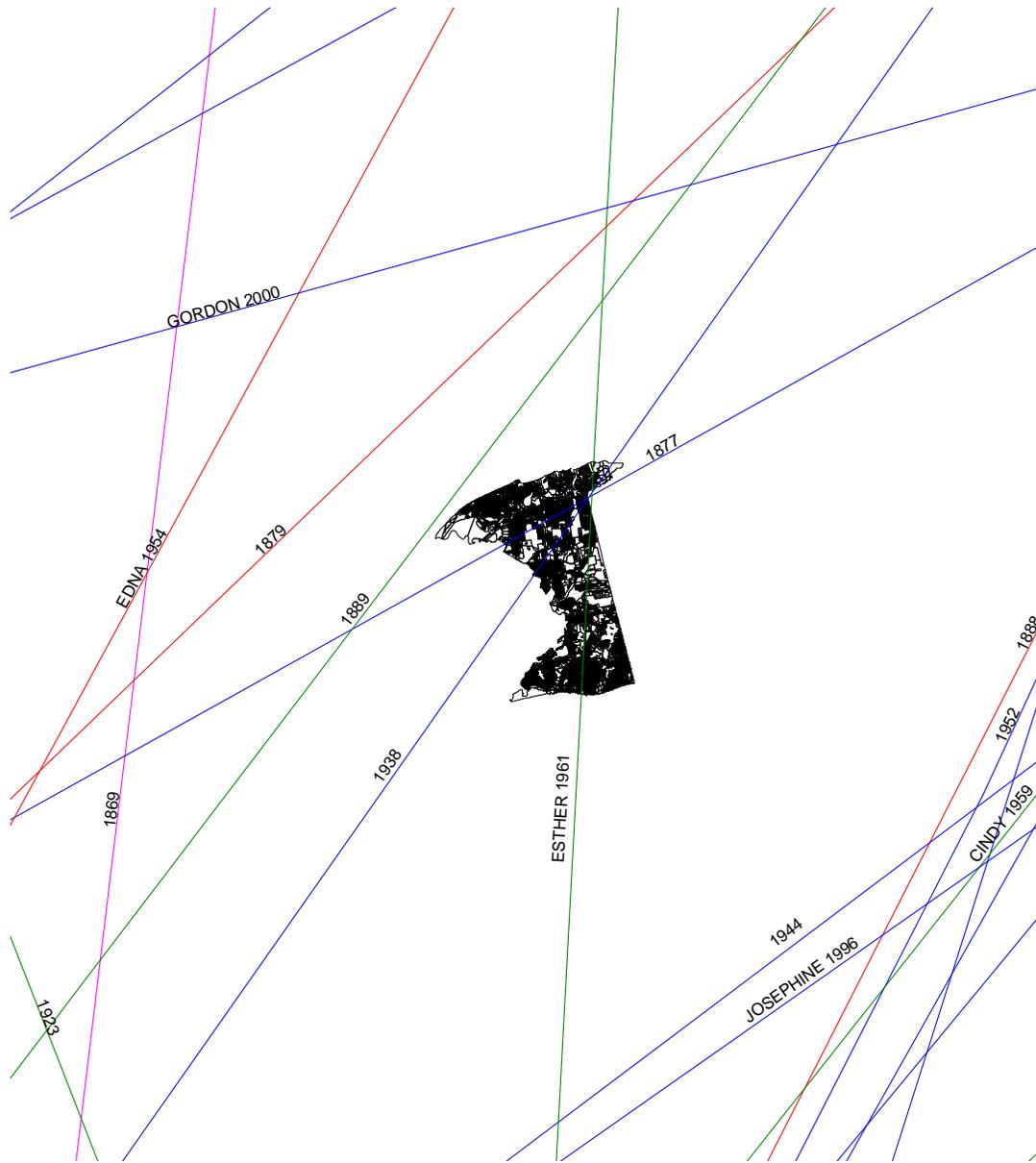
Hurricanes/Coastal Storms:

In 2004 the Cape had several near misses during Hurricane Season with Bonnie, Charley, Gaston and Hermine all passing near or over the Cape. In 2001 Tropical Storm Allison passed to the south of the Cape. In 2000 Hurricane Gordon passed over the Cape, followed shortly thereafter by Tropical Storm Helene passing south of the area. In 1997 Hurricane Danny passed south of the Cape. In 1996 Tropical Storm Josephine passed over Cape Cod.

Hurricane and coastal storms bring with it the one-two punch of heavy rains and high winds, creating flooding, storm surge and wind based damage issues. With 9 tropical events over a little more than a decade, the town clearly recognizes the problems associated with hurricanes and coastal storms.

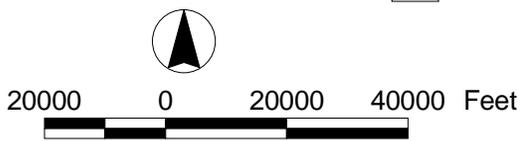
In August 19, 1991 Hurricane Bob brought a storm surge of about 10 to 15 feet to portions of Cape Cod, with wind gusts of up to 100 mph being registered in North Truro. This storm was followed shortly thereafter by the “Unnamed Storm” on October 30, 1991 which passed south of Cape Cod causing extensive shoreline and property damage.

Dennis residents memories of these two storm events vary widely. Some talk about boats lifted out of the Bass River and deposited on adjacent properties, others recollect very little coastal damage. However, even moderate hurricane events can trigger significant damage. Hurricane Charley in 2004 took down tree limbs and caused urban type flooding in many locations. Even Dennis Town Hall was not immune to water problems as the basement area flooded due to the sheer volume of rain that occurred in a short period of time.

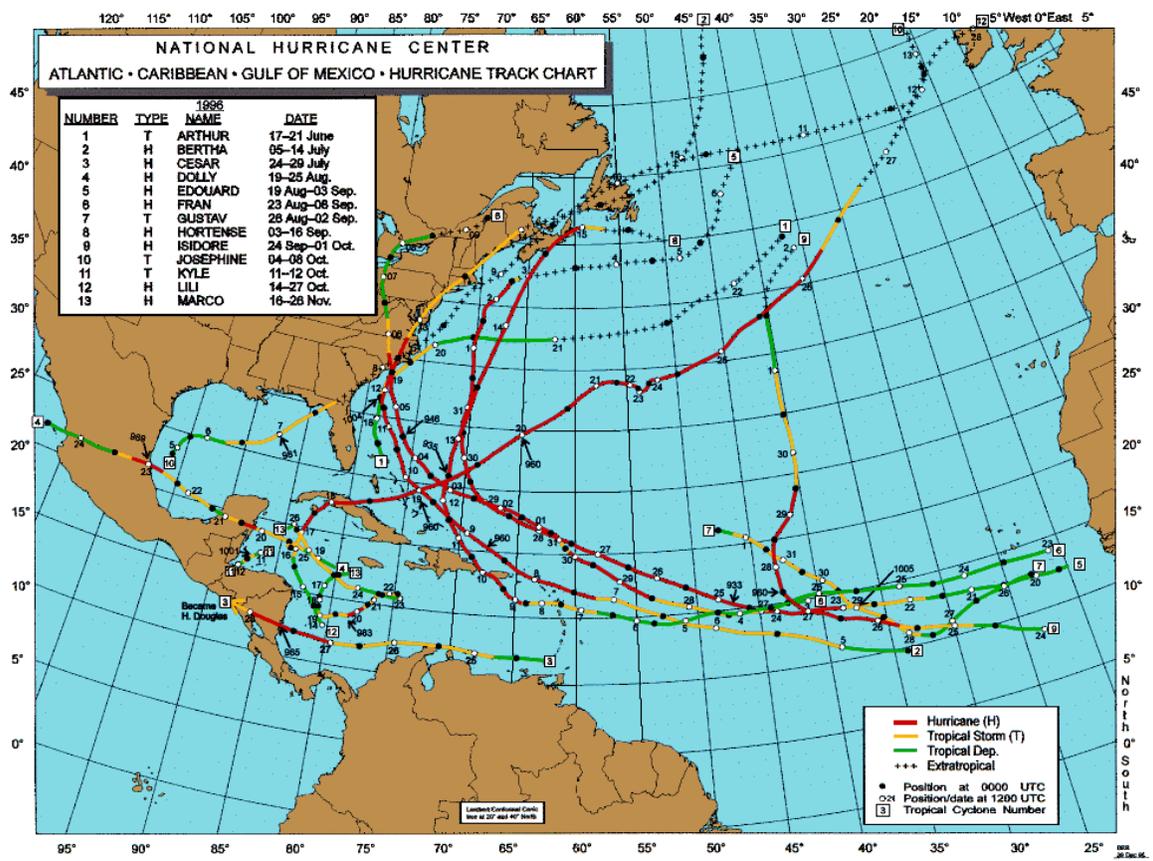
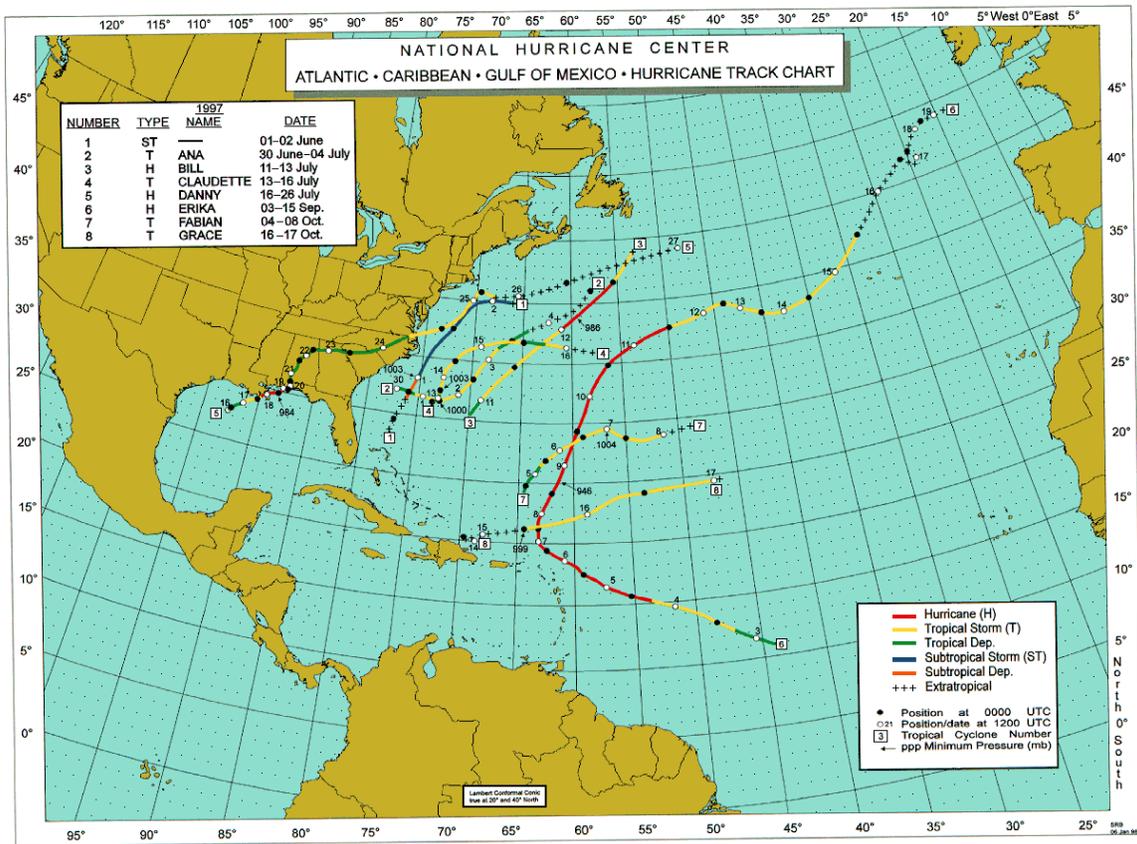


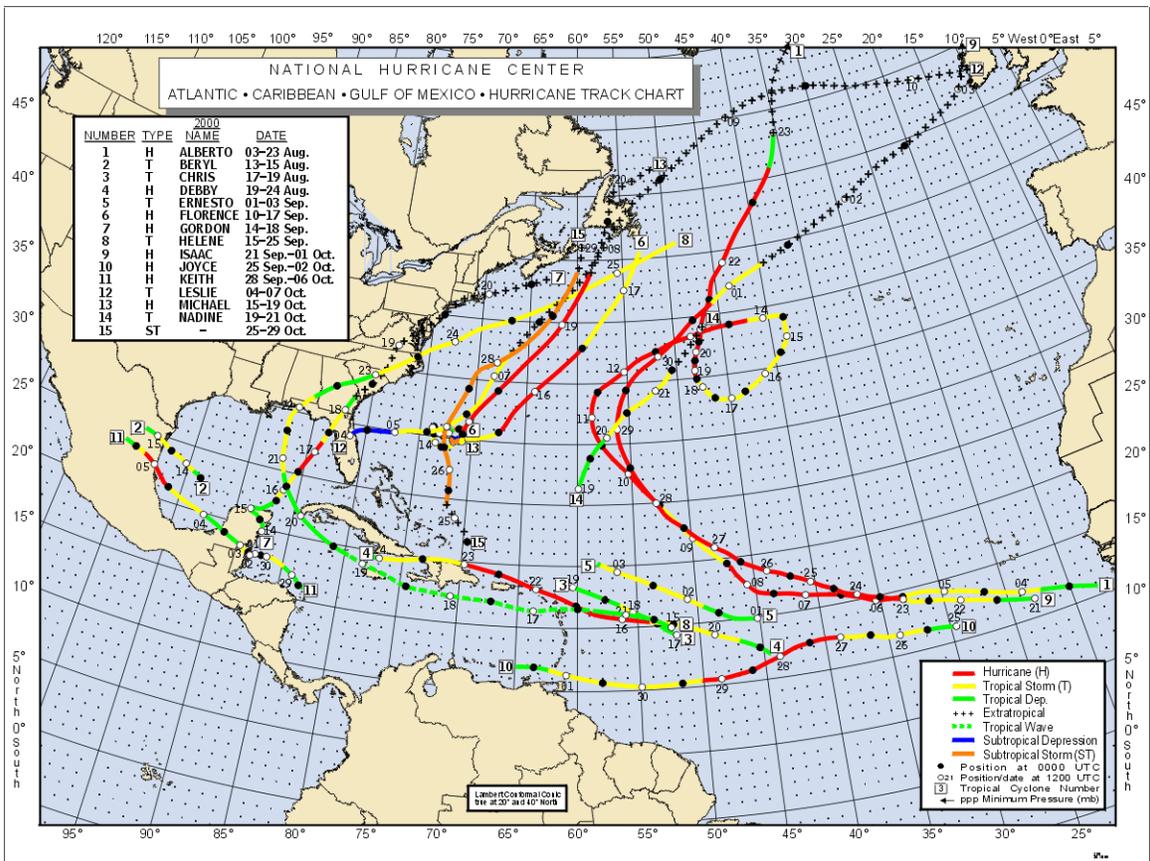
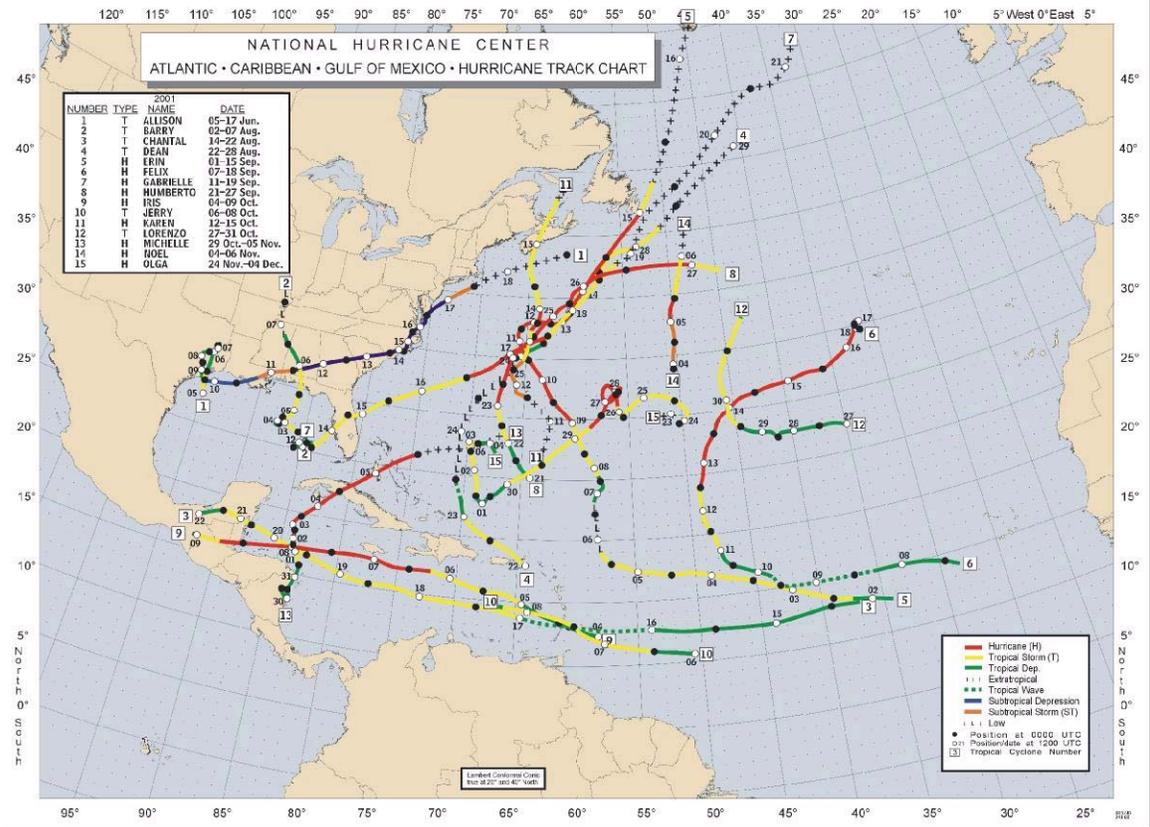
**HURRICANE, TROPICAL
STORM AND
EXTRA-TROPICAL
WEATHER EVENTS
IMPACTING DENNIS**

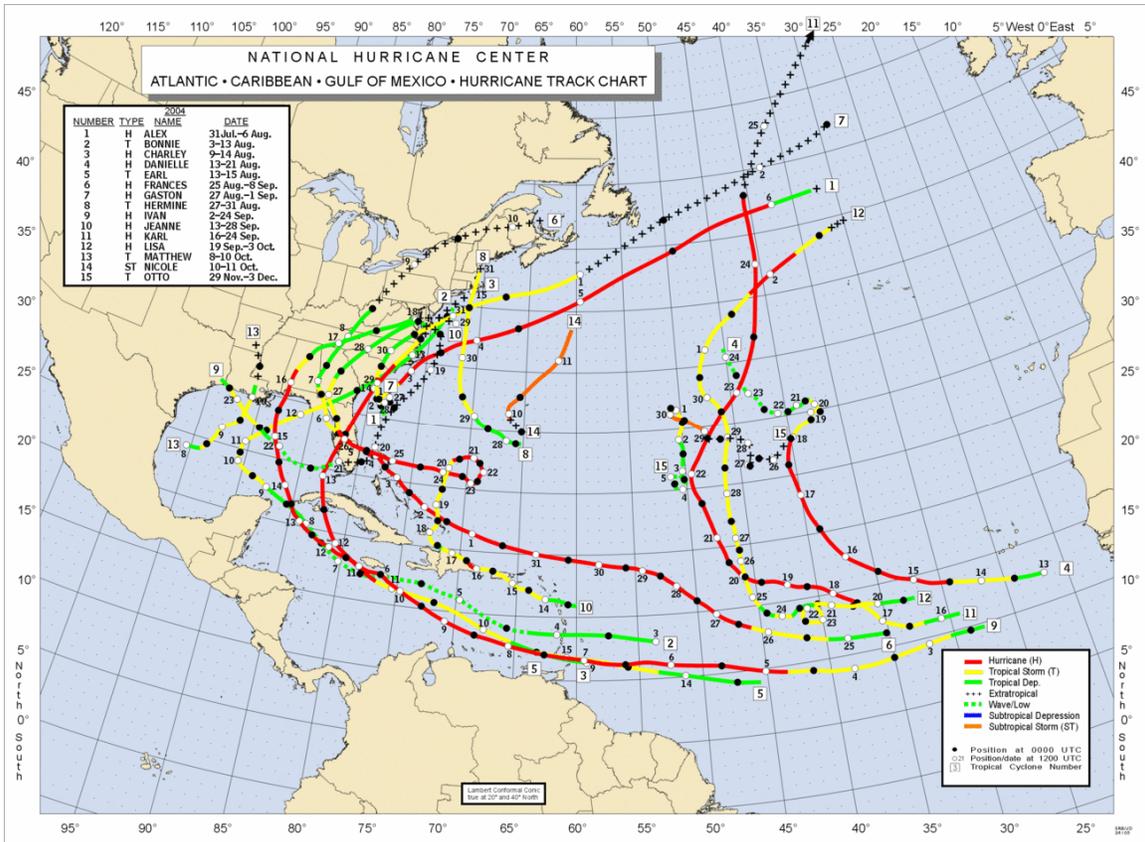
- Hurricane, Tropical Storm and Extra-Tropical Storm Events
 - Extra-Tropical
 - Category 1 Hurricane
 - Category 2 Hurricane
 - Tropical Storm
- Road Names
- Town Property Lines 2007



SOURCE: National Weather Service

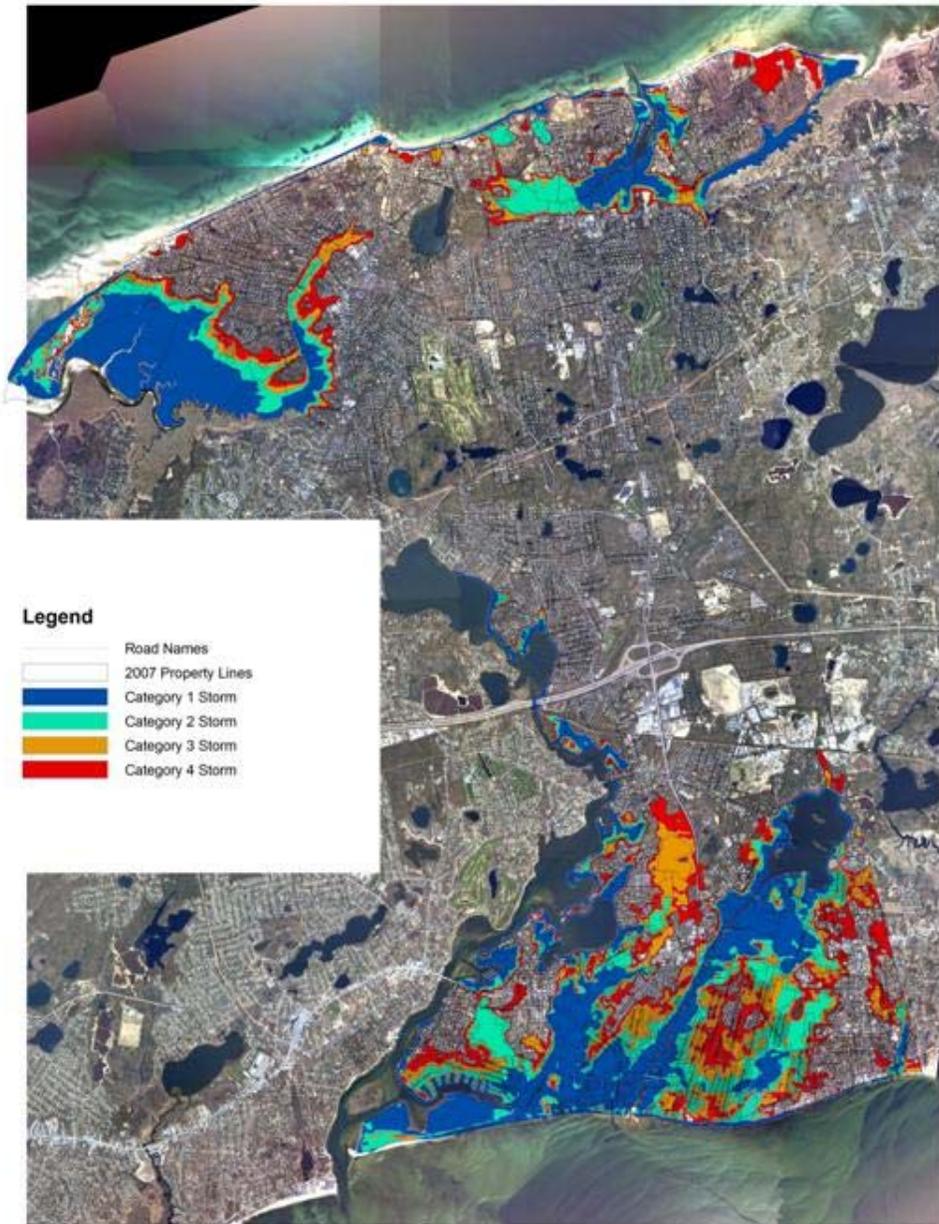






Beyond the “tropical” events are the far more frequent Northeaster events. Northeasters pose significant risks especially to the town’s shoreline. Over the past several winters there have been several winter storms that left nearly 3 feet of snow. The winter of 2004/2005 had two such events. Schools in many Cape communities were closed for up to a week due to the amount of snow left in the streets. In June 2009 a late season Northeaster pounded the Dennis coast for almost a week. When it was over, the town had experienced its worst barrier beach damage in over three decades. While the Dennis Barrier Beach system is not as exposed as that in Chatham, this storm event brings a strong reminder that we are part of a large sandbar that is always at risk.

Sea, Lake and Overland Surge from Hurricane (SLOSH) analysis provided to Dennis by the Cape Cod Commission provides additional information about at-risk properties and people due to potential SLOSH impacts. A Category 1 Hurricane will impact approximately 2,026 acres of land. Note this land area is less than the 1% storm event. This is an important consideration for the residents of Dennis in that many people have come in to Town Hall with questions about their flood zone status and state that they were here for Hurricane Bob (a Category 1 storm) and did not see any flooding impacts. A Category 2 Hurricane will add an additional almost 1,000 acres to the storm impact area, increasing flooding to about 3,000 total acres, in line with the 1% flood chance area. A Category 3 Hurricane will increase this figure by an additional 950 acres, raising the storm impacted area to nearly 4,000 acres. And, a Category 4 Hurricane will add yet an additional 970 acres, increasing the total impacted area to just over 4,900 acres of land.

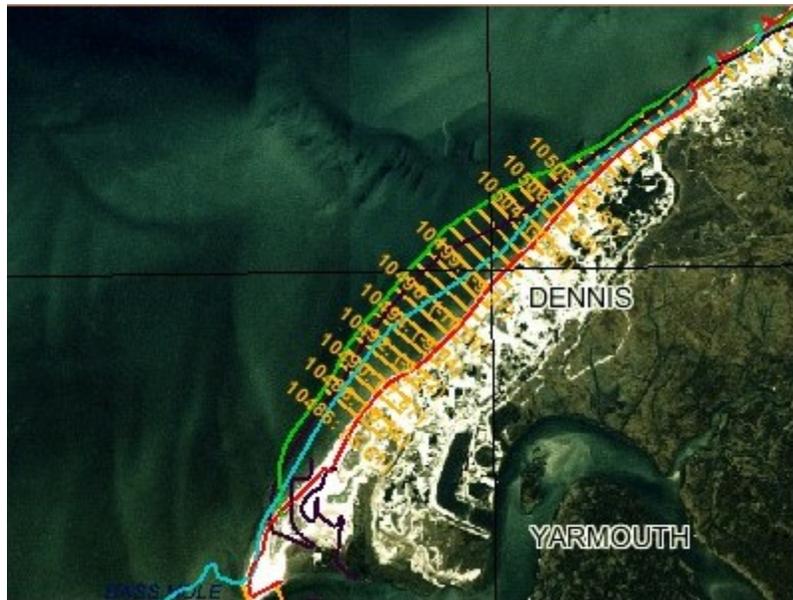


Areas Potentially Impacted By Hurricane Surge Zone

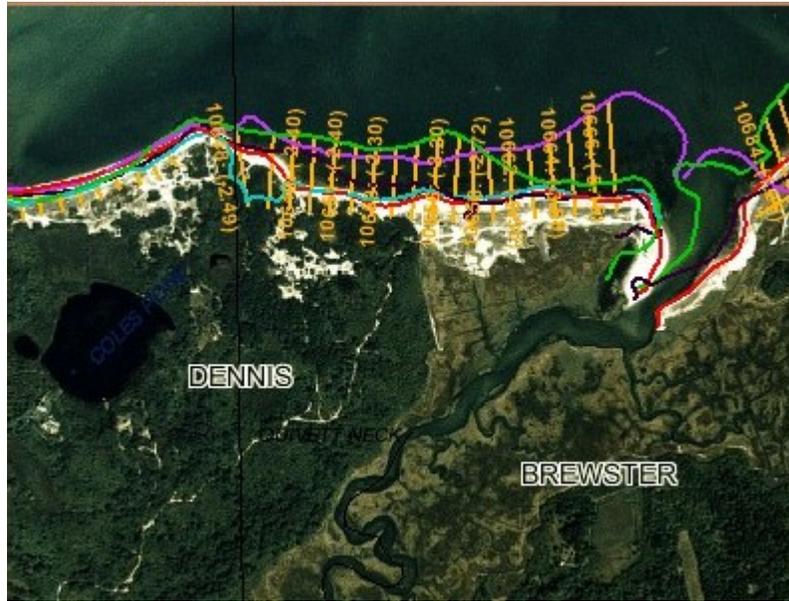
0 4,600 9,200 18,400 Feet

In population numbers, a Category 1 Hurricane could displace about 3,700 people (9,250 estimated summer population) due to storm impacts. A Category 2 Hurricane would increase that number by 1,438 and increase the number of impacted people to 5,138 (12,845 seasonally adjusted residents). A Category 3 Hurricane would trigger the displacement of about another 1,353 people, for a total of 6,491 people (16,227 summer population). Finally, a Category 4 storm would increase the number of people displaced to 7,489 people (18,722 seasonally adjusted), an increase of almost another 1,000 people.

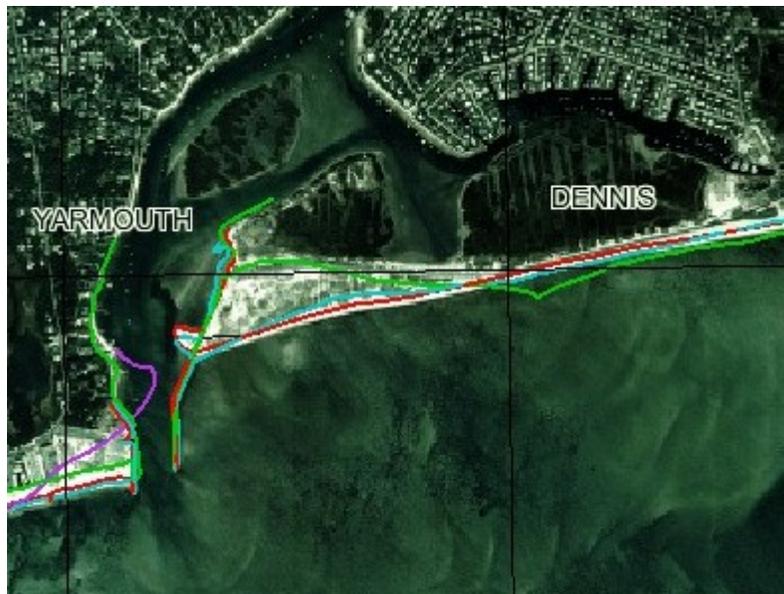
Erosion: Dennis has three barrier beaches, Chapin's Beach, West Dennis Beach and Crowe's Pasture Beach. These barrier beaches are subject to regular erosion action, as are many other portions of the Dennis Coastline. The following coastline change illustrations were drawn from the Massachusetts Coastal Zone Management website using the Shoreline Change Browser.



Chapin's Beach illustrates significant coastline loss over the past century, the green line illustrates the location of the coast between 1892 and 1938, the black line illustrates the coastline as measured between 1948 and 1975, the blue line illustrates 1978 to 1982 and the red line illustrates the coastline in 1994. The coast in this area illustrates consistent shoreline loss, with annual average losses as high as 11 feet per year.



Crowe's Pasture coastline change is also indicative of steady erosion. There were some shifting of the shoreline in and out prior to 1938, however, since 1938 the trend has been towards shoreline loss. However, the data since 1978 seems to suggest that the erosion has slowed, and that area that were lost (possibly during the Blizzard of 78) have recovered.



West Dennis Beach illustrates relative stability in comparison to the other barrier beaches. The beach has had significant sand deposition since the 1938 measurements, but has been relatively stable since the 1948-1975 measurements were made.

Beyond the three barrier beaches, the remainder of the Dennis coastline also experiences changes.



Cape Cod & Islands Long-Term Shoreline Change Rates (Mid 1800s - 1994)

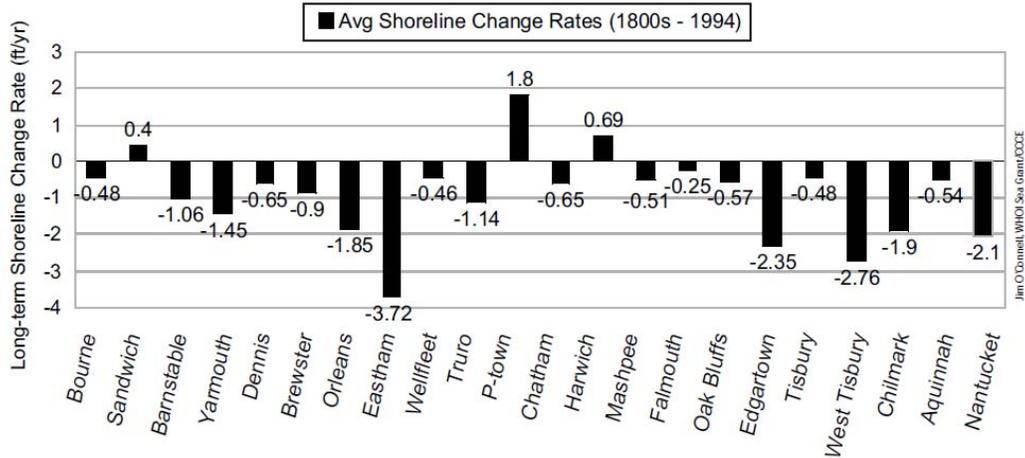


Figure 2. Long-term average annual shoreline change rates, by town, for Cape Cod, Martha's Vineyard, and Nantucket, Massachusetts.

Cape Cod & Islands Shoreline Change Data: Mid 1800s - 1994

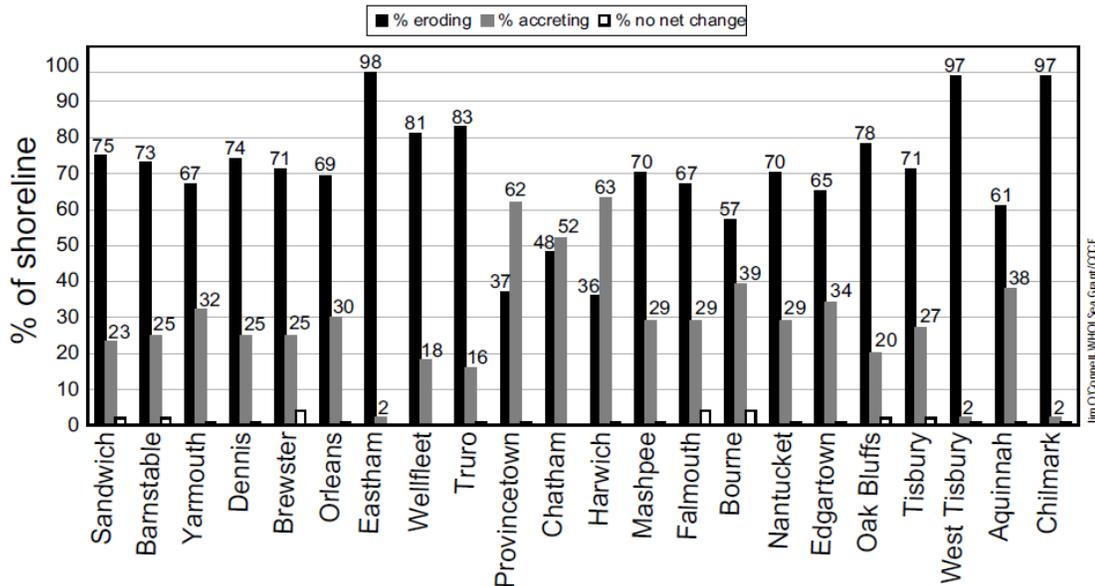


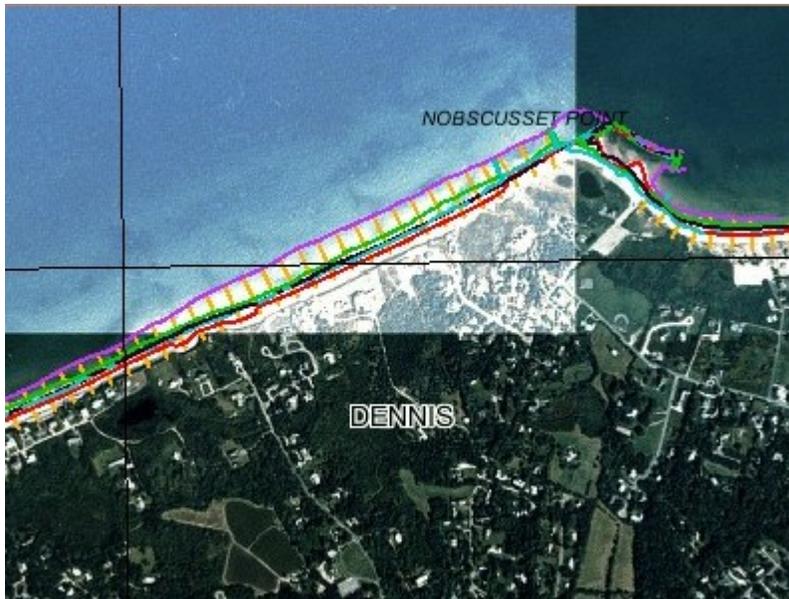
Figure 3. Percent of linear length of shoreline eroding, accreting and stable, by town, for Cape Cod, Nantucket, and Martha's Vineyard, Massachusetts, based on the long-term shoreline change data.

As the above charts illustrate, the Town Coastline has been withdrawing on average 0.65 feet per year and more beaches are losing sand than are gaining. This means that Dennis

is losing almost an acre of shoreline annually. The following discusses examples of this change in various locations along the north and south coasts



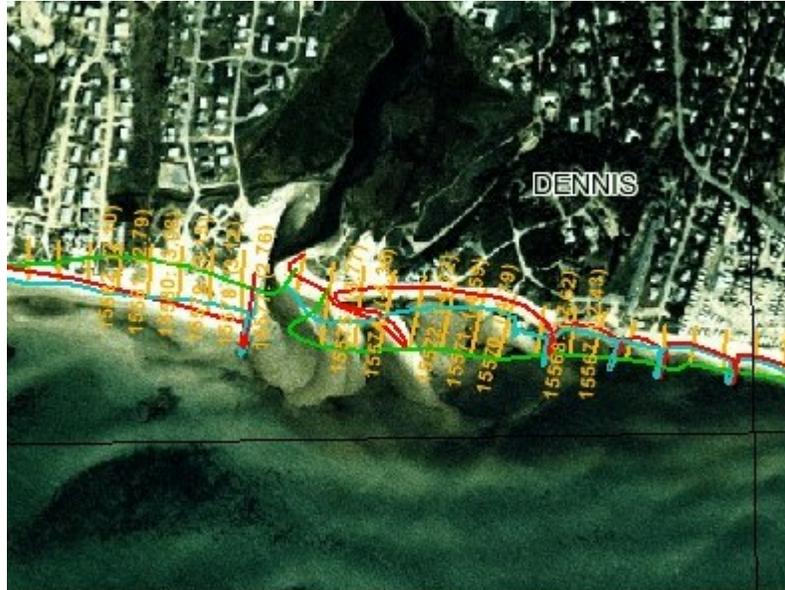
The Nobscusset Point section of the northern coastline illustrates some deterioration of the coastline. The majority of the deterioration occurred prior to 1938. Since 1938, while there has been some erosion, the amount of erosion has been limited.



The area east of Sesuit Harbor suggests that while the area has been subject to erosion in the past, the groin adjacent to the harbor has managed to capture sand, and maintains the coastline in this area.

The mouth of the Swan Pond River is another area that illustrates significant coastline

change over the years. Presently the town is working on a plan to dredge the mouth of this river as it has become nearly blocked by a sandbar. Historically, the land mass to the west of the mouth has expanded, while the land mass to the east of the mouth has deteriorated.



Fire Related:

1) Woodland and Open Pasture Fires: There are no reported wildfires in Barnstable County since 1950 when reporting became available. However, a significant amount of Dennis's landmass is covered with trees and brush. For these open areas, the town has worked with the Cape Cod Cooperative Extension Office to develop Wildfire Protection and Preparedness Plans for four areas in town. These studies include:

WILDLAND FIRE PROTECTION AND PREPAREDNESS PLAN FOR
PLASHES CONSERVATION AREA AND SURROUNDING OPEN SPACE
TRACTS

WILDLAND FIRE PROTECTION AND PREPAREDNESS PLAN FOR
RALPH AND FLORENCE SHOOP MEMORIAL

WILDLAND FIRE PROTECTION AND PREPAREDNESS PLAN FOR
GREEN BELT WELL FIELD

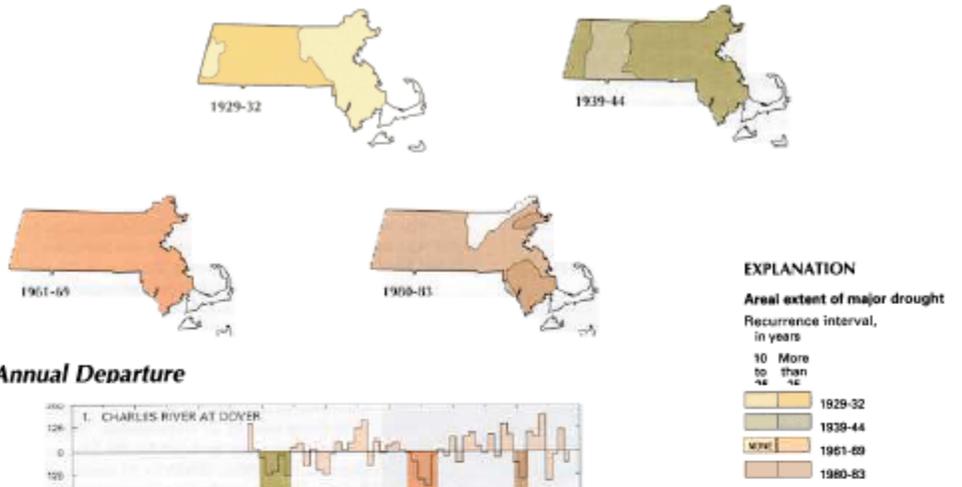
WILDLAND FIRE PROTECTION AND PREPAREDNESS PLAN FOR
PRINCESS BEACH CONSERVATION AREA AND ADJACENT SCARGO
HILL

Urban Wild Fires: In the 1920's Dennisport experienced a serious Urban Wild Fire. An entire block of businesses were lost as the building known as Ginn's Bazaar was destroyed. The village quickly replaced this structure with many of the single story wood structures that are present today. These structures are located cheek to jowl along the Main Street in the village. At the time, the goal was to quickly rebuild, no thought of fire

prevention went into site design. These buildings were prone to fire then, and with the aging equipment in them today, remain a major fire risk. The Town of Dennis has many other older neighborhoods, in particular sections of Dennisport and West Dennis, are also at risk for urban fires. In addition to these village centers, the town has several densely settled cottage colony areas. These areas are at particular risk to urban type fires. Many of the properties have poor quality construction, and in recent years have added heating capabilities (often electric) which further burden substandard electrical systems. None of these cottage areas have been constructed to modern fire safety standards with proper fire walls or other fire protection provisions.

Drought: Drought's do not appear to be of particular concern in Dennis. The graphics below are drawn from the U. S. Geological Survey Water Supply Paper 2375. The graphics illustrate that, historically, droughts in Massachusetts have not extended to Cape Cod.

Areal Extent of Droughts



Annual Departure

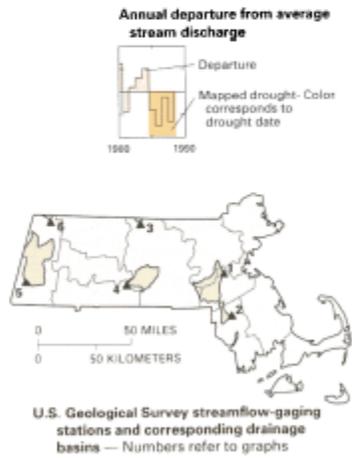
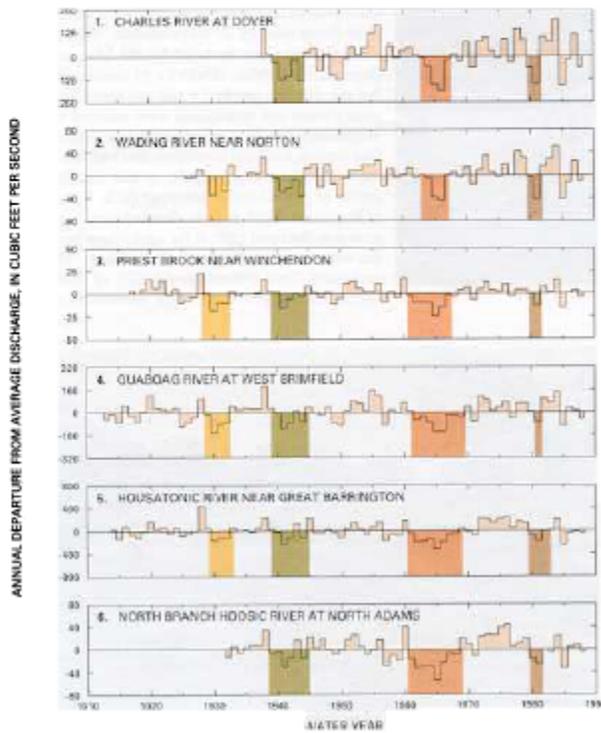


Figure 4. Areal extent of major droughts with a recurrence interval of 10 years or more in Massachusetts, and annual departure from average stream discharge for selected sites, water years 1913-88. Extent of drought is not shown on Cape Cod, Martha's Vineyard, and Nantucket Island. (Source: Data from U.S. Geological Survey files.)

Thunderstorms and other Heavy Rain Events: Thunderstorms and other heavy rain events are characterized as short-term events which may contain significant rainfall, often in the two or three inch category in a short period of time. While not a storm event that may cause flooding on the scale of a measurable storm, thunderstorms and other heavy rain events cause localized flooding in normally poorly drained areas. Thunderstorms are also accompanied by heavy winds, which may adversely impact the shallow rooted trees located in the poor soils found on Cape Cod and by the danger of lightening. There are particular areas of town that are more prone to flooding from these events than others, Sections of Upper County Road, Uncle Stanley's Road, and Hokum Rock Road have all experienced localized flooding during storm events. The Dennis DPW is constantly addressing localized flooding issues. The town has adopted a new town-wide storm water policy to address these flooding issues by making property owners responsible for storm water flow.

Blizzard: Periodically blizzards hit Dennis. Over the past several winters there have been several winter storms that left nearly 3 feet of snow. The winter of 2004/2005 had two such events. Schools in many Cape communities were closed for up to a week due to the amount of snow left in the streets. In June 2009 a late season Northeaster pounded the Dennis coast for almost a week. When it was over, the town had experienced its worst barrier beach damage in over three decades. While the Dennis Barrier Beach system is not as exposed as that in Chatham, this storm event brings a strong reminder that we are part of a large sandbar that is always at risk.

Until recently the winter of 1994 produced the heaviest winter snowfall of 65.8 inches of snow. This was surpassed in the winter of 1996 when it snowed as late as April 7, 1996 on Cape Cod and again during the winter of 2004. Often these will cause significant damage to coastal areas, in particular beaches and beach oriented properties. Northeaster's as they are called, pose as great a challenge as summer tropical weather patterns. Northeaster's bring wind combinations of wind, snow and ice which impact power supply at the most critical periods – when residents are most in need of electrical service to run heat. Local preparation for winter weather can take a larger toll on the town than even preparation for a low level hurricane.

Geological: Available data suggests that there have been no earthquake events within Dennis, however one event appears to have been centered in Harwich to the east of Dennis. This earthquake was minor in nature and resulted in no noticeable damage.

Sink Holes: Sink holes are natural depressions or holes in the ground. These are generally caused by the loss of soil under the surface, often by water. Dennis is predominantly located on glacial till. However, significant areas of town have been constructed within filled marsh and tide lands. In some cases areas, such as the center of Dennisport, have significant water flow underneath them (underwater rivers). While no sink holes have been reported, in the early 2000's the building that the Dennis Public Library was located in had to be closed as the building shifter six inches due to water table changes. Such water table shifts, have led to various infrastructure problems, most notably roadway cracking and premature pavement deterioration. Storm water regulatory changes are targeted to address some of these issues.

Tornado: There are no reports of tornadic activity in Dennis (although there are six reports on record for Barnstable County since 1968). However, given their sporadic, sudden appearance, and appearance during weather pattern changes on what is often good beach days, tornadoes pose a significant problem. The sudden appearance of water spouts, as happened a decade ago in Buzzard's Bay when two water spouts were seen off the coast of Bourne and Falmouth, could cause tremendous evacuation issues. There are limited routes out of any of the beach areas. For instance, evacuation from West Dennis Beach would rely totally on traveling Lighthouse Road or through densely settled residential neighborhoods. The amount of time it might take to evacuate West Dennis Beach would greatly exceed the travel time it might take an offshore water-spout to make land fall.

Dams: The 2004 Massachusetts State Hazard Mitigation Plan includes a map of dam locations and their ranking for potential to cause loss of life or damage should they fail. Dennis has one dam on the upper portion of Bound Brook. A significant hazard is defined as dams that are located where failure or mis-operation may cause loss of life and damage to homes, industrial or commercial facilities, secondary highways or railroads, or cause interruption of use or service of relatively important facilities.

Wind: Wind and wind damage has become the hot topic for natural disasters as we have entered the twenty-first century. A large number of insurers, eager to cut their losses have dropped insurance coverage or raised their premiums for homes on Cape Cod citing the increasing risk of catastrophic loss due to wind damage. This loss of coverage and increase in costs has actually been played out as an advantage to non-Cape Cod communities, as the insurers have to compensate for lost business by becoming more competitive in non-Cape Cod areas. (Source: *Cape's woes may benefit the suburbs: Insurers' exodus could reduce prices inland* By Bruce Mohl, Globe Staff, 3/14/2004).

Commercial insurers are using wind models to estimate the likelihood of hurricane landfall on Cape Cod and extending this to the amount of potential wind damage. The damage is likely to come from two sources:

- Direct damage to structures by the wind, ranging from the loss of roofing material or broken windows, to outright damage to structures from the wind; and
- Indirect damage due to falling limbs and trees also known as "blow-down."

Blow-down has been described as follows:

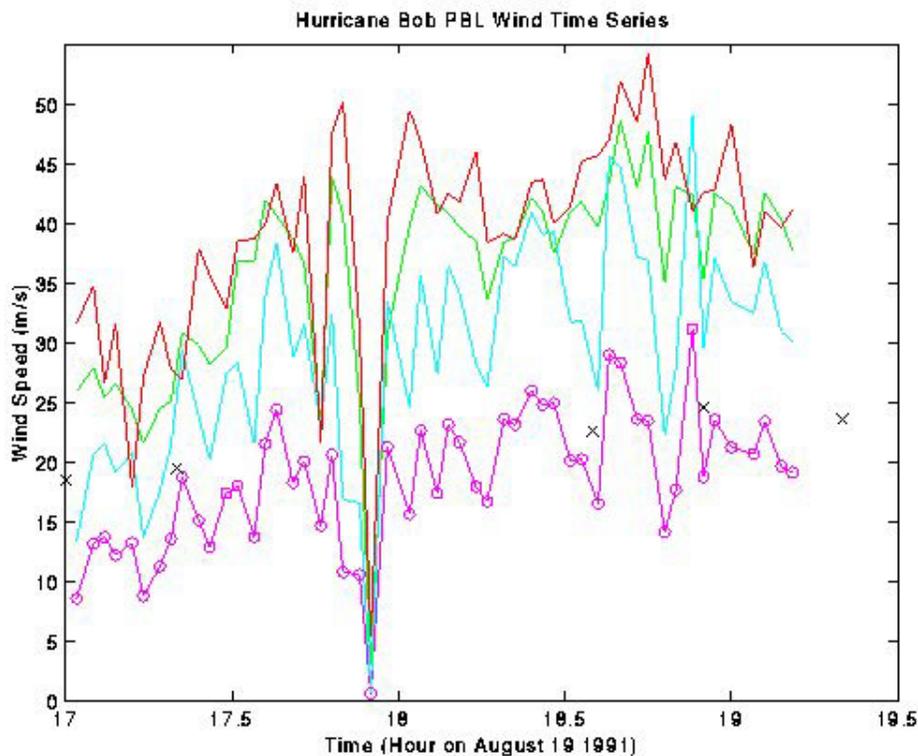
The term blow-down refers to trees which were simply blown over by straight line winds. In most instances, the trees fell with root balls intact. The blow down is believed to be the result from the combined effects of wet soils, wet leaves which add weight to the tree, and the winds. The winds cause the trees to move and push down on the wet grounds. In clay soils this can cause phenomena known as solifluction. The action of the wet ground and moving tree can act to loosen the soil, making the tree more susceptible to falling with moderate to strong winds.

An observation from Cape Cod associated with hurricane Bob from 1991 described a similar effect. All of the trees fell with "root balls" popping out of the

ground. There were vivid jolts as the as the bigger trees uprooted. The trees were pushed downward by the steadiness of the wind. The imbedded wind gust induced a swaying motion which was not strong enough to snap most trees. But these winds incrementally loosened the soil around the root systems until the tap roots snap and the trees sort of lazily falls over. At least that's what I observed in Bob.

Blow-Down with Hurricane Ivan, by Richard H. Grumm and John Lacorte National Weather Service, State College, PA 16801

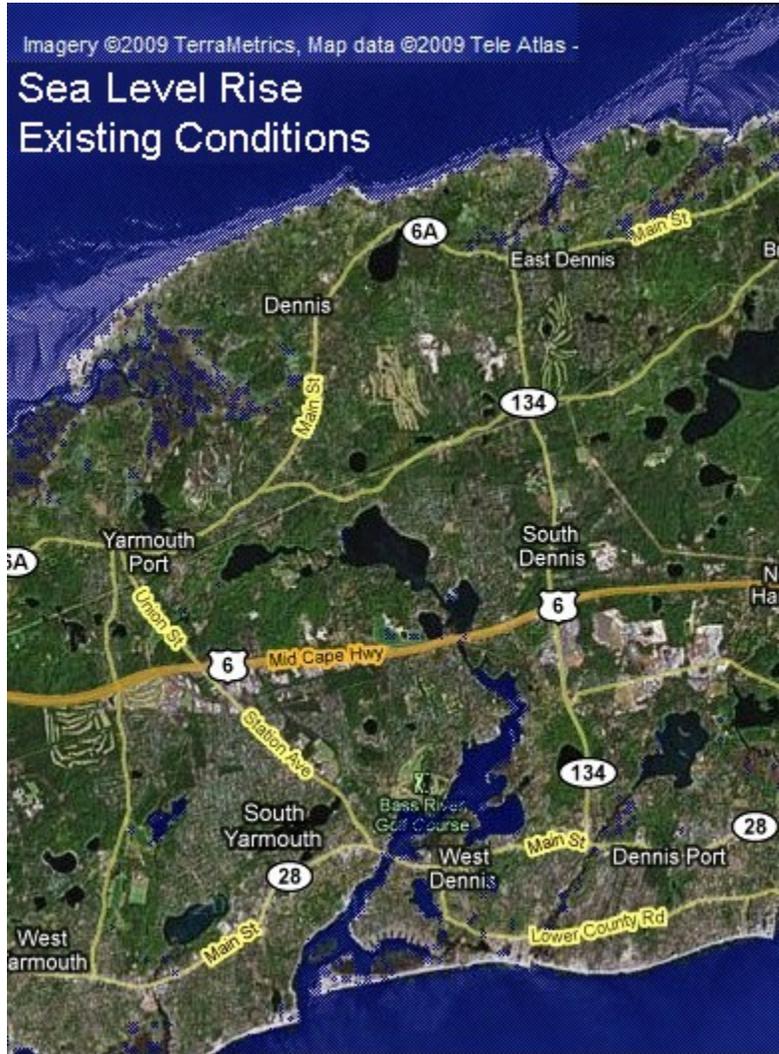
Wind is clearly a potential hazard that emergency planners need to come to grips with. It is also an issue that needs greater guidance from the state and federal emergency planners as decisions are being made on partial, rather biased, data. The following chart reflects the wind speeds of Hurricane Bob as it made landfall over Cape Cod:



Time series of the vertical configuration of the winds in Hurricane Bob as its eye passed over a Doppler profiler at Cape Cod, Massachusetts, in 1991. The red line (top on left) is the measured wind speed at 900 m altitude (2,952.76 ft), the green line (second from top on left) is the wind speed averaged over a layer from 140 m (459 ft) to 1140 m (3740 ft), and the blue line (third from top on left) is the measured wind speed at 140 m (459 ft). Computation of the wind speed at 10 m (32.8 ft) (purple line (bottom line)) is based on the 140 m value; these are compared with the surface observations (x's). (Source: *Hurricane Winds Over Land: Recommendations for Research*)

Sea Level Rise: Sea level rise is of particular concern to residents of coastal areas. Reports out of Woods Hole Oceanographic Institute are that Sea Level Rise in the past 100 years has been one foot. In addition, they state that sea level rise could be as high as three feet over

the next 100 years. These potential future changes could have significant impacts on the Town of Dennis. There are many sources of modeling data to review the impacts of sea level rise on Cape Cod. The following illustrates the output from one of those sources. The illustration is dramatic – especially the potential areas that could be impacted by future storm surges.



This first graphic illustrates the existing satellite image for Dennis.



This second graphic illustrates the potential impact of a three foot increase in sea level over the next century. Areas such as West Dennis Beach, Bass River, Chase Garden Creek, Quivet Creek, Sesuit Creek, and Swan River all illustrate increased areas inundated by water.



This final graphic illustrates the potential areas flooded if current flood levels for a 100 year storm remains the same (approximately 9 to 10 feet increase in water levels). The graphic illustrates significant water impacts along Route 28 and Route 6A.

Hazard Mapping

- Critical Facilities & Infrastructure Risk and Vulnerability Assessment – This map depicts the locations of critical facilities and infrastructure, extent of “A” and “V” flood zones, Sea, Lake and Overland Surges from Hurricane (SLOSH) zones.

2.3 **Hazard Identification Matrix**

Historically, the Town of Dennis has sustained damage from flooding, storm surge, and high winds associated with hurricanes, northeasters, and heavy rains. However, this plan and its mitigation strategy addresses multiple natural hazards, even those assessed with low probability. Risks that have been identified in the Hazard ID Matrix include:

- *Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise)* Flooding along the coast generally results from the high tides and storm surges associated with Hurricanes and New England Northeaster's.
- *Wind (from hurricanes, coastal storms, nor'easters)* Strong surface winds can cause a barrage of flying debris, can weaken trees as noted above through constant rocking action and can, in and of itself tear apart structures. Hurricanes are categorized by sustained winds of 74 mph to 200 mph, which can cause tremendous debris problems. These storms bring high winds resulting in heavy precipitation and coastal flooding. The angle at which the majority of these storms make landfall is approximately 60 to 90 degrees - a storm track generally perpendicular to the coastline, worsening the storm surge in north-south orientated bays and inlets. The damage would be increased by additional populations located in and around potential hazard areas.
- *Wildfire* As residential areas expand into relatively untouched woodlands, people living in these neighborhoods are increasingly threatened by forest fires. Protecting structures in woodland areas from fire poses special problems, and can stretch firefighting resources to the limit.

The Crowe's Pasture area and the large woodland holdings of the Dennis Water District adjacent to the Brewster Town Line have been identified as potential areas for wildfire risk. The Crowe's Pasture area is subject to a land management plan overseen by the Dennis Natural Resources Department and Barnstable County to manage the low lying brush.

In addition, wildfires could include a fast moving urban fire, similar to the one that devastated Dennisport in the 1920's. In that fire the densely settled wooden buildings in a full block were destroyed by an urban fire.

- *Shoreline erosion (from shoreline change)* Shoreline erosion has a potential to create critical impacts along coastline areas. During major storm events material is transported by waves and currents and deposited at various areas. Both erosion and accretion occur along the shoreline and site-specific shoreline change data needs to be analyzed for planning purposes.

The matrix on the following page was distributed through the Dennis Planning Department Weblog and paper copies were distributed around town to gauge the feelings of Dennis residents about the relative risks of various hazards. The survey reflects perceptions of public officials involved in hazardous incident management as well as the general public. Within the idea of preparing for incidents, it is important to understand both history, much of which is documented in this report, as well as public perceptions.

<i>Natural Hazard</i>	<i>Likelihood of Occurrence(i.e. highly, likely, possible, unlikely)</i>	<i>Location (i.e. local or small, medium or regional, multiple communities or large)</i>	<i>Impacts/Severity (i.e. catastrophic, critical, limited, negligible)</i>
Flood-Related Hazards			
Riverine	Possible	Swan River, Bass River, Sesuit Creek, Chase Garden Creek	Limited
Coastal	High	West Dennis, Dennisport	Critical
Erosion	High	Chapin Beach, West Dennis Beach	Critical
		Northern Coastline	Limited
		Southern Coastline	Limited
Dam Failures	Unlikely	Local	Negligible
Thunderstorms	High	Small	Limited
Winter Storms	High	Regional	Critical
Coastal Storms or nor'easters	High	Regional	Critical
Hurricanes	Possible	Large	Critical
Wind-Related Hazards			
Hurricanes	Possible	Large	Critical
Coastal Storms	High	Regional	Critical
Winter Storms	High	Regional	Critical
Downspouts	Possible	Small	Limited
Tornadoes	Possible	Small	Critical
Fire-Related Hazards			
Drought	Possible	Medium	Limited
Wildfires	Likely	Local	Limited
Urban Fires	Possible	Local	Critical
Flooding	Possible	Local	Limited
Geologic Hazards			
Earthquakes	Unlikely	Local	Negligible
Landslides	Possible	Small	Limited
Sink holes	Possible	Small	Limited

2.4 Dennis Capability Assessment

Local Resources

The resources available in the Town of Dennis are summarized in the following tables.

Table 5. Regulatory Tools

Regulatory Tools (ordinances, codes, plans)	Status
Building code	State Building Code
Zoning ordinance	First Adopted 1951
Subdivision ordinance or regulations	Last Amended 1993
Special purpose ordinances (floodplain management, stormwater management, hillside or steep slope ordinances, wildfire ordinances, hazard setback requirements)	Floodplain Management: Zoning and Wetlands Regulation; Stormwater: Town By-law; Hazard Setback: Zoning By-law and Wetlands Regulation; Hillside or Steep Slope: Crowe's Pasture only; Wildfire: none
Growth management ordinances (also called "smart growth" or anti-sprawl programs)	Village Centers adopted, land acquisition
Site plan review requirements	Planning Board conducts Site Plan Review
Comprehensive plan	Adopted 2002, under revision
A capital improvements plan	Somewhat
An economic development plan	As part of Comprehensive Plan
An emergency response plan	Yes, maintained by Police and Fire Dept.
A post-disaster recovery plan	No
Real estate disclosure requirements	No

Table 6. Administrative and Technical Capability

Staff/Personnel Resources

Town Administrator
 Town Clerk
 Fire Chief
 Police Chief
 Building Commissioner
 Planner
 Public Works Director
 Librarian
 Town Engineer
 Surveyors

Staff with education or expertise to assess the community's vulnerability to hazards
Personnel skilled in GIS and/or HAZUS

Table 7. Fiscal Capability

Financial Resources

Community Development Block Grants (CDBG)
Capital improvements project funding
Authority to levy taxes for specific purposes
Fees for water and sewer
Incur debt through general obligation bonds
Incur debt through special tax and revenue bonds
Incur debt through private activity bonds
Withhold spending in hazard-prone areas

State Resources

• **Massachusetts Emergency Management Administration (MEMA)** is responsible for coordinating all aspects of emergency management for the State of Massachusetts. Public education is one of its identified main categories for mitigation efforts. Improving hazard mitigation technical assistance for local governments is another high priority list item for the State. Providing hazard mitigation training, current hazard information, and the facilitation of communication with other agencies would encourage local hazard mitigation efforts. MEMA resources for mitigation planning.

• **DCR** Provides training and technical assistance on all aspects of the National Flood Insurance Program and flood mitigation.

Other state resources include:

• **Division of Senior Services:** Provides special outreach services for seniors, including food, shelter and clothing.

• **Division of Insurance:** Provides assistance in obtaining copies of policies and provides information regarding filing claims.

Federal Resources

The federal government requires local governments to have a hazard mitigation plan in place to be eligible for funding opportunities through FEMA such as the Pre-Disaster Mitigation Assistance Program and the Hazard Mitigation Grant Program. The Mitigation Technical Assistance Programs available to local governments are also a valuable resource. FEMA may also provide temporary housing assistance through rental assistance, mobile homes, furniture rental, mortgage assistance, and emergency home repairs. The Disaster Preparedness Improvement Grant also promotes educational opportunities with respect to hazard awareness and mitigation. FEMA, through its

Emergency Management Institute, offers training in many aspects of emergency management, including hazard mitigation. FEMA has also developed a large number of documents that address implementing hazard mitigation at the local level. Five key resource documents are available from FEMA Publication Warehouse (1-800-480-2520) and are briefly described below:

- **How-to Guides.** FEMA has developed a series of how-to guides to assist states, communities, and tribes in enhancing their hazard mitigation planning capabilities. The first four guides mirror the four major phases of hazard mitigation planning used in the development of the Multi-Hazard Mitigation Plan. The last five how-to guides address special topics that arise in hazard mitigation planning such as conducting cost-benefit analysis and preparing multi-jurisdictional plans. The use of worksheets, checklists, and tables make these guides a practical source of guidance to address all stages of the hazard mitigation planning process. They also include special tips on meeting Disaster Mitigation Act (DMA) 2000 requirements (<http://www.fema.gov/fima/planhowto.shtm>).

- **Post-Disaster Hazard Mitigation Planning Guidance for State and Local**

Governments. FEMA DAP-12, September 1990. This handbook explains the basic concepts of hazard mitigation and shows state and local governments how they can develop and achieve mitigation goals within the context of FEMA's post-disaster hazard mitigation planning requirements. The handbook focuses on approaches to mitigation, with an emphasis on multi-objective planning.

- **Mitigation Resources for Success CD.** FEMA 372, September 2001. This CD contains a wealth of information about mitigation and is useful for state and local government planners and other stakeholders in the mitigation process. It provides mitigation case studies, success stories, information about Federal mitigation programs, suggestions for mitigation measures to homes and businesses, appropriate relevant mitigation publications, and contact information.

- **A Guide to Federal Aid in Disasters.** FEMA 262, April 1995. When disasters exceed the capabilities of state and local governments, the President's disaster assistance program (administered by FEMA) is the primary source of federal assistance. This handbook discusses the procedures and process for obtaining this assistance, and provides a brief overview of each program.

- **The Emergency Management Guide for Business and Industry.** FEMA 141, October 1993. This guide provides a systematic approach to emergency management planning, response, and recovery. It also details a planning process that businesses can follow to better prepare for a wide range of hazards and emergency events. This effort can enhance a business's ability to recover from financial losses, loss of market share, damages to equipment, and product or business interruptions. This guide could be of great assistance to businesses.

Other federal resources include:

- **Department of Agriculture.** Assistance provided includes: Emergency Conservation Program, Non-Insured Assistance, Emergency Watershed Protection, Rural Housing Service, Rural Utilities Service, and Rural Business and Cooperative Service.

- **Department of Energy, Office of Energy Efficiency and Renewable Energy, Weatherization Assistance Program.** This program minimizes the adverse effects of high energy costs on low-income, elderly, and handicapped citizens through client education activities and weatherization services such as an all-around safety check of major energy systems, including heating system modifications and insulation checks.

- **Department of Housing and Urban Development, Office of Homes and**

Communities, Section 108 Loan Guarantee Programs. This program provides loan guarantees as security for federal loans for acquisition, rehabilitation, relocation, clearance, site preparation, special economic development activities, and construction of certain public facilities and housing.

- **Department of Housing and Urban Development, Community Development Block Grants.** Provides grant assistance and technical assistance to aid communities in planning activities that address issues detrimental to the health and safety of local residents, such as housing rehabilitation, public services, community facilities, and infrastructure improvements that would primarily benefit low-and moderate-income persons.

- **Department of Labor, Employment and Training Administration, Disaster Unemployment Assistance.** Provides weekly unemployment subsistence grants for those who become unemployed because of a major disaster or emergency. Applicants must have exhausted all benefits for which they would normally be eligible.

- **Federal Financial Institutions.** Member banks of FDIC, FRS or FHLBB may be permitted to waive early withdrawal penalties for Certificates of Deposit and Individual Retirement Accounts.

- **Internal Revenue Service, Tax Relief.** Provides extensions to current year's tax return, allows deductions for disaster losses, and allows amendment of previous tax returns to reflect loss back to three years.

- **United States Small Business Administration.** May provide low-interest disaster loans to individuals and businesses that have suffered a loss due to a disaster.

Other resources: The following are *Websites* that provide focused access to valuable planning resources for communities interested in sustainable development activities.

- **Federal Emergency Management Agency**, <http://www.fema.gov> – includes links to information, resources, and grants that communities can use in planning and implementation of sustainable measures.
- **American Planning Association**, <http://www.planning.org> – a non-profit professional association that serves as a resource for planners, elected officials, and citizens concerned with planning and growth initiatives.
- **Institute for Business and Home Safety**, <http://ibhs.org> – an initiative of the insurance industry to reduce deaths, injuries, property damage, economic losses, and human suffering caused by natural disasters. Online resources provide information on natural hazards, community land use, and ways citizens can protect their property from damage.

Other Funding Sources and Resources

- **American Red Cross**. Provides for the critical needs of individuals such as food, clothing, shelter, and supplemental medical needs. Provides recovery needs such as furniture, home repair, home purchasing, essential tools, and some bill payment may be provided.

Section 3: Vulnerability Assessment

3.1 Requirements

The goal of mitigation is to reduce the future impacts of a hazard including loss of life, property damage, and disruption to local and regional economies, environmental damage and disruption, and the amount of public and private funds spent to assist with recovery. Mitigation efforts begin with a comprehensive risk assessment. A risk assessment measures the potential loss from a disaster event caused by an existing hazard by evaluating the vulnerability of buildings, infrastructure, and people. It identifies the characteristics and potential consequences of hazards and their impact on community assets.

Federal Requirements for Risk Assessment

Federal regulations for hazard mitigation plans outlined in 44 CFR Section §201.6(c)(2) include a requirement for a risk assessment. This risk assessment requirement is intended to provide information that will help the community identify and prioritize mitigation activities that will prevent or reduce losses from the identified hazards. The federal criteria for risk assessments and information on how the MHMP meets those criteria are outlined below:

Section 201.6(c)(2) of the mitigation planning regulation requires local jurisdictions to provide sufficient hazard and risk information from which to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards. (FEMA 386-8)

Table 8. Risk Assessment - Federal Requirements

Section §201.6(c)(2) Requirement	Multi-Jurisdictional Hazard Mitigation Plan Where it is Addressed in Plan
Identifying Hazards §201.6(c)(2)(i) The risk assessment <i>shall</i> include a description of the type . . . of all natural hazards that can affect the jurisdiction . . .	Section 2, identifies severe weather (hurricanes, blizzards, thunderstorms and tornadoes), wildfire, and erosion as natural hazards to be profiled in the Dennis MHMP.
Profiling Hazards §201.6(c)(2)(i) The risk assessment <i>shall</i> include a description of the . . . location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.	Section 2, Risk Assessment, includes hazard-specific sections in the. The MHMP profiles the natural hazards that may affect the area. The MHMP includes location, extent, probability, impact and previous occurrences for each natural hazard identified. .

Assessing Vulnerability: Overview §201.6(c)(2)(i) The risk assessment *shall* include a description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

Section 3, Assessing Vulnerabilities contains overall summaries of each hazard and the impacts on the community are contained in each hazard specific section in Section 3.3.

Assessing Vulnerability: Addressing Repetitive Loss Properties §201.6(c)(2)(ii) The risk assessment in all plans approved after October 1, 2008 must also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged floods.

The Town of Dennis participates in the NFIP, Repetitive Loss information is provided to the extent feasible given privacy concerns.

Assessing Vulnerability: Identifying Structures §201.6(c)(2)(ii)(A) The plan *should* describe vulnerability in terms of the types and number of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.

Section 3.2, identifies critical facilities located in the profiled hazard areas.

Assessing Vulnerability: Estimating Potential Losses §201.6(c)(2)(ii)(B) The plan *should* describe vulnerability in terms of an estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate.

Section 3.6, estimates potential dollar losses to vulnerable structures.

Vulnerability Assessment Methodology

The goal of mitigation is to reduce the future impacts of a hazard including loss of life, property damage, and disruption to local and regional economies, environmental damage and disruption, and the amount of public and private funds spent to assist with recovery. Mitigation efforts begin with a comprehensive risk assessment. A risk assessment measures the potential loss from a disaster event caused by an existing hazard by evaluating the vulnerability of people, buildings, and infrastructure. It identifies the characteristics and potential consequences of hazards and their impact on community assets. A risk assessment typically consists of three components; hazards identification, vulnerability assessment and risk analysis.

1. Hazards Identification - The first step in conducting a risk assessment is to identify, profile hazards, and their possible effects on the jurisdiction. This information can be found in Section 2. Risk Assessment.

2. Vulnerability Assessment – Step 2 is to identify the jurisdiction’s vulnerability; the people, infrastructure and property that are likely to be affected. It includes everyone who enters the jurisdiction including employees, commuters, shoppers, tourists, and others. Populations with special needs such as children, the elderly, and the disabled should be considered; as should facilities such as the hospital, health clinic, senior housing and schools because of their additional vulnerability to hazards. Inventorying the jurisdiction’s assets to determine the number of buildings, their value, and population in hazard areas can also help determine vulnerability. A jurisdiction with many high-value buildings in a high-hazard zone will be extremely vulnerable to financial devastation brought on by a disaster event. Identifying hazard prone critical facilities is vital because they are necessary during response and recovery phases.

Critical facilities include:

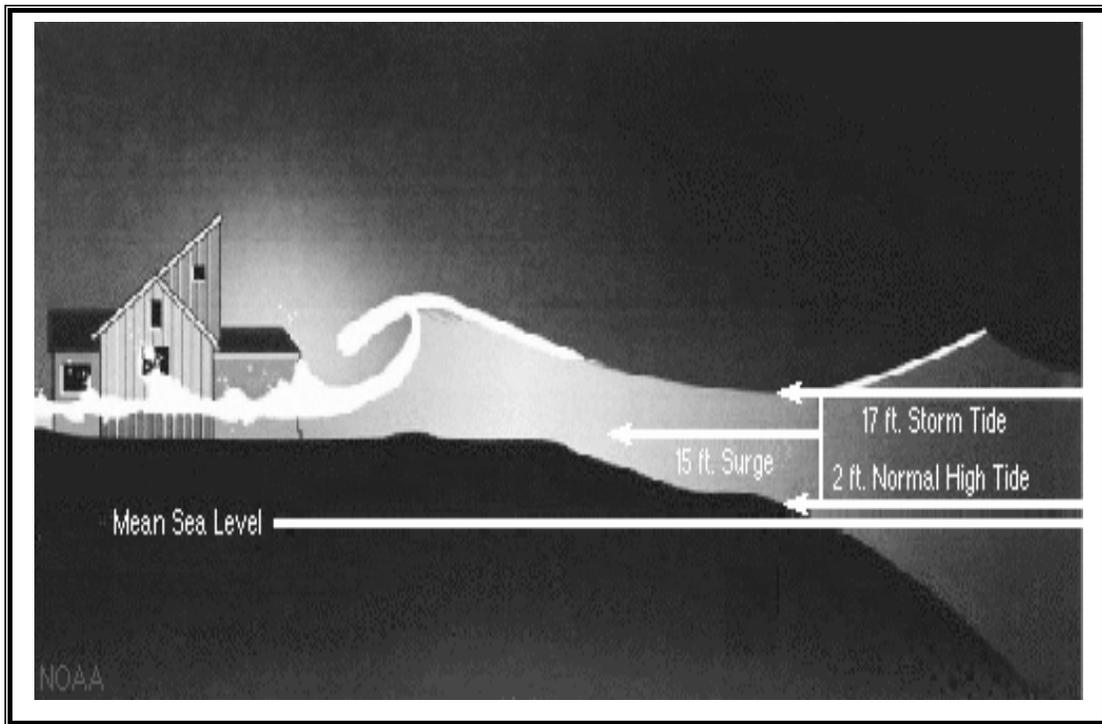
- Essential facilities, which are necessary for the health and welfare of an area and are essential during response to a disaster, including hospitals, fire stations, police stations, and other emergency facilities;
- Transportation systems such as highways, airways and waterways;
- Utilities, water treatment plants, communications systems, power facilities;
- High potential loss facilities such as bulk fuel storage facilities; and
- Hazardous materials sites.
- Other items to identify critical facilities include economic elements, areas that require special considerations, historic, cultural and natural resource areas and other jurisdiction-determined important facilities.

3. Risk Analysis – The next step is to calculate the potential losses to determine which hazard will have the greatest impact on the jurisdiction. Hazards should be considered in terms of their frequency of occurrence and potential impact on the jurisdiction. For instance, a possible hazard may pose a devastating impact on a community but have an extremely low likelihood of occurrence. Such a hazard must take lower priority than a hazard with only moderate impact but a very high likelihood of occurrence. For example, there might be several schools exposed to one hazard but one school may be exposed to four different hazards. A multi-hazard approach will identify such high-risk areas and indicate where mitigation efforts should be concentrated. The purpose of a vulnerability assessment is to identify the assets of a community that are susceptible to damage should a hazard incident occur. Facilities are designated in the plan as critical if they are: (1) vulnerable due to the type of occupant (children, disabled or elderly for example); (2)

critical to the community's ability to function (roads, power generation facilities, water treatment facilities, etc.); (3) have a historic value to the community (museum, cemetery); or (4) critical to the community in the event of a hazard occurring (emergency shelter, etc.). This hazard plan includes an inventory of critical facilities from the records and land use map. The description of each of the identified hazards includes a narrative and in some cases a map of the following information:

- The **location** or geographical area(s) of the hazard in the community.
- The **extent** (i.e. magnitude or severity) of potential hazard events.

To establish a planning baseline, the Town used the "Risk and Vulnerability Assessment (RVA) Map" (Section 2) generated by the Cape Cod Commission to review locations of critical facilities and infrastructure in the context of Hazard Mitigation Planning. During review and discussion forty-five (45) critical facilities were identified with twenty-three (23) facilities located within a Special Flood Hazard Area (SFHA) and Sea, Lake, and Overland Surge from Hurricanes (SLOSH) areas.



3.2 Dennis's Critical Facilities

Table 9: Critical Facilities and Infrastructure:

ID #	FACILITY NAME	STREET	FACILITY TYPE	SLOSH* Y/N	SFHA ** Y/N
1	Emergency Operations Center (Police Station)	90 Bob Crowell Road	A/B	No	No
2	Nathaniel Wixon Middle School	901 Route 134	A/G	No	No
3	Ezra Baker School	810 Route 28	A/G	Yes	No
4	Council on Aging/Senior Center	1045 Route 134	A/J	No	No
5	Carleton Hall	1006 Old Bass River Road	A/D	No	No
6	Jacob Sears Memorial Library	23 Center Street	A/D	No	No
7	Town Hall	485 Main Street	A/D	No	No
8	Eagle Pond Rehab and Living Center	1 Love Lane	A/H	No	No
9	Tony Kent Skating Ice Arena	8 South Gages Way	A/J	No	No
10	Fire Headquarters	883 Route 28	B	No	No
11	Fire Station # 2	1015 Old Bass River Road	B	No	No
12	Town Hall Annex	465 Route 28	D	Yes	No
13	Water District	80 Old Bass River Road	D	No	No
14	Department of Public Works	120 Theophilus Smith Rd	D	No	No
15	Dennis Public Library	5 Hall Street	D	Yes	No
16	South Dennis Public Library	389 Main Street	D	Yes	No
17	Dennis Free Library	272 Main Street	D	No	No
18	Dennis Memorial Library	1020 Old Bass River Road	D	No	No
19	Dennis Landfill	Theophilus Smith Rd	F	No	No
20	Dennis Head Start/VIC Hall	Depot Street	D/G/I	Yes	No
21	Sunshine and Rainbow Nursery School	713 Route 6A	G	No	No
22	Play and Learn Day Care and Pre School	434 Route 134	G/I	No	No
23	Scargo Nursery School Inc.	218 Main Street	G	Yes	No
24	Village Senior and Handicap Housing	226 Old Bass River Road	H	No	No
25	Windmill Village Senior Housing	109 Upper County Road	H	Yes	No
26	Village Senior and Handicap Housing	167 Center Street	H	Yes	Yes
27	Lewis Gordon Senior Housing Apartments	1110 Route 134	H	No	No
28	Northside Village	11 Antonelli Circle	H	Yes	Yes
29	Dennis Animal Hospital Inc.	5 Beach Street	K	Yes	No
30	North Side Marina	351 Sesuit Neck Road	L	Yes	Yes
31	Bass River Marina	140 Route 28	L	Yes	Yes
32	Mayfair Boatyard	73 Old Mayfair	L	Yes	Yes

ID #	FACILITY NAME	STREET	FACILITY TYPE	SLOSH* Y/N	SFHA ** Y/N
		Road			
33	First Student Bus Operation Center	153A Upper County Road	M	Yes	Yes
34	Cape Cod Regional Transit Authority Operation Center	40 American Way	M	No	No
35	West Dennis Beach	44 Lighthouse Road	J	Yes	Yes
36	Mayflower Beach	62 Horsefoot Path	J	Yes	Yes
37	Corporation Beach	Corporation Road	J	Yes	Yes
38	Glendon Road Beach	155 Old Wharf Road	J	Yes	Yes
39	South Village Beach	South Village Road	J	Yes	Yes
40	Sea Street Beach	5 Sea Street (Dennisport)	J	Yes	Yes
41	Sea Street Beach	Sea Street (East Dennis)	J	Yes	Yes
42	Cold Storage Beach	Cold Storage Road	J	Yes	Yes
43	Johnny Kelley Park	Bob Crowell Road	J	No	No
44	Haigis Beach	97 Old Wharf Road	J	Yes	Yes
45	Chapin Beach	Chapin's Beach Road	J	Yes	Yes

Critical Facilities and Infrastructure Key:

- | | |
|---|---|
| A Emergency Facilities/Shelters | G Schools |
| B Public Safety Facilities | H Nursing Homes/Elderly Housing |
| C Hospitals/ Acute Care Facilities | I Group Day Care Facilities |
| D Town Government Facilities | J Senior/Youth/Recreation Centers |
| E Infrastructure | K Designated Emergency Animal Shelters/Hospitals |
| F Hazardous Material Facilities | L Marinas/Boat Yards |
| M Transportation Facilities | |
- * **SLOSH** = Sea, Lake, & overland surges from hurricanes
- ** **SFHA** = Special Flood Hazards Area as designated on the Flood Insurance Rate Map (FIRM)

Of the twenty-three facilities located within the high hazard areas eighteen are town owned, and five privately owned.

3.3 Vulnerability Analysis

The Town used the RVA map identifying critical facilities to review potential vulnerabilities during the natural hazard events identified and described in Section 2: Hazard and Risk Assessment. To clearly and efficiently evaluate all of the potential natural hazards, the location and extent of possible specific areas were

identified. The following chart was developed that grouped potential hazards identified cause and effects of each hazard and areas susceptible to damage.

Table 10: Descriptive Location Chart

NATURAL HAZARD	CAUSE & EFFECT	LOCATION
FLOOD	<p>Natural Inundation in the floodplain (caused by coastal storms; winter storms; northeasters; hurricanes)</p> <ul style="list-style-type: none"> • Coastal Flooding • Episodic Erosion • River Flooding • Pond Flooding • Infrastructure Failure • Siltation <p>Infrastructure Failure (caused by coastal storms; winter storms; northeasters; hurricanes; ice/snow melt)</p> <ul style="list-style-type: none"> • Bridge Failure • Storm Drain Failure • Culvert Failure • Dam Failure • Dike Failure 	<p>Areas of Coastal Flooding</p> <ul style="list-style-type: none"> • West Dennis Beach • Mayflower Beach • Haigis Beach • Glendon Road Beach • Cold Storage Beach • Corporation Beach <p>• Chapin Beach</p> <p>• North Side Marina</p> <p>• South Village Beach</p> <p>• Sea Street Beach</p> <p>• Sea Street Beach</p> <p>Areas of River Flooding</p> <ul style="list-style-type: none"> • Upper County Road Bridge over the Swan River • Bass River Marina <p>• Mayfair Boatyard</p> <p>Areas of Episodic Erosion</p> <ul style="list-style-type: none"> • Mayflower Beach • Crowe’s Pasture <p>• Chapin’s Beach</p> <p>• West Dennis Beach</p> <p>Areas of Episodic Siltation</p> <ul style="list-style-type: none"> • Sesuit Harbor • Swan River <p>• Bass River</p> <p>• Chase Garden Creek</p> <p>Deficient Infrastructure</p> <ul style="list-style-type: none"> • Upper County Road Bridge over the Swan River • Route 28 Bridge over Swan River
WIND	<p>Hurricanes</p> <p>Northeasters</p> <p>Tornadoes</p> <p>Roofs Blowing Off</p> <p>Trees Downed</p>	<p>Roof Damage</p> <ul style="list-style-type: none"> • Town Hall • Nathaniel Wixon School • Dennis Public Library <p>• Ezra Baker School</p> <p>• Dennis Memorial Library</p> <p>• Town wide</p> <p>Trees Downed - Locations proximal to wind activity:</p> <ul style="list-style-type: none"> • Town wide

NATURAL HAZARD	CAUSE & EFFECT	LOCATION
<p>FIRE</p>	<p>Drought Wildfire Lightening Strikes Urban Fire</p>	<p>Wildfire Developed land / forested area interfaces:</p> <ul style="list-style-type: none"> • Crowes Pasture • Princess Beach/Scargo Hill • Old Chatham Rd Water District Lands • The Plashes • Shoop Gardens <p>Urban Fire</p> <ul style="list-style-type: none"> • Dennisport Village Center is blessed with many old buildings placed close together. The Village was the scene of a major urban fire in the 1920's which destroyed an entire block. Construction standards of the 1920's do not match modern fire safety standards, leaving this area once again at risk of an Urban Fire. • West Dennis, while not as compact as Dennisport shares many of the same urban fire concerns. The older portions of town still bear resemblance to the original village settlement with shared, wood, walls. This area is at significant risk should a fire begin in one of these older connected structures.
<p>GEOLOGIC</p>	<p>Earthquakes Landslides Sink Holes</p>	<p>Structural Damage - Locations proximal to seismic activity: According to Regional Hazard Risk Map II geologic activities have not been recorded.</p> <p>Loss of Land</p> <p>Dennis, as is all of Cape Cod, is a sandbar. There is always significant risk to the town due to coastal erosion. Some portions of town have experienced significant areas of erosion over the town's history. Major storms, such as the Blizzard of 78 vastly altered the coastline. Lesser storms, including a Northeaster in June of 2009 also have had significant impacts. Barrier Beach erosion at places like West Dennis Beach or Chapin's Beach could severely affect the lands behind these barrier beaches.</p> <p>Wave Inundation</p> <p>Dennis has several areas protected by barrier beaches. These barrier beaches protect lands in Dennis, Yarmouth and</p>

NATURAL HAZARD	CAUSE & EFFECT	LOCATION
		<p>Brewster from normal wave action. These barrier beach areas are at risk both to wind erosion as well as wave inundation. All three barrier beaches in town, West Dennis Beach, Chapin's Beach and Crowe's Pasture are all considered to be located within velocity zones and would be exposed to tremendous wave action and could be totally inundated in a 1% storm event.</p>
<p>OTHER</p>	<p>Snow & Ice Accumulation Chronic Erosion Sea Level Rise Sediment Deposition</p>	<p>Snow and Ice Accumulation <ul style="list-style-type: none"> • Most Private Roads • Trees along Scenic Roads <p>Street Flooding/ Impassable Roads <ul style="list-style-type: none"> • Lower County Road • Route 28 at Bass River • Lighthouse Road • Route 28 at Swan River • Swan Pond Road • Old Main Street, So Dennis • Bridge Street • Nobscusset Road, • Beach Street • Upper County Road • Uncle Barney's Road <p>Structural damage <ul style="list-style-type: none"> • Docks, piers town wide <p>Sediment Deposition <ul style="list-style-type: none"> • Sesuit Harbor • Swan River • Bass River • Chase Garden Creek </p></p></p></p>

3.4 **Shelter Adequacy Analysis**

The best indicator is the type of event that would most likely result in a large-scale evacuation is a severe hurricane, however blizzards are far more common. The following tables attempt to show the impact of a full-scale evacuation during a severe hazard event. Table 6 depicts the existing shelter facilities and capacities; Table 7 estimates the vulnerable population. Based upon the analysis, there is some question as to whether the available shelter resources are capable of accommodating the at risk population for a severe hurricane. This is especially significant in that the shelter areas may need to support the population that may be at health risk (the elderly and the infirm) due to prolonged power outages.

Table 11: Public Shelter Facilities Capacities

Name / Address	Flood Potential	Generator	Food Service Capabilities? Y/N	Handicap Accessible? Y/N	Capacity @20 sq. ft / person
A) Nathaniel Wixon Middle School 901 Route 134	None	Y	Y	Y	7,082
B) Ezra Baker School 810 route 28	Yes SLOSH	Y	Y	Y	2,731
C) Dennis Senior Center 1045 Route 134	None	Y	Y	Y	959
D) Carleton Hall 1006 Bass River Road	None	N	N	Y	309
D) Town Hall 485 Main Street	None	Y	N	Y	585
F) Jacob Sears Memorial Library 23 Center Street	None	N	N	Y	215
G) VIC Hall Depot Street	Yes SLOSH	N	N	Y	124
H) Dennis Yarmouth High School Regional Shelter Station Avenue, Yarmouth	None	Y	Y	Y	500
I) Cape Cod Regional Technical High School 351 Pleasant Lake Ave Harwich, MA	None	Y	Y	Y	??
Total Capacity					12,505

Sheltering will focus on using the regional shelter (DYHS) first with the Wixon School as a backup. The Council on Aging facility would be the third choice. The Ezra Baker School would be the fourth alternative for sheltering in an extreme situation.

Table 12: Vulnerable and Evacuating Populations

Population						
Population				Vulnerable Population**		
Census	Permanent	Seasonal	Total	Permanent	Seasonal	Total
2000	15,973	37,475*	53,488*	5,087	11,935*	17,022*
*Information derived from the GIS layers as maintained by the Dennis Planning Dept., U.S. Census Block Group Data, Assessors Information on Residential Units, Motel Units and Seasonal Cottages.						

As discussed earlier, there are about 5,087 people living year-round within the flood prone areas of Dennis. This figure increases dramatically in the summer time when 11,935 additional residents move into their seasonal homes, motel rooms and cottages – mostly within the waterfront areas of Dennisport and West Dennis. These people boost the summertime figure by some estimates to over 60,000 people in Dennis in July or August. Most of these hotel rooms, timeshares, cottages and condominium rentals are located in the most storm prone areas of Dennisport. The figures illustrate a likelihood that local shelter capabilities, in the summer time, could be overwhelmed by the sheer number of people who may need to be evacuated.

3.5 Evacuation Analysis

The ability to evacuate an area will truly depend on the storm forecast availability. NOAA and the National Weather Service provide significant, detailed analysis of Atlantic Hurricanes long before they reach the Cape Cod coastline. Obviously, if residents and visitors to Dennis heed the warnings of these storms, they would appear to be the easiest to prepare for and to stage a successful evacuation. Hurricanes and other tropical events provide the opportunity for people, if they take the warnings seriously, to entirely leave the area in an orderly fashion. Thus, while they occur in times when we have the greatest number of people here, they do provide an ability for evacuation over several days. Unfortunately, as happened with a Labor Day Weekend storm several years ago, people do not heed the warnings, wait for the last minute to leave, and generally get caught in traffic that takes hours to move short distances in – leading to traffic gridlock.

Even winter storms provide some level of predictability that was not present a few decades ago. Generally, however, these winter storms often gain strength in the late stages and can have larger impacts on the town than may have been predictable more than twenty-four hours out. Winter Storms clearly require a more localized approach. Looking at the shelters that are available in Dennis, only three are outfitted with generator capability. These three facilities provide capacity for slightly over 10,000 people – the crowded, 20 sf per person analysis of this report.

Dennis has an agreement with First Student Bus Company to provide four buses to the town for evacuations. The town did an exercise in June 2009 with First Student. The

Barnstable County Regional Evacuation Planning Committee has since held an exercise using an Upper Cape Facility (Oak Ridge School in Sandwich) and in January 2010 an exercise is planned for the Cape Cod Regional Technical School. In order to ensure preparedness for evacuation needs Barnstable County communities plan to hold annual exercises with each regional shelter.

Limited warning events, such as severe thunderstorms, or no warning events such as a tornado or waterspout raise far more tension in the emergency management system. A severe thunderstorm or waterspout can appear quite suddenly on a warm summer day. Their appearance could push for a quick evacuation of town beaches and parking areas depending upon the event. Clearing an area such as West Dennis Beach could take quite a feat, as there is only one significant road leading out of the beach – Lighthouse Road. Traffic leaving Lighthouse Road is forced to stop at Lower County Road/South Main Street, from which evacuees will need to decide whether to proceed to School Street or Trotting Park Road. Similar emergency evacuation concerns would exist at all of the other south side beaches. Complicating the matter is that, at many of the Dennisport beaches, the beachgoers arrive on foot. A sudden severe weather event could clearly leave many people exposed to dangerous weather conditions.

3.6 Repetitive Loss Properties And Remediation

A key feature for protecting residents, is Dennis' participation in the National Flood Insurance Program. NFIP provides a level of protection to homeowners living in a flood zone should they be impacted by flooding. As the flood maps in Section 2 illustrate the town has a significant land mass identified as subject to flooding. The maps also suggest that an even larger land mass is potentially exposed to flooding and may be added to NFIP in years to come.

NFIP data allows the town to track Repetitive Loss properties. These type of properties are a major issue in that they represent areas that have been impacted not just by one, but by several flood events.

As the following tables illustrate, there are 18 repetitive loss properties in Dennis. Fifteen are on the south side and three on the north side of town. This represents a two property increase since the last report in 2002. These two properties were on the north side of town. The overall value related to these repetitive loss properties is significant (Tables 13 and 14). Dennis also has a significant number of Flood Insurance policies in effect (Table 15).

Dennis has adopted building and zoning controls to push repetitive loss properties and other at risk properties towards flood protection standards. The town requires that any structure undergoing renovation valued at 50% of the buildings assessed value to comply with flood construction standards. Over the past several years these requirements have resulted in numerous structures being brought into compliance.

Table 13

Repetitive Loss Properties, Barnstable County (updated, 2009)

Loss Statistics of the National Flood Insurance Program (NFIP), Cape Cod, Massachusetts: 1978 (start NFIP) – April 30, 2009					
Town	Total Loss Claims	Closed Losses	Open Losses	CWOP Losses	Total Payments (\$)
Barnstable	272	193	1	78	2,893,815.62
Bourne	460	377	0	83	5,435,069.19
Brewster	15	9	0	6	33,894.27
Chatham	129	95	0	34	2,508,901.93
Dennis	222	148	0	74	1,427,839.87
Eastham	64	51	0	13	388,704.45
Falmouth	619	472	0	147	9,091,548.94
Harwich	40	26	0	14	330,024.53
Mashpee	57	31	0	26	186,258.77
Orleans	47	36	0	11	631,910.35
Provincetown	167	104	0	63	1,293,769.57
Sandwich	129	94	0	35	1,096,722.24
Truro	25	9	0	16	79,359.70
Wellfleet	31	18	0	13	135,130.25
Yarmouth	217	119	0	98	879,940.13
Total for MA	26,747	21,332	13	5,402	281,565,104.97

CWOP – closed without payment

Source: Cape Cod Commission

Table 14: Repetitive Flood Losses (current through Oct. 2009)
 Information provided by Cape Cod Commission

VILLAGE	LOSSES	PAID	TYPE	FLOOD ZONE
East Dennis	5	\$28,587.20	Single Family	A3 (EL 11)
West Dennis	3	\$11,373.15	Single Family	V13 (EL 13)
Dennisport	2	\$5,142.15	Single Family	A8 (EL 10)
West Dennis	2	\$18,090.41	Single Family	V13 (EL 12)
West Dennis	2	\$3,240.00	Single Family	A11 (EL11)
West Dennis	2	\$55,925.15	Single Family	V13 (EL 13)
Dennisport	3	\$31,379.70	Other Residential	V13 (EL 15)
Dennisport	2	\$9,634.74	Other Residential	V13 (EL 13)
Dennisport	2	\$26,335.25	Single Family	A11 (EL 11)
West Dennis	5	\$87,911.06	Condo	V13 (EL 12)
West Dennis	2	\$32,603.71	Single Family	V13 (EL 13)
West Dennis	2	\$9,158.65	Single Family	V13 (EL 12)
West Dennis	2	\$12,917.80	Single Family	A11 (EL 11)
West Dennis	2	\$12,980.73	Single Family	V13 (EL 13)
Dennisport	2	\$9,716.94	Single Family	A8 (EL10)
Dennisport	4	\$108,882.36	Single Family	V8 (EL 15)
West Dennis	3	\$45,521.51	Single Family	A11 (EL 11)
West Dennis	2	\$20,000.00	Single Family	
Dennis	2	\$9,299.07	Single Family	A3 (EL 11)
Dennis	3	7,898.54	Single Family	A4 (EL 12)
TOTALS	48	\$501,076.61		

Table 15

Policy Statistics of the National Flood Insurance Program (NFIP), Cape Cod, Massachusetts: 1978 (start NFIP) – April 30, 2009			
Town	Policies In-Force	Insurance In-Force (whole \$)	Written Premium In-Force
Barnstable	1,048	291,038,000	1,159,578
Bourne	1,152	244,073,400	1,714,400
Brewster	94	27,058,100	63,335
Chatham	422	119,267,300	396,752
Dennis	948	218,863,700	999,787
Eastham	155	45,563,100	122,582
Falmouth	2,150	517,057,100	2,900,569
Harwich	561	138,603,500	419,358
Mashpee	536	148,810,200	484,894
Orleans	188	57,247,800	170,202
Provincetown	788	135,983,800	712,681
Sandwich	388	90,522,100	472,623
Truro	223	41,500,300	218,583
Wellfleet	151	38,243,400	138,368
Yarmouth	1,292	286,323,600	1,372,282
Total for Barnstable County	10,096 (@ 20% MA total)	2,400,155,400	11,345,994
Total for MA	50,197	10,722,546,000	51,087,948

Source: Cape Cod Commission

3.7 Estimating Potential Dollar Loss

Flooding and urban fires provide the two areas where the town is most capable of estimating the dollar value of loss in the town. The Dennis Planning Office worked with the Dennis Assessor's Office to extract the value of all properties within flood prone and fire prone areas in Dennis. We have determined that the current replacement value of structures subject to flooding within the 1% storm event flood zone (as mapped for adoption by FEMA on July 30, 2009) to be about \$494 million. These values increase to \$1.04 billion for properties potentially at risk of flooding (1% storm event) originally mapped by FEMA (draft maps dated May 12, 2009). While these latter maps have been deferred by FEMA for additional study the land mass identified on these May 12, 2009 maps match Army Corps of Engineers Category 2 Hurricane SLOSH zone impacts. These areas also match much anecdotal evidence of the reach of significant hurricane events impacting Dennis in 1938 and 1954.

The last major urban fire to occur in Dennis was in 1920. In that year an entire urban block in Dennisport was destroyed. Land development patterns in Dennisport and West Dennis continue to illustrate areas which could be subject to such fires. In particular, in Dennisport the same area that burned in 1920 continues to be developed in a densely settled pattern of shared walls and zero setbacks as when the fire occurred. Since 1920,

areas of Dennisport nearer the water have also developed in densely settled neighborhoods of cottages along Old Wharf Road. These areas also illustrate possible urban wildfire threats. Finally, in West Dennis, a small section of the village, dating back over 100 years, is similarly densely settled. Structural replacement values in these areas are:

Dennisport Village Center	\$3.1 million
Dennisport Cottage Colony Area	\$23.9 million
West Dennis Village Center	\$1.5 million

3.8 Vulnerability – Development Trends and Future Structures in Hazard Zones

Dennis is a community that is very near build-out. Southerly coastal areas developed in the early to mid 1900's. Northerly coastal areas developed much more recently. Due to these development trends, there are far more properties "at-risk" in southern areas of town than elsewhere. These properties are, actually, "at-risk" for many of the identified hazards. Flood prone areas are as likely, if not more likely, to experience other severe weather issues as they are flooding. These low lying coastal areas are exposed to wind, driving rain and snow. Snow and ice build-up on older infrastructure is also an issue.

Dennis sees the need to promote re-investment in many of these areas, essentially to promote transition to upgraded structures meeting modern construction, wetland, fire safety, and erosion control requirements. The following paragraphs provide some detail on how Dennis is preparing to protect both existing and future structures from hazards:

Flooding: The town has undertaken significant efforts in the past two decades to ensure the protection of its open areas as well as its developed neighborhoods. The open land preservation efforts have included acquiring flood prone properties and placing them into conservation protection. Thereby protecting future generations both from ill-advised development in flood zones as well as by protecting areas capable of providing for flood storage. In addition, the town has adopted flood plain controls under its local Zoning, Health and Wetlands Regulations. This multi-prong approach has put into place measures to ensure that structures are constructed or reconstructed in a flood safe manner.

The Town of Dennis has 2,459 parcels of land located within the 1% flood zone. Of these, 2,138 have structures located on them. These parcels comprise 5,376 acres. The Commonwealth of Massachusetts owns 20 of these acres, the Town of Dennis owns 1,045 acres for conservation, recreation or educational purposes (1 school), the Dennis Conservation Trust owns 194 acres and the Massachusetts Audubon Society owns 9 acres. Land developed for residential purposes comprise 2,267 acres, with 2,624 residential structures (some residential properties contain more than one residential structure). Land developed for commercial purposes include 235 acres with 758,000 sf of commercial space (motels, retail plazas, offices, etc.). The net result finds that about 1,600 acres of land that is undeveloped located within the flood zone. Nearly all of this acreage (1,594 acres) is classified by the Dennis Assessors as unbuildable.

As this illustrates, any real potential for new development within the flood areas of Dennis are minimal. Redevelopment, however is not only possible, but might be desirable. The town has, as noted above, has adopted flood plain zoning, wetland regulations, health regulations and implements the state building code for these areas. Redevelopment of these older areas is probably desirable. Dennis Assessors records for these areas illustrate that, of the 2,624 residential structures located within the flood zone, 2,167 (83%) were constructed prior to 1980. Any significant remodeling of these structures will trigger the 50% of structural value trigger and will require the building to be constructed to modern flood zone construction standards.

Erosion: The town has also adopted coastal bank setback requirements in both the Zoning By-law and Wetlands Regulations. These setback requirements provide some measure of protection for structures against the hazards of coastal erosion. By requiring that new structures be set back at least 50 feet from the top of a coastal bank, the town has provided significant protections against damage from coastal erosion. The town has also created a committee to study the cause and effects of erosion of the three Coastal Banks in Dennis. This Committee is charged with developing a long range plan for protecting these critical town natural features.

Wind: Both public and private entities work to protect Dennis residents from wind damage. The Dennis DPW reviews the conditions of trees on an on-going basis. As it identifies public trees that are sick or dying, or that pose a public risk, the DPW removes these trees. These efforts provide opportunities to maintain public access during storm events by trying to ensure obstacles are removed prior to them becoming a hazard. The areas public utility (NSTAR) provides a similar plan to remove trees that could threaten the town's power grid. NSTAR's tree trimming program is designed to review and remove trees and branches that could come into contact with power lines during a storm.

Severe Weather: The Town of Dennis Building Department strictly enforces Massachusetts Building Code requirements as they apply to reconstruction and rehabilitation of existing structures and new construction. These standards include provisions for wind protection as well as from flooding and other severe weather conditions. The Town also works with other Cape Cod communities on emergency planning and for the provision of shelters when needed for the protection of the town's citizenry.

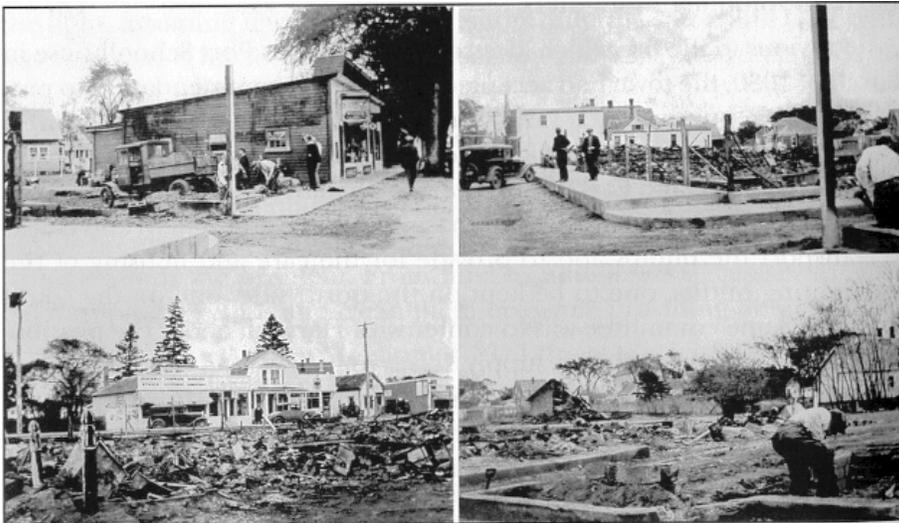
Wildland Fires: The Dennis Fire Department and Natural Resources Department have teamed with the Barnstable County Cooperative Extension Office to develop wild fire maintenance standards for several large tracts of land in Dennis. These plans identify efforts to reduce or remove underbrush and other materials that could feed a wildfire. In addition, in Crowe's Pasture, the town has worked with county and state agencies to restore a natural pasture, and to maintain that pasture areas through controlled burns.

Urban Fires: The Town of Dennis, through its Building and Fire Departments provide code inspection services for all "public" places in Dennis. These inspections look for fire

hazards and identify safety hazards building owners need to address as part of annual licensing requirements. The at risk areas are described below:

Dennisport Village Center: Most of the buildings in this area date to the 1800's. A section burned in the 1920's and was rebuilt in a hurried fashion. The area contains about 67.4 acres, with the densest area (and most fire prone) confined to just under six acres of land. The densest area is predominantly developed with about 2.5 acres of land within the district being under the footprint of buildings, 2.6 acres paved for parking or vehicular access and about 0.7 acres of green space. In this area there is currently 60,594 sf of retail development, ten residential units (7 recently occupied as part of an affordable housing special permit), 1,900 sf of office space and 5,052 sf of restaurant space (166 seats).

Under the build-out scenario, the total retail floor space could, theoretically increase to about 76,369 sf, with 81 residential units (151 bedrooms) and 7,189 sf of restaurant space. This is theoretical, in that the one site to date to start the redevelopment process is, in actuality, looking at a reduction in commercial space over existing conditions and fewer residential units than build-out would suggest. The construction standards from 1920 and earlier clearly do not address modern fire code standards. As with the flood zone, discussion, redevelopment is desirable, not just for economic development, but for fire safety reasons. Redevelopment will require that all sites meet modern fire safety standards, thereby reducing the urban wildfire risks in this area.



West Dennis Village Center

The core of West Dennis is a small, one block area that is similar in nature to Dennisport Village Center. The area, of only about two acres, resembles the development pattern from over 100 years ago. Side by side wood buildings with little protection against a rapid fire spreading across multiple structures. The town has rezoned this area to promote reinvestment in this area.



Dennisport Cottage Colony Areas

This area contains about 60 acres of land and contains a mix of open wetland areas to the north which might be considered a wildland fire risk. However, the biggest concern is the 34 acres of land that is occupied at a density of 19 units (cottage and recreational vehicles) to an acre. This area contains 439 cottages and 213 recreational vehicles in some cases practically touching one another. The area, built from the 1930's to the 1950's, are mostly one-room cottages with little insulation and exposed wires. Many of the cottages have been retrofitted over the years with indoor cooking facilities and various forms of heating. No modern construction or fire safety standards have ever been applied in these areas. The location is a significant risk for fire involving multiple structures. The town is working with the cottage owners and property owners on ways to promote re-investment in these areas to encourage compliance with modern building codes.

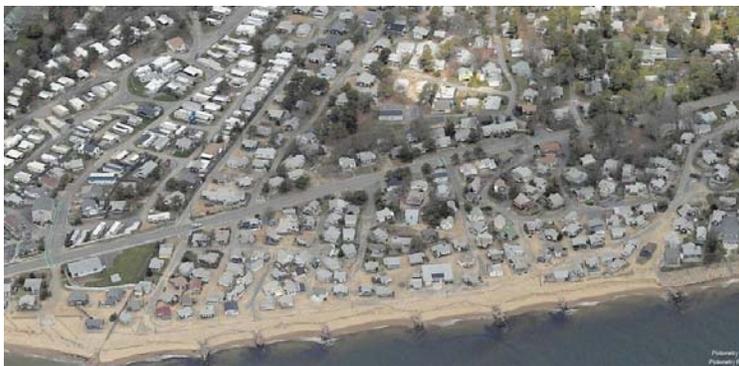


Table 8 illustrates many of the measures currently in place in Dennis to protect and guide land development. As part of the development of the hazard mitigation plan a matrix assessing existing plans, programs and policies that Dennis has in place that incorporate hazard mitigation or other protective measures has been included below.

Table 16: Existing Protection Matrix

Existing Protection	Description	Area Covered	Enforcement and/or Effectiveness
Flood Plain Zoning – Section 6 Floodplain District	Floodplain Compliance Regulations	As designated by the Flood Insurance Rate Map (FIRM) for the Town of Dennis, Community # 250005 (Zones A's & V's)	Building Commissioner
Local Wetlands Protection Bylaw	Regulates development within wetland resource areas including Special Flood Hazard Areas	Wetland Resource Areas	Conservation Commission
Beach Maintenance Program	Raking and cleaning beaches of debris	Town Beaches	Department of Public Works Beach and Recreation Dept.
Comprehensive Management Emergency Plan	Provides a framework wherein the community can plan and perform respective emergency functions during a disaster or emergency situation on the local, state or national level.	Town wide	Local Emergency Planning Committee
Storm Water By-law	Provides for proper storm water system design to control volume and rate of storm water run-off	Town wide	Building Commissioner with review by Engineering Department (Adopted October 2009)
Subdivision Regulations	Requires utilities to be placed underground, drainage designed in accordance with town Storm Water By-law	Residential and Commercial Districts	Planning Board
Site Plan Review	Review of development projects for storm water control in accordance with Storm Water by-law	Commercial Districts	Planning Board
Wildfire Assessment & Preparedness Program	County grant program to reduce wildfires	Shoop Community Gardens, Princess Beach/Scargo Hill, The Plashes, Water District Greenbelt Area	Barnstable County Cooperative Extension Service, Fire Department Dept of Natural Resources & Conservation Commission
Dock Regulations		100 Year Floodplain Areas as designated by FIRM	Conservation Commission
National Flood Insurance Program (NFIP)	Federally backed flood insurance available to homeowners, renters & businesses	100 Year Floodplain Areas as designated by FIRM	FEMA / Building Commissioner
Building Permits	Building Code Enforcement		Building Commissioner
Barrier Beaches Management	Management Plan for the protection and nurturing of the three Barrier Beaches in Dennis.	Chapin Beach, West Dennis Beach, Crowe's Pasture	Barrier Beach Committee (est. Aug. 4, 2009)
Land Acquisition	Acquisition of critical land areas for resource management.	Town-Wide	Community Preservation Committee, Dennis Conservation Trust
Quivet Neck/Crowe's Pasture Resource Protection District	Special Zoning to protect the Quivet Neck/Crowe's Pasture Resource Protection Area from inappropriate development.	Quivet Neck and Crowe's Pasture in north east Dennis	Planning Board, Building Commissioner
Environmentally Sensitive Area Waste Water Requirements	Ensures proper design of septic systems located in areas designated as environmentally sensitive (high water table, proximity to wetlands, flood zones)	Areas with high water tables, proximate to wetlands, or located within flood zones	Board of Health, Conservation Commission

Section 4: Mitigation Strategy Action Plan

MITIGATION STRATEGY

“Section 201.6(c)(3) of the mitigation planning regulation requires jurisdictions to develop a mitigation strategy. The mitigation strategy serves as the long-term blueprint for reducing the potential losses identified in the risk assessment. The mitigation strategy includes the development of goals, objectives, and prioritized mitigation actions.”

The development of goals, and the actions or projects to meet these goals are based on the town’s abilities under state law; as zoning, wetlands and health regulations; and the financial resources available to Dennis to reduce losses and vulnerability from hazards. The goals are long-term policy statements that support the mitigation strategy. An example of a goal for an urban wildfire hazard could be, “Minimize urban wildfire losses.” From there, the Town would look at objectives to attain the goals, for instance. Unlike goals, objectives are specific and measurable, such as, “Increase the use of sprinklers in centralized urban settings.”

Following the identification of goals and objectives, the mitigation planning regulation at 44 CFR Part 201 requires Dennis to identify, analyze, and prioritize alternative actions by hazard types. These actions must be quite specific. An example of an action for an urban wildfire hazard might be “Seek grant opportunities to promote urban revitalization and fire prevention in Dennisport.”

The federal guidance recommends that Dennis develop actions that can be implemented by using local tools, such as capital improvement budgets, special district funds, or implementing changes in by-laws, policies, or procedures. The guidance also wants us to consider mitigation actions that may not be currently feasible, but may become a realistic possibility following a disaster event (acquiring property that may be destroyed by flooding). Access to State or Federal funds may enable Dennis to accomplish actions during post-disaster recovery.

We are required, after five years of implementing the mitigation strategy, to update these goals and actions. In the plan update, goals and objectives may be reaffirmed or updated based on current conditions, including the completion of mitigation initiatives, an updated or new risk assessment. At five year intervals we will be required to review the changes in Dennis since the previous plan was approved to determine whether goals have been met or if they remain consistent with current conditions.

This section will list potential loss reduction actions and analyze various actions that achieve our stated goals and objectives to reduce or avoid the effects of the hazards in this report. The section includes a comprehensive range of mitigation actions and consists of multiple mitigation actions for each profiled hazard.

This section outlines Dennis's overall strategy to reduce our community's vulnerability to the effects of natural hazards. It has been separated into the following two distinct sections:

Mitigation Objectives – these are designed to support and correspond directly with the Community Goals (see Section 1).

Mitigation Actions – these are specific measures to be undertaken by the Town in order to achieve identified objectives. Each action identifies the objective it is intended to achieve, includes some general background information justifying the proposed action, and provides measures to assure successful and timely implementation.

Also important to note is that each Mitigation Objective and Mitigation Action is designed to be performance-based, making it easier for the Town of Dennis to measure the Plan's progress over time and during the Plan's future evaluations.

It is expected that while the *Community Goals* established in Section I may remain the same for an extended period of time, the objectives and actions included in this *Mitigation Strategy* will be updated and /or revised through regular enhancements to this Plan.

4.1 Mitigation Objectives

The following objectives have been formulated to support and to correspond directly with the Community Goals in Section 1. These objectives have been developed also to provide the Town with measurable short-term milestones.

- **Goal #1:** *Reduce the loss of life, property, infrastructure, and environmental and cultural resources in the Town from natural disasters.*
 - 1a. Preserve the natural and beneficial functions of the town's floodplain, wetlands, beaches and dunes through continued support of natural resource protection policies and by discouraging growth in environmentally sensitive areas.
 - 1b. Enhance the Town's capability to conduct hazard risk assessments, demonstrate funding needs, and track mitigation activities throughout town (whether directly as part of this plan, or indirectly through the normal course of business).

- 1c. Ensure that all new construction is completed using wind-resistant design techniques that will limit damage caused by high winds and reduce the amount of wind-borne debris.
 - 1d. Ensure that all municipal structural mitigation measures be coordinated with Town Boards and Commissions to review a project's sensitivity to natural features, historic resources and community character.
- **Goal #2:** *Coordinate local hazard mitigation planning and activities with those of Barnstable County and neighboring towns.*
 - 2a. Ensure that current emergency services are adequate to protect public health and safety. Ensure coordination with neighboring towns and County emergency services.
 - **Goal #3:** *Seek for and take advantage of funding opportunities to implement the Multi-Hazard Mitigation Plan.*
 - 3a. Maximize the use available hazard mitigation grant programs to protect the Town's most vulnerable populations and structures.
 - 3b. Make use of available land preservations funds, including Community Preservation Act funding, to acquire critical repetitive loss parcels to return to open space.
 - **Goal #4:** *Mitigate potential financial losses incurred by municipal, residential and commercial establishments due to disaster.*
 - 4a. Ensure that all critical facilities are protected from the effects of natural hazards to the maximum extent possible.
 - 4b. Ensure that new construction within high hazard areas are completed using wind-resistant design techniques that will limit damage caused by high winds and reduce the amount of wind-borne debris.
 - 4c. Decrease the number of FEMA-identified "repetitive loss properties" from 14 currently to 10 by the year 2010.
 - **Goal #5:** *Develop and conduct hazard awareness information and educational programs for the public.*
 - 5a. Increase the level of knowledge and awareness for Town residents on the hazards that are potential threats to the area.
 - 5b. Educate property owners on the affordable, individual mitigation and preparedness measures that can be taken before the next hazard event.
 - 5c. Educate Town staff on cost-effective, mitigation and preparedness measures that can be taken before the next hazard event.

4.2 Mitigation Actions

In formulating this Mitigation Strategy, a wide range of activities were considered in order to help achieve the goals of the community and to lessen the vulnerability of the Town of Dennis to the effects of natural hazards. In general, all of these activities fall into one of the following broad categories of mitigation techniques.

Mitigation Techniques

1. Prevention

Preventative activities are intended to keep hazard problems from getting worse. They are particularly effective in reducing a community's future vulnerability, especially in areas where development has not occurred or capital improvements have not been substantial. Examples of preventative activities include:

- Planning and Zoning
- Open space preservation
- Floodplain regulations
- Storm water management
- Drainage system maintenance
- Capital improvements programming
- Shoreline/ riverine/ fault zone setbacks
- Capital improvement programming

2. Property Protection

Property protection measures protect existing structures by modifying the building to withstand hazardous events, or removing structures from hazardous locations. Examples include:

- Acquisition
- Relocation
- Building elevation
- Critical facilities protection
- Retrofitting (i.e., windproofing, floodproofing, etc.)
- Safe rooms
- Insurance
- Installing shutters for wind protection

3. Natural Resource Protection

Natural resource protection activities reduce the impact of natural hazards by preserving or restoring natural areas and their mitigative functions. Such areas include floodplains, wetlands and dunes. Parks, recreation or conservation agencies and organizations often implement these measures. Examples include:

- Floodplain protection
- Beach and dune preservation
- Riparian buffers

- Fire resistant landscaping
- Fuel Breaks
- Erosion and sediment control
- Wetland preservation and restoration
- Habitat preservation
- Slope stabilization

4. Structural Projects

Structural mitigation projects are intended to lessen the impact of a hazard by modifying the environmental natural progression of the hazard event. They are usually designed by engineers and managed or maintained by public works staff. Examples include:

- Reservoirs
- Levees/dikes/floodwalls/seawalls
- Diversions/Detention/Retention
- Channel modification
- Beach nourishment
- Storm sewers

5. Emergency Services

Although not typically considered a "mitigation technique," emergency service measures do minimize the impact of a hazard event on people and property. These commonly are actions taken immediately prior to, during, or in response to a hazard event. Examples include:

- Warning systems ("Reverse 911")
- Evacuation planning and management
- Sandbagging for flood protection

6. Public Information and Awareness

Public Information and awareness activities are used to advise residents, business owners, potential property buyers, and visitors about hazards, hazardous areas, and mitigation techniques they can use to protect themselves and their property. Examples of measures to educate and inform the public include:

- Outreach projects
- Speaker series/demonstration events
- Hazard map information
- Real estate disclosure
- Library materials
- School children education
- Hazard expositions

4.3 Prioritization of Action Items

Actions that will be undertaken to implement effective hazard mitigation in high risk areas in the Town of Dennis are consistent with the State and County approach of using both non-structural and structural projects, and to use a *non-structural* hazard mitigation approach before undertaking a *structural* approach.

- A *non-structural* hazard mitigation approach is a strategy that does not change the natural hazard, but involves preventative actions that improve infrastructure to reduce the damages, or improve coordination of resources.
- A *structural* hazard mitigation approach involves strategies that inhibit a natural hazard, such as a sea wall or dam.

4.4 Action Items

It is important to note that these mitigation actions are short-term, specific measures to be undertaken by Dennis. It is expected this component of the MHM Plan will be the most dynamic; it will be used as the primary indicator to measure the Plan's progress over time and will be routinely updated and/or revised through future planning efforts.

The section is broken down in the following manner for each hazard (it is possible that particular actions will be viable for more than one hazard or approach (i.e. prevention and property protection could have similar recommendations:

“* Prevention: Government administrative or regulatory actions or processes that influence the way land and buildings are developed and built. These actions also include public activities to reduce hazard losses. Examples include planning and zoning, building codes, capital improvement programs, open space preservation, and storm water management regulations.

“* Property Protection: Actions that involve the modification of existing buildings or infrastructure to protect them from a hazard, or removal from the hazard area. Examples include acquisition, elevation, relocation, structural retrofits, flood proofing, storm shutters, and shatter-resistant glass.

“* Public Education & Awareness: Actions to inform and educate citizens, elected officials, and property owners about potential risks from hazards and potential ways to mitigate them. Such actions include outreach projects, real estate disclosure, hazard information centers, and school-age and adult education programs.

“* Natural Resource Protection: Actions that, in addition to minimizing hazard losses also preserve or restore the functions of natural systems. These actions include sediment and erosion control, stream corridor restoration, watershed management, forest and vegetation management, and wetland restoration and preservation.

“* Structural Projects: Actions that involve the construction of structures to reduce the impact of a hazard. Such structures include storm water controls (e.g., culverts), floodwalls, seawalls, retaining walls, and safe rooms.”

Further, each action will be reviewed in Accordance with the STAPLEE criteria:

S

Social

The public must support the overall implementation strategy and specific mitigation actions. Therefore, the projects will have to be evaluated in terms of community acceptance.

T

Technical

It is important to determine if the proposed action is technically feasible, will help to reduce losses in the long term, and has minimal secondary impacts. Determine whether the alternative action is a whole or partial solution, or not a solution at all.

A

Administrative

Under this part of the evaluation criteria, examine the anticipated staffing, funding, and maintenance requirements for the mitigation action to determine if the jurisdiction has the personnel and administrative capabilities necessary to implement the action or whether outside help will be needed.

P

Political

Understanding how your current community and State political leadership feels about issues related to the environment, economic development, safety, and emergency management. This will provide valuable insight into the level of political support have for mitigation activities and programs. Proposed mitigation objectives sometimes fail because of a lack of political acceptability.

L

Legal

Without the appropriate legal authority, the action cannot lawfully be undertaken. When considering this criterion, determine whether your jurisdiction has the legal authority at the State, or local level to implement the action, or whether the jurisdiction must pass new laws or regulations. Each level of government operates under a specific source of delegated authority. As a general rule, most local governments operate under enabling legislation that gives them the power to engage in different activities. Identify the unit of government undertaking the mitigation action, and include an analysis of the interrelationships between local, regional, State, and Federal governments. Legal authority is likely to have a significant role later in the process when your State, or community will have to

determine how mitigation activities can best be carried out, and to what extent mitigation policies and programs can be enforced.

E

Economic

Every local and State government experiences budget constraints at one time or another. Cost-effective mitigation actions that can be funded in current or upcoming budget cycles are much more likely to be implemented than mitigation actions requiring general obligation bonds or other instruments that would incur long-term debt to a community. States and local communities with tight budgets or budget shortfalls may be more willing to undertake a mitigation initiative if it can be funded, at least in part, by outside sources. “Big ticket” mitigation actions, such as large-scale acquisition and relocation, are often considered for implementation in a post-disaster scenario when additional Federal and State funding for mitigation is available.

E

Environmental

Impact on the environment is an important consideration because of public desire for sustainable and environmentally healthy communities and the many statutory considerations, such as NEPA, to keep in mind when using Federal funds. You will need to evaluate whether, when implementing mitigation actions, there would be negative consequences to environmental assets such as threatened and endangered species, wetlands, and other protected natural resources.

Further, each item will be broken down further based upon suggestions by the Cape Cod Commission into subsections under the STAPLEE criteria. The detailed discussion of each strategy can be found in Appendix 4-1 at the end of this section. Below is a prioritized review of the town’s recommended strategies with appropriate implementing agencies identified.

STRATEGY	HAZARDS ADDRESSED	STAPLEE SCORE	RESPONSIBLE AGENCY
Increase public awareness of Flood Zone Issues, including use of town website and Dennis Planning Department Weblog	<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise)</i>	64	Dennis Planning Department
Regulatory – Coastal Bank Setbacks	<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise); Shoreline erosion (from shoreline change)</i>	63	Planning Board, Zoning By-law Study Committee, Conservation Commission, Zoning Board of Appeals
Inform public about new building code requirements	<i>Wind (from hurricanes, coastal storms, nor'easters)</i>	61	Building Department, Planning Department
Building Standards	<i>Wind (from hurricanes, coastal storms, nor'easters)</i>	60	Building Department
Promote strategies that lead to reinvestment of older properties in at risk areas, i.e. village centers and cottage colony areas	<i>Wildfire</i>	60	Fire Department
Regulating construction projects within and adjacent to protected wetlands.	<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise)</i>	58	Conservation Commission
Wetland Protection By-law application to coastal dunes – i.e. elevate structures to allow shifting sands across the footprint of structures.	<i>Shoreline erosion (from shoreline change)</i>	58	Conservation Commission

STRATEGY	HAZARDS ADDRESSED	STAPLEE SCORE	RESPONSIBLE AGENCY
Flyers, signage and other information on erosion and the importance of our dunes.	<i>Shoreline erosion (from shoreline change)</i>	57	Natural Resources, Planning Department
Barrier Beach Management Plan Committee	<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise)</i>	56	Barrier Beach Restoration Committee, Natural Resources Department
Conduct informational workshops regarding strategies to reduce wildfire risk within wildland and residential interface	<i>Wildfire</i>	56	Natural Resources, Planning Department, Fire Department
Conduct informational workshops regarding strategies to reduce urban wildfire risk.	<i>Wildfire</i>	56	Fire Department
Pursue available grants for retrofits of private and public facilities. With the completion of this document Dennis intends to start pursuing federal grant monies to elevate structures above flood level.	<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise); Wind (from hurricanes, coastal storms, nor'easters)</i>	54	Dennis Planning Department, Natural Resources Department, Board of Selectmen
Flood Zone Construction Standards.	<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise)</i>	54	Building Department

STRATEGY	HAZARDS ADDRESSED	STAPLEE SCORE	RESPONSIBLE AGENCY
Physical intervention – restoring river flow (culverts)	<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise)</i>	54	Department of Public Works, Engineering Department, Natural Resources
Land Acquisition within floodplain/Ongoing.	<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise)</i>	52	Board of Selectmen, Community Preservation Committee, Dennis Land Trust
Storm water Control	<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise)</i>	50	Building Department, Engineering Department, Planning Board
Change FEMA Flood Insurance Program as it relates to properties totally destroyed by flooding such that these properties are taken for the value of the premium payout. Requires changes at the federal level and is outside town control.	<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise)</i>	46	FEMA, Congress
Reduce Fuel Sources through mechanical devices, prescribed burns or selective cutting	<i>Wildfire</i>	45	Natural Resources, Department of Public Works
Beach and Dune Replenishment	<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise); Wind (from hurricanes, coastal storms, nor'easters); Shoreline erosion (from shoreline change)</i>	42	Barrier Beach Restoration Committee, Natural Resources Department

STRATEGY	HAZARDS ADDRESSED	STAPLEE SCORE	RESPONSIBLE AGENCY
Beach armoring	<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise)</i>	41	Private, Conservation Commission, Department of Public Works

IMPLEMENTATION OF NATIONAL FLOOD INSURANCE PROGRAM (NFIP)

Requirement §201.6(c)(3)(ii):

[The mitigation strategy] must also address the jurisdiction's participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.

The Town of Dennis participates in the NFIP. The town has worked with FEMA in 2009 to coordinate the public review of proposed flood boundary changes and will adopt the necessary Zoning, Wetland and Board of Health regulations in early 2010 to continue this participation. This participation is based on an agreement between Dennis and FEMA which will be renewed in 2010 as necessary. Dennis cooperates with FEMA and the NFIP on its three basic aspects: 1) floodplain identification and mapping (i.e. the public review process for the 2009 floodplain changes); 2) floodplain management (as documented in Dennis Zoning, Wetlands and Health Regulations); and 3) flood insurance (a major component of the 2009 floodplain revisions review).

As part of the town's participation in NFIP Dennis has adopted the current flood maps (1986 and 1992) and will adopt the 2009 maps in May of 2010. The town recognizes that these maps creates broad-based awareness of the flood hazards in Dennis and provides the data needed to administer floodplain programs and to actuarially rate new construction for flood insurance.

Dennis, as a participant in NFIP, has adopted and enforces floodplain management regulations through Zoning, Wetlands and Health Regulations to mitigate the effects of flooding on new and improved structures.

Dennis' participation in the NFIP enables property owners to purchase insurance as a protection against flood losses. Dennis also encourages property owners to understand the NFIP program as evidenced by the August 3, 2009 workshop held with FEMA to explain NFIP and the map revision process.

Dennis is committed to continued compliance with the NFIP. And will continue to:

- * Adopt and enforce floodplain management requirements, this includes our Zoning Wetlands and Health Regulations which require that structures which are substantially improved within Special Flood Hazard Areas (SFHAs) must meet NFIP standards;

- * The town will continue to work with FEMA and state officials on floodplain identification and mapping, as necessary the town will initiate requests for map updates – in particular the town will work with FEMA on the further exploration of changes associated with the initial May 2009 maps which identified a much larger potential flood hazard area than what was ultimately proposed as changes for Dennis; and

- * Dennis will continue to provide of community assistance and monitoring activities to FEMA, state officials and local residents as it applies to floodplain management.

Adopted July 26, 2011

APPENDIX 4-1

**TOWN OF DENNIS IMPLEMENTING STRATEGIES
EVALUATION MATRIX**

Each item will be scored on a scale of 3=Good, 2=Average and 1 = Poor under STAPLEE criteria.

HAZARD	
<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise)</i>	
PREVENTION	
ACTION/TIMEFRAME	SCORE
Land Acquisition within floodplain/Ongoing.	52
SOCIAL	
COMMUNITY ACCEPTANCE	
The town has adopted the Community Preservation Act and has used this funding source and state grants to acquire properties through-out town. The funds have been used within the floodplain along Swan Pond River, Quivet Creek, Sesuit Creek, Chase Garden Creek and Bass River.	3
EFFECTS ON SEGMENT OF POPULATION	
The land acquired to date, except for one instance, has all been vacant land. The acquisition of vacant land that is subject will not displace homeowners and will provide flood storage for nearby properties.	3
TECHNICAL	
TECHNICAL FEASIBILITY	
Land acquisition has been accomplished on many sites in town and remains a feasible alternative.	3
LONG TERM SOLUTION	
Land Acquisition of flood prone properties provides for permanently protected lands, preserving these areas from ill advised construction and providing long term flood management.	3
SECONDARY IMPACTS	
Land is removed from the Dennis Tax Rolls, thereby increasing the tax load on other properties	1
ADMINISTRATIVE	
STAFFING	
The town has limited staffing to maintain existing town land holdings. In that lands taken for flood prevention may not impose a tremendous burden on town staff, passive acquisitions do not pose the staffing issues that may go along with active open areas.	1
FUNDING ALLOCATED	
The Community Preservation Funds have been committed to a number of open space projects. Funding is presently limited, however the funding is dedicated to open space, historic preservation and affordable housing, and provides a long term dedicated funding stream.	2
MAINTENANCE OPERATIONS	
Maintenance (picking up litter) will be an issue on any empty parcel.	1
POLITICAL	
POLITICAL SUPPORT	

In the past questions have been raised about acquiring flood zone properties. Questions have arisen as to what level of benefit was the town receiving from acquiring properties which provided “limited” public benefits. There have been greater levels of support for properties which can support public access and recreational uses.	2
LOCAL SUPPORT	
The town leaders have generally supported land acquisitions	3
PUBLIC SUPPORT	
Town Meeting has supported land acquisitions	3
LEGAL	
STATE AUTHORITY	
State law authorizes the town to acquire property.	3
EXISTING LOCAL AUTHORITY	
The town is authorized to acquire property and has adopted the CPA for such acquisitions.	3
POTENTIAL LEGAL CHALLENGE	
The town only acquires land from willing sellers, no eminent domain proceedings are contemplated	3
ECONOMIC	
BENEFIT OF ACTION	
Land is acquired for flood storage, thereby protecting adjacent properties from flooding and preventing structures from being built on flood prone properties.	3
COST OF ACTION	
Varies by site.	2
CONTRIBUTES TO ECONOMIC GOALS	
The protection of the flood prone areas from inappropriate development protects scenic vistas of the town, preserving views that attract tourists to the town.	3
OUTSIDE FUNDING REQUIRED	
Yes, as match for local funds	1
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
Protects land and water.	3
EFFECTS OF HAZMAT WASTE SITES	
None	1
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Yes	3
CONSISTENT WITH FEDERAL LAWS	
Yes	3

HAZARD	
<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise)</i>	
PROPERTY PROTECTION	
ACTION/TIMEFRAME	SCORE
Change FEMA Flood Insurance Program as it relates to properties totally destroyed by flooding such that these properties are taken for the value of the premium payout.	46
Requires changes at the federal level and is outside town control.	
SOCIAL	
COMMUNITY ACCEPTANCE	
Mixed, properties at risk increase threats to town services, but also pay significant property taxes.	2
EFFECTS ON SEGMENT OF POPULATION	
Some homeowners would have their properties taken for insurance value	1
TECHNICAL	
TECHNICAL FEASIBILITY	
Would require congressional legislative change	3
LONG TERM SOLUTION	
Removal is the best long-term strategy	3
SECONDARY IMPACTS	
Would increase open space and flood storage	3
ADMINISTRATIVE	
STAFFING	
Would require federal staffing	1
FUNDING ALLOCATED	
None	1
MAINTENANCE OPERATIONS	
None	3
POLITICAL	
POLITICAL SUPPORT	
Unknown, support was clearly voiced at Coastal Zone 2009 in Boston	3
LOCAL SUPPORT	
Would be opposed by homeowners in the most at risk areas	1
PUBLIC SUPPORT	
Possibly quite large when the costs are explained	2
LEGAL	
STATE AUTHORITY	
No	1
EXISTING LOCAL AUTHORITY	
No	1
POTENTIAL LEGAL CHALLENGE	
Definitely	1

ECONOMIC	
BENEFIT OF ACTION	
Provides long term protection against future flood damages, and removes recurring loss properties	3
COST OF ACTION	
Funding needs will be significant	1
CONTRIBUTES TO ECONOMIC GOALS	
Protects properties near repetitive loss areas by eliminating insurance risks	2
OUTSIDE FUNDING REQUIRED	
Yes	2
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
Removing repetitive loss properties would protect land and water	3
EFFECTS OF HAZMAT WASTE SITES	
Could reduce risk of toxic releases	3
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Yes	3
CONSISTENT WITH FEDERAL LAWS	
Yes	3

HAZARD	
<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise)</i>	
PROPERTY PROTECTION	
ACTION/TIMEFRAME	SCORE
Pursue available grants for retrofits of private and public facilities.	54
With the completion of this document Dennis intends to start pursuing federal grant monies to elevate structures above flood level.	
SOCIAL	
COMMUNITY ACCEPTANCE	
The Planning Department has had several requests for assistance with pursuing FEMA funding for protection against hurricanes damage. One purpose of completing the study is to increase the town's eligibility for such funds.	3
EFFECTS ON SEGMENT OF POPULATION	
Grants would have the greatest benefit to people in "harm's way" – closest to the water's edge for instance	2
TECHNICAL	
TECHNICAL FEASIBILITY	
Grants for retrofits are available, however funding is limited	2
LONG TERM SOLUTION	
Retrofits provide a short term solution.	1
SECONDARY IMPACTS	
Reinvestment in properties exposed to strong storm impacts will ensure that structures remain in at risk areas	2
ADMINISTRATIVE	
STAFFING	
Town will need to provide staff to seek and oversee grants	1
FUNDING ALLOCATED	
None	1
MAINTENANCE OPERATIONS	
None	3
POLITICAL	
POLITICAL SUPPORT	
The town recognizes the need to help people and properties in at risk areas	3
LOCAL SUPPORT	
The residents in the most at-risk areas are beginning to solicit the town to pursue these type of grants	3
PUBLIC SUPPORT	
The general public will support protecting their neighbors investments, to a point.	2
LEGAL	
STATE AUTHORITY	

Yes	3
EXISTING LOCAL AUTHORITY	
Yes	3
POTENTIAL LEGAL CHALLENGE	
None	3
ECONOMIC	
BENEFIT OF ACTION	
Protects property values	3
COST OF ACTION	
Funding needs will be significant	2
CONTRIBUTES TO ECONOMIC GOALS	
Protecting property values promotes the town's economic goals	3
OUTSIDE FUNDING REQUIRED	
Yes	2
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
Protects land and water against adverse impacts if buildings are damaged in storms. Depending upon the actions invested in, land and water quality could be improved	3
EFFECTS OF HAZMAT WASTE SITES	
Could reduce risk of toxic releases	3
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Yes	3
CONSISTENT WITH FEDERAL LAWS	
Yes	3

HAZARD	
<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise)</i>	
PROPERTY PROTECTION	
ACTION/TIMEFRAME	SCORE
Flood Zone Construction Standards.	54
On-going.	
SOCIAL	
COMMUNITY ACCEPTANCE	
Flood zone construction standards have been adopted as part of the Dennis Zoning By-law. These requirements establish that new construction or substantial rehabilitation must comply with flood zone construction standards. The threshold has led to many projects attempting to stay below the threshold.	2
EFFECTS ON SEGMENT OF POPULATION	
The target population, owners of properties within the flood zone have been resistant to this requirement and seek methods to remain below the threshold.	1
TECHNICAL	
TECHNICAL FEASIBILITY	
Raising first floor elevation to above base flood elevation is technically feasible. Convincing people that this is in their best interest is more difficult.	3
LONG TERM SOLUTION	
Requiring construction of homes to meet Base Flood Elevation requirements will provide long term benefits, by elevating a number of properties to heights that will not be impacted by flooding.	3
SECONDARY IMPACTS	
The secondary impact of this requirement has been three-fold. First, it has led to many who seek to meet this standard to upgrade their existing structures to address other construction standards that have changed over time. It has also led to neighbors also elevating their structures. However, it has also led to some neighbors opposing construction plans by their neighbors as the buildings being too tall.	2
ADMINISTRATIVE	
STAFFING	
This effort is maintained within the normal Building Department function.	3
FUNDING ALLOCATED	
No additional funding is required to oversee this requirement.	3
MAINTENANCE OPERATIONS	
There are no maintenance requirements imposed on the town for this requirement.	3
POLITICAL	

POLITICAL SUPPORT	
The town has supported establishing flood standards for new construction	3
LOCAL SUPPORT	
Local support has been mixed outside of the political arena as some people do not support the idea that homes should be taller or need to be raised above base flood elevation.	1
PUBLIC SUPPORT	
Public support by residents outside the flood zone has been positive.	3
LEGAL	
STATE AUTHORITY	
Standards are set within the state building code.	3
EXISTING LOCAL AUTHORITY	
Local authority is through the local zoning and implementation of the state building code.	3
POTENTIAL LEGAL CHALLENGE	
Legal challenge would only come if the town were to seek to exceed state building code requirements	3
ECONOMIC	
BENEFIT OF ACTION	
Flood insurance is reduced for homes in the flood zone that meet BFE construction standards. Most homes that are constructed to these standards are also being improved to a point that increases property values.	3
COST OF ACTION	
Construction costs can be significant, especially for senior citizens who own many smaller, older homes within the flood zone.	1
CONTRIBUTES TO ECONOMIC GOALS	
Protecting the town from economic problems caused by major flooding can be accomplished with adherence to this requirement.	3
OUTSIDE FUNDING REQUIRED	
Private resources are often limiting, which leads to many seeking to cut corners to stay below the threshold. Outside funding such as grants may be needed to fully implement this requirement beyond the voluntary measures in place.	1
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
This depends on the process used by homeowners. Some elevate their structures on pilings which improve water flow across a property and allows for dune formation with shifting sands. Others seek to use fill to elevate, which displaces and redirects flood waters.	2
EFFECTS OF HAZMAT WASTE SITES	
None	3
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
When the Conservation Commission is involved in reviewing a project, the goals of improved dune formation and shifting sands are more easily accomplished.	2

Adopted July 26, 2011

CONSISTENT WITH FEDERAL LAWS	
Yes	3

HAZARD	
<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise)</i>	
PUBLIC EDUCATION AND AWARENESS	
ACTION/TIMEFRAME	SCORE
Increase public awareness of Flood Zone Issues, including use of town website and Dennis Planning Department Weblog	64
Ongoing, the Weblog proved very successful in publicizing changes to the FEMA flood zones in 2009.	
SOCIAL	
COMMUNITY ACCEPTANCE	
The Dennis Planning Department has used the internet to conduct significant outreach. The Weblog is currently visited on average 70 times per day. The flood maps are one of the top attractions to the blog.	3
EFFECTS ON SEGMENT OF POPULATION	
Dennis year round and seasonal residents make up the bulk of visitors to the flood information on the weblog.	3
TECHNICAL	
TECHNICAL FEASIBILITY	
The weblog exists	3
LONG TERM SOLUTION	
The weblog takes advantage of the current state of technology for reaching people via the internet. It provides for 24 hour access to planning information.	3
SECONDARY IMPACTS	
The web presence for the Planning Department has increase the interaction between the Planning Department and the general public.	3
ADMINISTRATIVE	
STAFFING	
Administered within existing staffing levels	3
FUNDING ALLOCATED	
The town has not allocated any extra funds for this outreach effort. Existing free resources have met the needs of this effort.	3
MAINTENANCE OPERATIONS	
The outreach on flood issues are one more burden on the Town Planner, with no increase in support for the department.	1
POLITICAL	
POLITICAL SUPPORT	
The town has provided significant support to the outreach efforts for the flood zone as well as other efforts to keep the public involved.	3
LOCAL SUPPORT	
The residents have welcomed the public outreach currently being used, and we would expect that continued public support for future efforts.	3

PUBLIC SUPPORT	
Tremendous support	3
LEGAL	
STATE AUTHORITY	
State issues revolve around open access to public records and information, the weblog makes the Planning Department and files such as flood maps more accessible to the public.	3
EXISTING LOCAL AUTHORITY	
The town seeks to reach out to residents by all means available.	3
POTENTIAL LEGAL CHALLENGE	
None	3
ECONOMIC	
BENEFIT OF ACTION	
The town has found a way to reach residents of all ages and keep them informed with minimal costs. The weblog has served over 5,000 visitors for the flood maps alone. Town staff would not be able to have this level of contact with the public.	3
COST OF ACTION	
Free internet services are used	3
CONTRIBUTES TO ECONOMIC GOALS	
Informing the public of flood issues, the location of flood zones, etc. help people to make informed decisions. Increased awareness of the flood zones have also made the public more aware of strategies to reduce the impacts of flooding.	3
OUTSIDE FUNDING REQUIRED	
Free resources have been used	3
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
None	3
EFFECTS OF HAZMAT WASTE SITES	
None	3
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Yes, we have a tool available to share information with residents without generating additional waste (paper).	3
CONSISTENT WITH FEDERAL LAWS	
Yes	3

HAZARD	
<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise)</i>	
NATURAL RESOURCE PROTECTION	
ACTION/TIMEFRAME	SCORE
Beach and Dune Replenishment	42
Committee formed 2009, strategy developed 2010, implementation after 2010.	
SOCIAL	
COMMUNITY ACCEPTANCE	
Dennis has three barrier beaches. These beaches are also major players in town recreational efforts. As such, residents are infinitely aware of the need to protect and replenish these areas.	3
EFFECTS ON SEGMENT OF POPULATION	
Beach and dune replenishment improve access for beach goers as well as provides protection for properties near these areas from flooding.	3
TECHNICAL	
TECHNICAL FEASIBILITY	
Significant permitting hurdles exist for beach and dune replenishment – especially using dredge materials (which have their own permitting hurdles)	1
LONG TERM SOLUTION	
Beach and dune replenishment is a short term strategy which must be kept up with. The armoring of many beaches has impacted natural sand migration, which increases the need for human intervention.	1
SECONDARY IMPACTS	
Can reduce erosion issues (discussed later)	3
ADMINISTRATIVE	
STAFFING	
Requires significant staff efforts to develop a plan and implement it.	1
FUNDING ALLOCATED	
Limited funds have been allocated for beach nourishment	1
MAINTENANCE OPERATIONS	
None programmed	1
POLITICAL	
POLITICAL SUPPORT	
There is political support, however, the process is costly financial support is more difficult.	2
LOCAL SUPPORT	
There is support for maintaining the beaches and dunes, however, many do not understand the nature of the problem.	1
PUBLIC SUPPORT	
Support comes from users when they are adversely impacted by reduced	1

beach area for swimmers and four-wheel drive. When repairs are made, unfortunately it becomes an out of site/out of mind issue.	
LEGAL	
STATE AUTHORITY	
State regulates beach and dune restoration through environmental permitting process which can render some efforts untimely.	1
EXISTING LOCAL AUTHORITY	
Town oversees replenishment efforts through Conservation and Beach staff.	3
POTENTIAL LEGAL CHALLENGE	
Incorrect permitting submittals, endangered species, etc. can all lead to legal challenges.	1
ECONOMIC	
BENEFIT OF ACTION	
Beach and dune replenishment preserves what Dennis is all about, our beaches. In addition, these efforts protect nearby properties from flooding. The benefit of the actions are tremendous.	3
COST OF ACTION	
Beach and dune replenishment can be coordinated with other local efforts (in particular dredging local rivers and harbors to keep them open to vessels). As such, the cost serves two purposes.	3
CONTRIBUTES TO ECONOMIC GOALS	
Maintaining the Dennis Beaches and Dunes support the Dennis economy by continuing to provide the beaches people expect in town and protecting adjacent properties from flooding.	3
OUTSIDE FUNDING REQUIRED	
Outside funding comes from Barnstable County. Other resources are needed as well.	2
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
Beach and dune replenishment reuses/reallocates sand that naturally moves along the coast. This natural process has been impacted by barricades and armoring that has occurred along the coast. The replenishment actions actually attempt to restore a natural process that has been disrupted.	3
EFFECTS OF HAZMAT WASTE SITES	
Dredge materials need to be tested to ensure it is not contaminated.	1
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Protecting the dunes and beaches are consistent with the environmental goals of Dennis.	3
CONSISTENT WITH FEDERAL LAWS	
Beaches and dunes are regulated by EPA and the Endangered Species Act. While protection of these resources would seem consistent with these laws, significant permitting hurdles exist.	1

HAZARD	
<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise)</i>	
STRUCTURAL PROJECTS	
ACTION/TIMEFRAME	SCORE
Storm water Control	50
Adopted October 2009	
SOCIAL	
COMMUNITY ACCEPTANCE	
Storm water control has been a part of local regulations since the 1970's and are generally accepted.	3
EFFECTS ON SEGMENT OF POPULATION	
Storm water controls are in effect through-out the town but mostly affect only properties that are undertaking some level of changes.	2
TECHNICAL	
TECHNICAL FEASIBILITY	
Storm water improvements on sites being altered is feasible and required. However, many areas are not undergoing the type of changes that would trigger upgrades to storm water systems.	2
LONG TERM SOLUTION	
Storm water improvements provide long term corrections to run-off issues and provides for flood storage opportunities.	3
SECONDARY IMPACTS	
Some storm water systems can breed disease carrying insects.	1
ADMINISTRATIVE	
STAFFING	
Correcting storm water on public property will require a significant town staff commitment. Correcting systems on private property takes efforts by the private owners, and requires town staff to review and ensure the systems are properly designed and constructed.	1
FUNDING ALLOCATED	
Limited funding.	1
MAINTENANCE OPERATIONS	
Significant maintenance costs will need to be programmed.	1
POLITICAL	
POLITICAL SUPPORT	
Political support exists for storm water regulations and proper storm water design.	3
LOCAL SUPPORT	
Support for storm water improvements are mixed. Those directly impacted by flooding support improving storm water control. Those who anticipate increased costs generally do not.	2
PUBLIC SUPPORT	

Overall there is public support for the concept of storm water control.	3
LEGAL	
STATE AUTHORITY	
EPA Phase II Storm Water Control requirements have established a mandate for the state and town to meet storm water control guidelines.	3
EXISTING LOCAL AUTHORITY	
The town has existing regulations on the books for storm water improvements	3
POTENTIAL LEGAL CHALLENGE	
Storm water controls may lead to legal challenges as we dictate who must control water run-off.	1
ECONOMIC	
BENEFIT OF ACTION	
Controlling storm water will protect property investments	3
COST OF ACTION	
Storm water control systems are costly in regards to construction and maintenance costs.	1
CONTRIBUTES TO ECONOMIC GOALS	
Protecting properties from flooding promotes the town's economic goals.	3
OUTSIDE FUNDING REQUIRED	
Yes	2
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
Storm water control can protect wetland resources and waterbodies.	3
EFFECTS OF HAZMAT WASTE SITES	
None	3
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Controlling storm water will promote the environmental goals of Dennis	3
CONSISTENT WITH FEDERAL LAWS	
Yes	3

HAZARD	
<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise)</i>	
STRUCTURAL PROJECTS	
ACTION/TIMEFRAME	SCORE
Physical intervention – restoring river flow (culverts)	54
One project constructed, other projects in design, depend upon state funding.	
SOCIAL	
COMMUNITY ACCEPTANCE	
Split decision, some see the enlargement of culverts to restore coastal tidal areas as reducing their susceptibility to flooding, while others expect increases in flooding.	2
EFFECTS ON SEGMENT OF POPULATION	
Past efforts illustrate improved flow increases overall flood storage.	3
TECHNICAL	
TECHNICAL FEASIBILITY	
Dennis has completed one project to date.	3
LONG TERM SOLUTION	
Yes	3
SECONDARY IMPACTS	
Some properties will see water in areas that have not experienced tidal flow in years. This tidal flow will restore wetlands and saltwater vegetation.	3
ADMINISTRATIVE	
STAFFING	
Design and permitting are time intensive.	1
FUNDING ALLOCATED	
No	1
MAINTENANCE OPERATIONS	
Similar to other roads, but less than maintaining an undersize culvert.	3
POLITICAL	
POLITICAL SUPPORT	
Support has been present.	3
LOCAL SUPPORT	
Split decision for affected neighborhoods.	2
PUBLIC SUPPORT	
Existing project has been well received.	3
LEGAL	
STATE AUTHORITY	
Significant permitting process	1
EXISTING LOCAL AUTHORITY	
Conservation Commission supportive of efforts.	3
POTENTIAL LEGAL CHALLENGE	

Possible challenges from property owners who believe they will be adversely impacted.	2
ECONOMIC	
BENEFIT OF ACTION	
Existing project has opened up new areas to kayaking and canoes.	3
COST OF ACTION	
Typical road construction costs.	2
CONTRIBUTES TO ECONOMIC GOALS	
Yes	3
OUTSIDE FUNDING REQUIRED	
State highway funds	2
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
Positive impact by restoring coastal wetlands	3
EFFECTS OF HAZMAT WASTE SITES	
None	3
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Yes	3
CONSISTENT WITH FEDERAL LAWS	
Yes	3

HAZARD	
<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise)</i>	
PREVENTION/PROPERTY PROTECTION	
ACTION/TIMEFRAME	SCORE
Regulatory – Coastal Bank Setbacks	63
Adopted 2005.	
SOCIAL	
COMMUNITY ACCEPTANCE	
Split on this, those on the bluffs feel we are overly restricting their access to views. Others in town recognize the need to protect the top of bank areas.	2
EFFECTS ON SEGMENT OF POPULATION	
Positive, regulation preserves and restores the integrity of these areas.	3
TECHNICAL	
TECHNICAL FEASIBILITY	
By-law presently on the books and enforced by Building Commissioner and Board of Appeals	3
LONG TERM SOLUTION	
Protects these areas from encroachment and from being undermined.	3
SECONDARY IMPACTS	
Leaves some older structures in ill advised areas	2
ADMINISTRATIVE	
STAFFING	
Handled through existing zoning channels (Building Department and Board of Appeals Office)	3
FUNDING ALLOCATED	
Existing	3
MAINTENANCE OPERATIONS	
None	3
POLITICAL	
POLITICAL SUPPORT	
Strong	3
LOCAL SUPPORT	
Everyone knows what to expect	3
PUBLIC SUPPORT	
Adopted unanimously a Town Meeting	3
LEGAL	
STATE AUTHORITY	
State Zoning Act	3
EXISTING LOCAL AUTHORITY	
Zoning By-law	3
POTENTIAL LEGAL CHALLENGE	

Typical of any zoning decision	2
ECONOMIC	
BENEFIT OF ACTION	
Reduces risk of building collapse	3
COST OF ACTION	
Property owner bears the costs, no town costs	3
CONTRIBUTES TO ECONOMIC GOALS	
Protection of property value	3
OUTSIDE FUNDING REQUIRED	
No	3
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
Protects embankments	3
EFFECTS OF HAZMAT WASTE SITES	
None	3
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Yes	3
CONSISTENT WITH FEDERAL LAWS	
Yes	3

HAZARD	
<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise)</i>	
PUBLIC EDUCATION AND AWARENESS	
ACTION/TIMEFRAME	SCORE
Barrier Beach Management Plan Committee	56
Committee created 2009	
SOCIAL	
COMMUNITY ACCEPTANCE	
Erosion at Chapin's Beach this past summer raised awareness of the problems faced by these sensitive areas.	3
EFFECTS ON SEGMENT OF POPULATION	
Erosion of barrier beaches affect beach users as well as property owners behind the beach. The Committee will need to transmit the message to all town residents of the risks the town faces if the barrier beaches are broached by flooding.	3
TECHNICAL	
TECHNICAL FEASIBILITY	
The educational aspect of this project is do-able. The challenge will be in restoring and maintaining these areas.	3
LONG TERM SOLUTION	
Public education will need to be an ongoing effort.	3
SECONDARY IMPACTS	
Failure to educate the public could have dire impacts.	2
ADMINISTRATIVE	
STAFFING	
Efforts will fall to the Natural Resources Department.	1
FUNDING ALLOCATED	
No new funding allocated.	1
MAINTENANCE OPERATIONS	
Ongoing costs will be incurred.	1
POLITICAL	
POLITICAL SUPPORT	
Strong support	3
LOCAL SUPPORT	
Users understand the issues	3
PUBLIC SUPPORT	
Message needs to get out to other parts of town.	2
LEGAL	
STATE AUTHORITY	
None for public education, significant issues for restoration	2
EXISTING LOCAL AUTHORITY	
Yes	3

POTENTIAL LEGAL CHALLENGE	
Possible over environmental permitting	2
ECONOMIC	
BENEFIT OF ACTION	
Positive on tourism	3
COST OF ACTION	
Education is cost effective	3
CONTRIBUTES TO ECONOMIC GOALS	
Yes	3
OUTSIDE FUNDING REQUIRED	
Not for education	3
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
Seeks support for protecting dunes and barrier beaches	3
EFFECTS OF HAZMAT WASTE SITES	
None	3
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Yes	3
CONSISTENT WITH FEDERAL LAWS	
Yes	3

HAZARD	
<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise)</i>	
NATURAL RESOURCE PROTECTION	
ACTION/TIMEFRAME	SCORE
Regulating construction projects within and adjacent to protected wetlands.	58
Ongoing	
SOCIAL	
COMMUNITY ACCEPTANCE	
Dennis was the first community to adopt its own local wetland regulations. These regulations have been generally well received since adoption. Some believe that the regulations go to far, while others feel stricter regulations are necessary.	2
EFFECTS ON SEGMENT OF POPULATION	
People within 100 feet of a regulated wetland, or 200 feet of a riverbank are regulated and restricted on what they can do. The town is very strict on altering wetlands, and somewhat less restrictive on projects within the wetland setback area. Overall the wetland regulations seek to protect the integrity of wetland areas from development – protecting against loss of flood storage and protecting from erosion.	2
TECHNICAL	
TECHNICAL FEASIBILITY	
Wetland regulations is doable and has been undertaken for many years. However, the regulations are only as good as the ability to identify encroachments and seek enforcement.	2
LONG TERM SOLUTION	
Wetland regulations have been in place for years and have been quite successful in achieving their goals. Wetland regulations are a strong, long term solution.	3
SECONDARY IMPACTS	
Wetland regulations generally direct development efforts away from these protected resources. Secondary impacts include protecting wildlife corridors.	3
ADMINISTRATIVE	
STAFFING	
The Dennis Wetland Regulations requires significant staff effort. These efforts are overseen by the Dennis Conservation Commission and the Dennis Natural Resources Department. The Department has a staff of four and is supplemented by a consultant paid through development review fees.	2
FUNDING ALLOCATED	
Funding for technical review comes from applicants, funding for enforcement must come from the town.	2
MAINTENANCE OPERATIONS	
The town must oversee and enforce the by-law as it relates to illegal	1

activities within wetland resource areas. These efforts are quite time consuming.	
POLITICAL	
POLITICAL SUPPORT	
Political support is strong	3
LOCAL SUPPORT	
Local support is strong	3
PUBLIC SUPPORT	
Public support is strong	3
LEGAL	
STATE AUTHORITY	
The state has adopted statewide wetland regulations and a River's Protection Act. The town authority comes through the state. The town's regulations are generally more comprehensive than the state's.	3
EXISTING LOCAL AUTHORITY	
The town has a local wetland regulation.	3
POTENTIAL LEGAL CHALLENGE	
Challenges to local decisions are made first to the state and then to court.	2
ECONOMIC	
BENEFIT OF ACTION	
Protection of wetlands through regulation protects not only those who locate near wetlands (direct benefits) but also the remainder of the community through cleaner water and flood storage.	3
COST OF ACTION	
The implementation of the wetland regulation is carried out through existing staffing levels	3
CONTRIBUTES TO ECONOMIC GOALS	
Protecting wetlands protects the town from pollution and flooding.	3
OUTSIDE FUNDING REQUIRED	
Funding comes from the town tax base as well as application and review fees.	3
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
Protects water quality and critical land masses	3
EFFECTS OF HAZMAT WASTE SITES	
None	3
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Yes	3
CONSISTENT WITH FEDERAL LAWS	
Yes	3

HAZARD	
<i>Flood (coastal storm surge, storm tides & wave action, erosion, and sea level rise)</i>	
STRUCTURAL PROJECTS	
ACTION/TIMEFRAME	SCORE
Beach armoring	41
Ongoing	
SOCIAL	
COMMUNITY ACCEPTANCE	
Beach armoring has been used by the town and residents to attempt to protect properties adjacent to the beaches.	3
EFFECTS ON SEGMENT OF POPULATION	
Beach armoring has very differing impacts. It “protects” one property at the expense of nearby properties and long term natural beach sedimentation.	1
TECHNICAL	
TECHNICAL FEASIBILITY	
Beach armoring is feasible and has been being implemented in Dennis for years.	3
LONG TERM SOLUTION	
Beach armoring provides some levels of protection for immediate properties but are being determined to not be permanent fixes, and are even being determined as being problems for nearby properties.	1
SECONDARY IMPACTS	
Erosion of adjacent properties, trapping of sediment that would normally restore beaches, siltation of some harbors.	1
ADMINISTRATIVE	
STAFFING	
Armoring requires significant staff efforts for constructing and maintaining. The revetments and seawalls at several town beaches are in need of repair and staffing is not available.	1
FUNDING ALLOCATED	
No	1
MAINTENANCE OPERATIONS	
Maintenance (public) is performed at a level well below what is needed. Most private armoring efforts are also only maintained when critical status occurs.	1
POLITICAL	
POLITICAL SUPPORT	
Political support for armoring has been strong	3
LOCAL SUPPORT	
Residents want their beaches protected so they are supportive of these efforts	3

PUBLIC SUPPORT	
The larger public supports these efforts as well	3
LEGAL	
STATE AUTHORITY	
Significant permitting efforts are required for armoring projects	1
EXISTING LOCAL AUTHORITY	
Local wetland permitting is also needed	2
POTENTIAL LEGAL CHALLENGE	
As the adverse, secondary impacts are identified for armoring projects, especially due to erosion on nearby properties, the risk of challenge will increase	1
ECONOMIC	
BENEFIT OF ACTION	
Protecting beaches is critical in Dennis as tourism is the key to the local economy	3
COST OF ACTION	
Armoring is very costly	1
CONTRIBUTES TO ECONOMIC GOALS	
Protecting beaches and properties adjacent to the coast protects the areas economy	3
OUTSIDE FUNDING REQUIRED	
Yes, and limited funds are available	1
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
Very mixed. Armoring protects an immediate economic resource. However, armoring increases erosion in other areas and denies some areas from needed, replenishing sands.	1
EFFECTS OF HAZMAT WASTE SITES	
None	3
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
The jury is out on this as areas such as Chapin's Beach start to face erosion due to lack of natural sand movement.	1
CONSISTENT WITH FEDERAL LAWS	
Yes	3

HAZARD	
<i>Wind (from hurricanes, coastal storms, nor'easters)</i>	
PREVENTION	
ACTION/TIMEFRAME	SCORE
Building Standards	60
Ongoing	
SOCIAL	
COMMUNITY ACCEPTANCE	
The State Building Code was amended in the past 24 months to establish greater control over wind resistant construction. Dennis implements these regulations. The town has accepted these standards, as discussed in the relevant sections below, the public is less accepting.	3
EFFECTS ON SEGMENT OF POPULATION	
Everyone who builds or undertakes renovations over a particular percentage of property value.	3
TECHNICAL	
TECHNICAL FEASIBILITY	
The standards are relatively straight-forward	3
LONG TERM SOLUTION	
Wind resistant construction provides a long term solution to protection of homes and businesses	3
SECONDARY IMPACTS	
Wind resistant construction can save on home owners insurance	3
ADMINISTRATIVE	
STAFFING	
The town implements these standards as part of the normal building code process.	3
FUNDING ALLOCATED	
Normal Building Department function	3
MAINTENANCE OPERATIONS	
None	3
POLITICAL	
POLITICAL SUPPORT	
The town has embraced these changes	3
LOCAL SUPPORT	
Builders and impacted homeowners complain about the cost of meeting these new standards	1
PUBLIC SUPPORT	
The changes are not well known, unless someone intends to build or renovate. As such the level of public support is limited	1
LEGAL	
STATE AUTHORITY	
State law that the town implements	3

EXISTING LOCAL AUTHORITY	
Town enforces state building code	3
POTENTIAL LEGAL CHALLENGE	
Limited as the law is relatively straight-forward. The only issue seems to be with establishing the pre-existing value and value of construction which triggers the need for the improvements.	2
ECONOMIC	
BENEFIT OF ACTION	
Less property damage, lower insurance rates	3
COST OF ACTION	
Costly to homeowner at a particular point in time, however savings on insurance, etc. has been estimated to outweigh the added costs	3
CONTRIBUTES TO ECONOMIC GOALS	
Protecting property against loss is important to long term health of the area	3
OUTSIDE FUNDING REQUIRED	
Private funds	2
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
Little impact, except that a protected house might not be damaged thus reducing impacts of storms	3
EFFECTS OF HAZMAT WASTE SITES	
Protects against some hazardous materials releases	3
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Yes	3
CONSISTENT WITH FEDERAL LAWS	
Yes	3

HAZARD	
<i>Wind (from hurricanes, coastal storms, nor'easters)</i>	
NATURAL RESOURCE PROTECTION	
ACTION/TIMEFRAME	SCORE
Beach and Dune Replenishment	42
Committee formed 2009, strategy developed 2010, implementation after 2010.	
SOCIAL	
COMMUNITY ACCEPTANCE	
Dennis has three barrier beaches. These beaches are also major players in town recreational efforts. As such, residents are infinitely aware of the need to protect and replenish these areas.	3
EFFECTS ON SEGMENT OF POPULATION	
Beach and dune replenishment improve access for beach goers as well as provides protection for properties near these areas from flooding.	3
TECHNICAL	
TECHNICAL FEASIBILITY	
Significant permitting hurdles exist for beach and dune replenishment – especially using dredge materials (which have their own permitting hurdles)	1
LONG TERM SOLUTION	
Beach and dune replenishment is a short term strategy which must be kept up with. The armoring of many beaches has impacted natural sand migration, which increases the need for human intervention.	1
SECONDARY IMPACTS	
Can reduce erosion issues (discussed later)	3
ADMINISTRATIVE	
STAFFING	
Requires significant staff efforts to develop a plan and implement it.	1
FUNDING ALLOCATED	
Limited funds have been allocated for beach nourishment	1
MAINTENANCE OPERATIONS	
None programmed	1
POLITICAL	
POLITICAL SUPPORT	
There is political support, however, the process is costly financial support is more difficult.	2
LOCAL SUPPORT	
There is support for maintaining the beaches and dunes, however, many do not understand the nature of the problem.	1
PUBLIC SUPPORT	
Support comes from users when they are adversely impacted by reduced beach area for swimmers and four-wheel drive. When repairs are made,	1

unfortunately it becomes an out of site/out of mind issue.	
LEGAL	
STATE AUTHORITY	
State regulates beach and dune restoration through environmental permitting process which can render some efforts untimely.	1
EXISTING LOCAL AUTHORITY	
Town oversees replenishment efforts through Conservation and Beach staff.	3
POTENTIAL LEGAL CHALLENGE	
Incorrect permitting submittals, endangered species, etc. can all lead to legal challenges.	1
ECONOMIC	
BENEFIT OF ACTION	
Beach and dune replenishment preserves what Dennis is all about, our beaches. In addition, these efforts protect nearby properties from flooding. The benefit of the actions are tremendous.	3
COST OF ACTION	
Beach and dune replenishment can be coordinated with other local efforts (in particular dredging local rivers and harbors to keep them open to vessels). As such, the cost serves two purposes.	3
CONTRIBUTES TO ECONOMIC GOALS	
Maintaining the Dennis Beaches and Dunes support the Dennis economy by continuing to provide the beaches people expect in town and protecting adjacent properties from flooding.	3
OUTSIDE FUNDING REQUIRED	
Outside funding comes from Barnstable County. Other resources are needed as well.	2
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
Beach and dune replenishment reuses/reallocates sand that naturally moves along the coast. This natural process has been impacted by barricades and armoring that has occurred along the coast. The replenishment actions actually attempt to restore a natural process that has been disrupted.	3
EFFECTS OF HAZMAT WASTE SITES	
Dredge materials need to be tested to ensure it is not contaminated.	1
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Protecting the dunes and beaches are consistent with the environmental goals of Dennis.	3
CONSISTENT WITH FEDERAL LAWS	
Beaches and dunes are regulated by EPA and the Endangered Species Act. While protection of these resources would seem consistent with these laws, significant permitting hurdles exist.	1

HAZARD	
<i>Wind (from hurricanes, coastal storms, nor'easters)</i>	
PROPERTY PROTECTION	
ACTION/TIMEFRAME	SCORE
Pursue available grants for retrofits of private and public facilities	54
With the completion of this report the town will start seeking these grants	
SOCIAL	
COMMUNITY ACCEPTANCE	
The Planning Department has had several requests for assistance with pursuing FEMA funding for protection against hurricanes damage. One purpose of completing the study is to increase the town's eligibility for such funds.	3
EFFECTS ON SEGMENT OF POPULATION	
Grants would have the greatest benefit to people in "harm's way" – closest to the water's edge for instance	2
TECHNICAL	
TECHNICAL FEASIBILITY	
Grants for retrofits are available, however funding is limited	2
LONG TERM SOLUTION	
Retrofits provide a short term solution.	1
SECONDARY IMPACTS	
Reinvestment in properties exposed to strong storm impacts will ensure that structures remain in at risk areas	2
ADMINISTRATIVE	
STAFFING	
Town will need to provide staff to seek and oversee grants	1
FUNDING ALLOCATED	
None	1
MAINTENANCE OPERATIONS	
None	3
POLITICAL	
POLITICAL SUPPORT	
The town recognizes the need to help people and properties in at risk areas	3
LOCAL SUPPORT	
The residents in the most at-risk areas are beginning to solicit the town to pursue these type of grants	3
PUBLIC SUPPORT	
The general public will support protecting their neighbors investments, to a point.	2
LEGAL	
STATE AUTHORITY	
Yes	3
EXISTING LOCAL AUTHORITY	

Yes	3
POTENTIAL LEGAL CHALLENGE	
None	3
ECONOMIC	
BENEFIT OF ACTION	
Protects property values	3
COST OF ACTION	
Funding needs will be significant	2
CONTRIBUTES TO ECONOMIC GOALS	
Protecting property values promotes the town's economic goals	3
OUTSIDE FUNDING REQUIRED	
Yes	2
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
Protects land and water against adverse impacts if buildings are damaged in storms. Depending upon the actions invested in, land and water quality could be improved	3
EFFECTS OF HAZMAT WASTE SITES	
Could reduce risk of toxic releases	3
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Yes	3
CONSISTENT WITH FEDERAL LAWS	
Yes	3

HAZARD	
<i>Wind (from hurricanes, coastal storms, nor'easters)</i>	
PUBLIC EDUCATION AND AWARENESS	
ACTION/TIMEFRAME	SCORE
Inform public about new building code requirements	61
Ongoing	
SOCIAL	
COMMUNITY ACCEPTANCE	
The public appears to be poorly informed about the new building code requirements related to wind standards. As such the standards are being resisted and avoided if at all possible. Using available resources (i.e. town website and blog) the town could provide information to the public about these new standards	3
EFFECTS ON SEGMENT OF POPULATION	
The wind standards affect all residents.	3
TECHNICAL	
TECHNICAL FEASIBILITY	
Public information campaigns are easy to pursue and the town has the mechanism to pursue better public information awareness.	3
LONG TERM SOLUTION	
Public education leads to better decision making.	3
SECONDARY IMPACTS	
May improve other aspects of homes in harms way if they understand the fine points of the new wind construction standards.	3
ADMINISTRATIVE	
STAFFING	
Will require additional efforts from existing staff	1
FUNDING ALLOCATED	
No funding allocated for this measure at present	1
MAINTENANCE OPERATIONS	
No long term maintenance requirements, once the piece is written it will not need much up-keep	3
POLITICAL	
POLITICAL SUPPORT	
There is political support in town for educating the public on important information	3
LOCAL SUPPORT	
Yes	3
PUBLIC SUPPORT	
Yes	3
LEGAL	
STATE AUTHORITY	
Yes	3

EXISTING LOCAL AUTHORITY	
Yes	3
POTENTIAL LEGAL CHALLENGE	
None	3
ECONOMIC	
BENEFIT OF ACTION	
Positive as better public awareness may remove fears of improving older homes	3
COST OF ACTION	
Cost benefit will be positive as this would be a low cost item for the town which would be outweighed by long term savings to just a single homeowner	3
CONTRIBUTES TO ECONOMIC GOALS	
Yes	3
OUTSIDE FUNDING REQUIRED	
Possibly	2
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
Net benefit if homes that would otherwise be damaged were improved	3
EFFECTS OF HAZMAT WASTE SITES	
None	3
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Yes	3
CONSISTENT WITH FEDERAL LAWS	
Yes	3

HAZARD	
<i>Wildfire</i>	
PREVENTION	
ACTION/TIMEFRAME	SCORE
Reduce Fuel Sources through mechanical devices, prescribed burns or selective cutting	45
Ongoing	
SOCIAL	
COMMUNITY ACCEPTANCE	
Mechanical and selective cutting would not meet too much resistance except for noise, controlled burns affect population with asthma. A mixed community acceptance of this at best.	2
EFFECTS ON SEGMENT OF POPULATION	
Mixed, those protected from fire would benefit, however the smoke from controlled burns could affect a far larger population.	2
TECHNICAL	
TECHNICAL FEASIBILITY	
Definitely feasible.	3
LONG TERM SOLUTION	
On-going routine maintenance, not a long term one time only fix	1
SECONDARY IMPACTS	
See above noise and smoke impacts	1
ADMINISTRATIVE	
STAFFING	
Would require additional staffing	1
FUNDING ALLOCATED	
No	1
MAINTENANCE OPERATIONS	
Would require on-going maintenance commitment	1
POLITICAL	
POLITICAL SUPPORT	
Possibly for some, less intrusive measures	2
LOCAL SUPPORT	
Mixed	2
PUBLIC SUPPORT	
Mixed	2
LEGAL	
STATE AUTHORITY	
Yes	3
EXISTING LOCAL AUTHORITY	
Yes	3
POTENTIAL LEGAL CHALLENGE	
	2

ECONOMIC	
BENEFIT OF ACTION	
Fire protection could provide some economic benefit	2
COST OF ACTION	
Quite costly	1
CONTRIBUTES TO ECONOMIC GOALS	
Not sure	2
OUTSIDE FUNDING REQUIRED	
Yes would definitely help	2
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
Protects land from wild fires	3
EFFECTS OF HAZMAT WASTE SITES	
None	3
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Yes	3
CONSISTENT WITH FEDERAL LAWS	
Yes	3

HAZARD	
<i>Wildfire</i>	
PUBLIC EDUCATION AND AWARENESS	
ACTION/TIMEFRAME	SCORE
Conduct informational workshops regarding strategies to reduce wildfire risk within wildland and residential interface	56
2012	
SOCIAL	
COMMUNITY ACCEPTANCE	
Educational activities are well received	3
EFFECTS ON SEGMENT OF POPULATION	
Would provide positive information for population	3
TECHNICAL	
TECHNICAL FEASIBILITY	
Definitely can be done	3
LONG TERM SOLUTION	
Provides short term information and would need to be repeated	1
SECONDARY IMPACTS	
Raises public awareness	2
ADMINISTRATIVE	
STAFFING	
Would need to use existing staff	1
FUNDING ALLOCATED	
None	1
MAINTENANCE OPERATIONS	
None	3
POLITICAL	
POLITICAL SUPPORT	
Would be supported by town bodies	3
LOCAL SUPPORT	
Would be supported by residents in the affected areas	3
PUBLIC SUPPORT	
Would be supported town wide as well	3
LEGAL	
STATE AUTHORITY	
Yes	3
EXISTING LOCAL AUTHORITY	
Yes	3
POTENTIAL LEGAL CHALLENGE	
None	3
ECONOMIC	
BENEFIT OF ACTION	

Public education would reduce wild fire risks	3
COST OF ACTION	
Low cost with high benefit potential	3
CONTRIBUTES TO ECONOMIC GOALS	
Prevention is a strong goal	3
OUTSIDE FUNDING REQUIRED	
Yes	1
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
Limited	2
EFFECTS OF HAZMAT WASTE SITES	
None	3
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Yes	3
CONSISTENT WITH FEDERAL LAWS	
Yes	3

HAZARD	
<i>Wildfire</i>	
PUBLIC EDUCATION AND AWARENESS	
ACTION/TIMEFRAME	SCORE
Conduct informational workshops regarding strategies to reduce urban wildfire risk.	56
2011	
SOCIAL	
COMMUNITY ACCEPTANCE	
Educational activities are well received	3
EFFECTS ON SEGMENT OF POPULATION	
Would provide positive information for residents and businesses	3
TECHNICAL	
TECHNICAL FEASIBILITY	
Definitely can be done	3
LONG TERM SOLUTION	
Provides short term information and would need to be repeated	1
SECONDARY IMPACTS	
Raises public awareness	2
ADMINISTRATIVE	
STAFFING	
Would need to use existing staff	1
FUNDING ALLOCATED	
None	1
MAINTENANCE OPERATIONS	
None	3
POLITICAL	
POLITICAL SUPPORT	
Would be supported by town bodies	3
LOCAL SUPPORT	
Would be supported by residents in the affected areas	3
PUBLIC SUPPORT	
Would be supported town wide as well	3
LEGAL	
STATE AUTHORITY	
Yes	3
EXISTING LOCAL AUTHORITY	
Yes	3
POTENTIAL LEGAL CHALLENGE	
None	3
ECONOMIC	
BENEFIT OF ACTION	
Public education would reduce wild fire risks	3

COST OF ACTION	
Low cost with high benefit potential	3
CONTRIBUTES TO ECONOMIC GOALS	
Prevention is a strong goal	3
OUTSIDE FUNDING REQUIRED	
Yes	1
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
Limited	2
EFFECTS OF HAZMAT WASTE SITES	
None	3
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Yes	3
CONSISTENT WITH FEDERAL LAWS	
Yes	3

HAZARD	
<i>Wildfire</i>	
PREVENTION	
ACTION/TIMEFRAME	SCORE
Promote strategies that lead to reinvestment of older properties in at risk areas, i.e. village centers and cottage colony areas	60
Ongoing	
SOCIAL	
COMMUNITY ACCEPTANCE	
Generally this will result in up-zoning properties to allow increased economic return from a property, in some cases this will be welcome, in others there could be some resistance.	2
EFFECTS ON SEGMENT OF POPULATION	
For property owners this will be positive, for cottage owners (tenants at will on the land) there will be some negative impacts.	2
TECHNICAL	
TECHNICAL FEASIBILITY	
Re-zoning is technically feasible.	3
LONG TERM SOLUTION	
The impacts of re-zoning can take years to be implemented, zoning is clearly long-term.	3
SECONDARY IMPACTS	
Property improvements, increased property value, new economic opportunities.	3
ADMINISTRATIVE	
STAFFING	
This is part of the normal staffing operations of the Planning Department	3
FUNDING ALLOCATED	
Accomplished within existing budgetary constraints.	2
MAINTENANCE OPERATIONS	
None	3
POLITICAL	
POLITICAL SUPPORT	
There is strong political support for revitalizing the villages and the waterfront cottage areas.	3
LOCAL SUPPORT	
This will be mixed, most will support, but there will be some resistance to change within the cottage colony areas.	2
PUBLIC SUPPORT	
Strong support through-out town.	3
LEGAL	
STATE AUTHORITY	
State zoning act	3

EXISTING LOCAL AUTHORITY	
Yes	3
POTENTIAL LEGAL CHALLENGE	
Any zoning decision is open to challenge	2
ECONOMIC	
BENEFIT OF ACTION	
Increased jobs, improved property value, new investment in older structures.	3
COST OF ACTION	
The increased value of properties and improved safety of structures far outweigh the costs of rezoning.	3
CONTRIBUTES TO ECONOMIC GOALS	
Yes, most of these proposals are coming from the Economic Development Committee.	3
OUTSIDE FUNDING REQUIRED	
None	3
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
Increased density can increase demands on water services, beaches, etc.	2
EFFECTS OF HAZMAT WASTE SITES	
None/positive as reinvestment leads to removal of hazardous materials	3
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Yes	3
CONSISTENT WITH FEDERAL LAWS	
Yes	3

HAZARD	
<i>Shoreline erosion (from shoreline change)</i>	
PREVENTION	
ACTION/TIMEFRAME	SCORE
Regulatory – Coastal Bank Setbacks	63
Ongoing	
SOCIAL	
COMMUNITY ACCEPTANCE	
Split on this, those on the bluffs feel we are overly restricting their access to views. Others in town recognize the need to protect the top of bank areas.	2
EFFECTS ON SEGMENT OF POPULATION	
Positive, regulation preserves and restores the integrity of these areas.	3
TECHNICAL	
TECHNICAL FEASIBILITY	
By-law presently on the books and enforced by Building Commissioner and Board of Appeals	3
LONG TERM SOLUTION	
Protects these areas from encroachment and from being undermined.	3
SECONDARY IMPACTS	
Leaves some older structures in ill advised areas	2
ADMINISTRATIVE	
STAFFING	
Handled through existing zoning channels (Building Department and Board of Appeals Office)	3
FUNDING ALLOCATED	
Existing	3
MAINTENANCE OPERATIONS	
None	3
POLITICAL	
POLITICAL SUPPORT	
Strong	3
LOCAL SUPPORT	
Everyone knows what to expect	3
PUBLIC SUPPORT	
Adopted unanimously a Town Meeting	3
LEGAL	
STATE AUTHORITY	
State Zoning Act	3
EXISTING LOCAL AUTHORITY	
Zoning By-law	3
POTENTIAL LEGAL CHALLENGE	
Typical of any zoning decision	2

ECONOMIC	
BENEFIT OF ACTION	
Reduces risk of building collapse	3
COST OF ACTION	
Property owner bears the costs, no town costs	3
CONTRIBUTES TO ECONOMIC GOALS	
Protection of property value	3
OUTSIDE FUNDING REQUIRED	
No	3
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
Protects embankments	3
EFFECTS OF HAZMAT WASTE SITES	
None	3
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Yes	3
CONSISTENT WITH FEDERAL LAWS	
Yes	3

HAZARD	
<i>Shoreline erosion (from shoreline change)</i>	
PROPERTY PROTECTION	
ACTION/TIMEFRAME	SCORE
Wetland Protection By-law application to coastal dunes – i.e. elevate structures to allow shifting sands across the footprint of structures.	58
Ongoing	
SOCIAL	
COMMUNITY ACCEPTANCE	
Mixed, some object to the idea of houses on stilts	2
EFFECTS ON SEGMENT OF POPULATION	
Mixed, elevating structures above shifting sands will impact the maximum height a structure can be, leading some to feeling they are allowed smaller homes than if they did not have to elevate the structure.	2
TECHNICAL	
TECHNICAL FEASIBILITY	
Currently part of town by-laws.	3
LONG TERM SOLUTION	
Yes, improved sand movement allows for dune replenishment	3
SECONDARY IMPACTS	
Beach and dune replenishment	3
ADMINISTRATIVE	
STAFFING	
Overseen by Natural Resources Staff and Conservation Commission, no new commitments of staff	3
FUNDING ALLOCATED	
Conservation Commission is funded and also collects review fees to cover consultant services	3
MAINTENANCE OPERATIONS	
Enforcement follow-up	2
POLITICAL	
POLITICAL SUPPORT	
The town was one of the first to adopt a Local Wetlands By-law	3
LOCAL SUPPORT	
Yes	3
PUBLIC SUPPORT	
Yes	3
LEGAL	
STATE AUTHORITY	
State authorizes the adoption of local wetland protection measures	3
EXISTING LOCAL AUTHORITY	
Yes	3
POTENTIAL LEGAL CHALLENGE	

Decisions can be challenge by applicants who do not want to have an elevated structure and by abutters who may object to having such structures in their neighborhoods	1
ECONOMIC	
BENEFIT OF ACTION	
Reinvestment in property, reduced risk of hazards, improved beach re-nourishment	3
COST OF ACTION	
There is some cost to property owners, but the benefits outweigh those costs.	3
CONTRIBUTES TO ECONOMIC GOALS	
Protection of our dunes and beaches are critical to the local economy	3
OUTSIDE FUNDING REQUIRED	
Outside funding would benefit these efforts and allow people who would not otherwise consider raising a house to do so.	3
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
Protects beaches and dunes	3
EFFECTS OF HAZMAT WASTE SITES	
None	3
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Yes	3
CONSISTENT WITH FEDERAL LAWS	
Yes	3

HAZARD	
<i>Shoreline erosion (from shoreline change)</i>	
PUBLIC EDUCATION AND AWARENESS	
ACTION/TIMEFRAME	SCORE
Flyers, signage and other information on erosion and the importance of our dunes.	57
2010	
SOCIAL	
COMMUNITY ACCEPTANCE	
Will be well received.	3
EFFECTS ON SEGMENT OF POPULATION	
Limited	2
TECHNICAL	
TECHNICAL FEASIBILITY	
Yes	3
LONG TERM SOLUTION	
Information distribution is easily accomplished and can be repeated once developed.	3
SECONDARY IMPACTS	
May increase awareness of beach protection beyond the limits of those living directly on the beaches	3
ADMINISTRATIVE	
STAFFING	
Would require additional efforts	2
FUNDING ALLOCATED	
None	1
MAINTENANCE OPERATIONS	
Needs on-going information distribution	2
POLITICAL	
POLITICAL SUPPORT	
Yes would be supported	3
LOCAL SUPPORT	
Yes	3
PUBLIC SUPPORT	
Yes	3
LEGAL	
STATE AUTHORITY	
None needed	3
EXISTING LOCAL AUTHORITY	
None needed	3
POTENTIAL LEGAL CHALLENGE	
None	3
ECONOMIC	

BENEFIT OF ACTION	
Limited	2
COST OF ACTION	
There would be a cost to this that would require funds, cost benefit is tenuous.	2
CONTRIBUTES TO ECONOMIC GOALS	
Protection of beaches and dunes would protect our tourist resource	3
OUTSIDE FUNDING REQUIRED	
Yes	2
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
Could protect some dunes	2
EFFECTS OF HAZMAT WASTE SITES	
None	3
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Yes	3
CONSISTENT WITH FEDERAL LAWS	
Yes	3

HAZARD	
<i>Shoreline erosion (from shoreline change)</i>	
STRUCTURAL PROJECTS	
ACTION/TIMEFRAME	SCORE
Beach and Dune Replenishment	42
Committee formed 2009, strategy developed 2010, implementation after 2010.	
SOCIAL	
COMMUNITY ACCEPTANCE	
Dennis has three barrier beaches. These beaches are also major players in town recreational efforts. As such, residents are infinitely aware of the need to protect and replenish these areas.	3
EFFECTS ON SEGMENT OF POPULATION	
Beach and dune replenishment improve access for beach goers as well as provides protection for properties near these areas from flooding.	3
TECHNICAL	
TECHNICAL FEASIBILITY	
Significant permitting hurdles exist for beach and dune replenishment – especially using dredge materials (which have their own permitting hurdles)	1
LONG TERM SOLUTION	
Beach and dune replenishment is a short term strategy which must be kept up with. The armoring of many beaches has impacted natural sand migration, which increases the need for human intervention.	1
SECONDARY IMPACTS	
Can reduce erosion issues (discussed later)	3
ADMINISTRATIVE	
STAFFING	
Requires significant staff efforts to develop a plan and implement it.	1
FUNDING ALLOCATED	
Limited funds have been allocated for beach nourishment	1
MAINTENANCE OPERATIONS	
None programmed	1
POLITICAL	
POLITICAL SUPPORT	
There is political support, however, the process is costly financial support is more difficult.	2
LOCAL SUPPORT	
There is support for maintaining the beaches and dunes, however, many do not understand the nature of the problem.	1
PUBLIC SUPPORT	
Support comes from users when they are adversely impacted by reduced beach area for swimmers and four-wheel drive. When repairs are made,	1

unfortunately it becomes an out of site/out of mind issue.	
LEGAL	
STATE AUTHORITY	
State regulates beach and dune restoration through environmental permitting process which can render some efforts untimely.	1
EXISTING LOCAL AUTHORITY	
Town oversees replenishment efforts through Conservation and Beach staff.	3
POTENTIAL LEGAL CHALLENGE	
Incorrect permitting submittals, endangered species, etc. can all lead to legal challenges.	1
ECONOMIC	
BENEFIT OF ACTION	
Beach and dune replenishment preserves what Dennis is all about, our beaches. In addition, these efforts protect nearby properties from flooding. The benefit of the actions are tremendous.	3
COST OF ACTION	
Beach and dune replenishment can be coordinated with other local efforts (in particular dredging local rivers and harbors to keep them open to vessels). As such, the cost serves two purposes.	3
CONTRIBUTES TO ECONOMIC GOALS	
Maintaining the Dennis Beaches and Dunes support the Dennis economy by continuing to provide the beaches people expect in town and protecting adjacent properties from flooding.	3
OUTSIDE FUNDING REQUIRED	
Outside funding comes from Barnstable County. Other resources are needed as well.	2
ENVIRONMENTAL	
EFFECTS ON LAND/WATER	
Beach and dune replenishment reuses/reallocates sand that naturally moves along the coast. This natural process has been impacted by barricades and armoring that has occurred along the coast. The replenishment actions actually attempt to restore a natural process that has been disrupted.	3
EFFECTS OF HAZMAT WASTE SITES	
Dredge materials need to be tested to ensure it is not contaminated.	1
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Protecting the dunes and beaches are consistent with the environmental goals of Dennis.	3
CONSISTENT WITH FEDERAL LAWS	
Beaches and dunes are regulated by EPA and the Endangered Species Act. While protection of these resources would seem consistent with these laws, significant permitting hurdles exist.	1

Section 5: Implementation and Adoption of this Plan

Section 201.6(c)(4) of 44 CFR requires a formal plan maintenance process to ensure that the mitigation plan remains an active and relevant document. The plan maintenance process includes a method and schedule for monitoring, evaluating, and updating the plan at least every five (5) years. This also includes an explanation of how Dennis intends to incorporate the mitigation strategies into existing planning mechanisms, such as The Dennis Local Comprehensive Plan (a requirement not just of this process but also a requirement of the Cape Cod Commission' Regional Policy Plan Consistency Finding), the Dennis capital improvement program, Zoning By-law, Wetlands Regulations and Board of Health Regulations. Lastly, the town is required to identify a continued public participation process for use throughout the plan maintenance process.

5.1 Process

The final Multi-Hazard Mitigation (MHM) Plan was adopted by the Dennis Board of Selectmen after the close of the public comment period and incorporation of applicable comments on July 26, 2011. The MHM Plan will be implemented through the delegation of assignments by the Board of Selectmen through the Town Administrator, and as specified within this Plan. In *Section 4: Mitigation Strategy*, mitigation actions are listed and assigned specific implementation measures which include the assignment of responsibilities to Town departments/committees and/or specific Town staff, along with the establishment of a targeted completion date for each proposed mitigation action. When applicable, potential funding sources were also listed.

It will be the responsibility of the Town Administrator, as he/she sees fit, to ensure these actions are ultimately carried out no later than the target completion dates unless reasonable circumstances prevent their implementation (i.e., lack of funding availability). Otherwise, the completion of each proposed mitigation action has been determined feasible within the timeframe allowed.

5.2 Funding Sources

Although all mitigation techniques will likely save money by avoiding losses, many projects are costly to implement. The Town of Dennis will make use of its Capital Improvement Program as well as continue to seek outside funding assistance for mitigation projects in both the pre- and post-disaster environment.

5.3 Monitoring and Reporting

Periodic monitoring and reporting of MHM Plan is required to ensure that the goals and objectives for Dennis are kept current and that local mitigation efforts are being carried out. The Plan has therefore been designed to be user-friendly in terms of monitoring implementation and preparing regular progress reports.

5.4 Annual Reporting Procedures

The MHM Plan shall be reviewed annually, by the Planning Team, or as situations dictate such as following a disaster declaration. Each year, the Town Administrator will assign responsibility for conducting this annual review to a specific department or individual.

This department or individual will ensure the following:

1. The Board of Selectmen and the Town Administrator will receive an annual report and/or presentation on the implementation status of the MHM Plan. This report will include, at a minimum, a completed, printed version of the Mitigation Action Plan (MAP) indicating the implementation status of each identified action.
2. The report will also include an evaluation of the effectiveness and appropriateness of the mitigation actions proposed in the Plan.
3. The report will recommend, as appropriate, any required changes or amendments to the Plan. If the Board of Selectmen determines that the recommendations warrant modification to the MHM Plan, the Board may initiate a Plan Amendment as described below.

5.5 Revisions and Updates

Periodic revisions and updates to the MHM Plan are required to ensure that the hazard mitigation goals and objectives for Dennis are kept current. More importantly, revisions may be necessary to ensure the Plan is in full compliance with Federal regulations and State statutes. This portion of the Plan outlines the procedures for completing such revisions and updates.

Five (5) Year Plan Review - The MHM Plan should be reviewed every five (5) years to determine if there have been any significant changes in Town that would affect the Action Plan. Increased development, increased exposure to certain hazards, the development of new mitigation capabilities or techniques, and changes to Federal, State or County legislation are examples of changes that may affect the condition of the MHM Plan.

Regional Shelter Exercises - In order to ensure preparedness for evacuation needs Barnstable County communities plan to hold annual exercises with each regional shelter. The town did an exercise in June 2009 with First Student. The Barnstable County Regional Evacuation Planning Committee has since held an exercise using an Upper Cape Facility (Oak Ridge School in Sandwich) and in January 2010 an exercise is planned for the Cape Cod Regional Technical School. Should the Regional Shelter Exercises suggest changes to local procedures, the MHM plan will be adjusted accordingly.

Disaster Declaration - Following a disaster declaration, the MHM Plan will need to be revised to reflect on lessons learned or to address specific circumstances arising out of the disaster.

Selectmen Determination - If the Board of Selectmen determines that the recommendations warrant modification to the MHM Plan, the Board may either initiate a Plan Amendment as described below or, if conditions justify, may direct the Town Administrator to undertake a complete update of the Plan.

5.6 Plan Amendments

An amendment to the Plan should be initiated only by the Board of Selectmen, either at its own initiative or upon the recommendation of the Town Administrator, Town Planner, or some other person or agency. Upon initiation of an amendment to the Plan, Dennis will forward information on the proposed amendment to all interested parties including, but not limited to, all affected Town departments, residents and businesses. Information will also be forwarded to Barnstable County (Cape Cod Commission) and the Massachusetts Emergency Management Agency. This information will be sent out in order to seek input on the proposed Plan amendment for not less than a forty-five (45) day review and comment period.

At the end of the comment period, the proposed amendment and all review comments will be forwarded to the Town Administrator (or his/her designee) for consideration. If no comments are received from the reviewing parties within the specified review period, such will be noted accordingly. The Town Administrator (or his/her designee) will review the proposed amendment along with the comments received from other parties, and submit a recommendation to the Board of Selectmen within sixty (60) days.

5.7 Relationship To Other Planning Documents

The Town of Dennis is under a variety of Planning Mandates in addition to the MHM Plan mandate. These mandates include

1. The adoption and regular updating of the Local Comprehensive Plan which is an overarching planning document which looks at a broad array of goals and objectives about where the town is, where it would like to be, and creates a path to achieving the vision of the plan.
2. The adoption of and regular update to the Open Space and Recreation Plan which provides guidance to the town on the preservation of open areas, creation of recreational opportunities and planned expenditures to achieve the goals of this plan.
3. Commonwealth Capital consistency, which is a set of state goals, and a review of actions taken by the town to comply with these state goals.
4. Annual and long term capital improvement programming, which provides the local mechanism for turning the goals of the MHM into actual projects.
5. The Dennis Police Department maintains the Community Emergency Management Plan (CEMP). The CEMP was reviewed as part of the creation of the MHM Plan and will be used for future updates as well.

Each of these activities provide opportunities to review the effectiveness of the MHM plan, make determinations as to how the MHM either should shape a particular set of actions, or should be modified based upon updated land use planning goals and objectives. Working together, and coordinated by the same individuals, these three planning documents and the MHM Plan provide a strong framework for long term coordinated planning as it comes to floodplain management.

5.8 Public Participation

Public participation is a critical part of community buy-in to the process of developing a plan and to gain acceptance of the recommendations of a planning document. For the past several years Dennis has made a major commitment to public participation in all aspects of local government and planning in particular. From the outset the MHM Plan has been released for public review section by section on the Dennis Planning Department Weblog. The Weblog has been visited 3,000 times since the first section was released for review with the MHM plan drafts being visited by over 100 people in that time. The blog has become a major factor in public outreach. During the 2009 review of proposed FEMA floodplain changes the blog reached over 5,000 people.

The full document was formally made available for public review on November 5, 2009. The Availability of the document was announced on November 10, 2009 with a public comment period running through December 10, 2009. The Dennis Planning Board held a public comment meeting on December 7, 2009 as part of the public review.

In addition, the town will utilize public forums, such as regularly scheduled Planning Board and Selectmen' Meetings; local access cable; press releases and other evolving technologies.



Town of Dennis

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**CERTIFICATE OF ADOPTION
Town of Dennis MASSACHUSETTS
BOARD OF SELECTMEN
A RESOLUTION ADOPTING THE Town of Dennis
HAZARD MITIGATION PLAN**

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

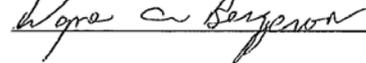
WHEREAS, the Town of Dennis Hazard Mitigation Plan contains several potential future projects to mitigate potential impacts from natural hazards in the Town of Dennis, and

WHEREAS, a duly-noticed public meeting was held by the BOARD OF SELECTMEN on July 26, 2011, and

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

NOW, THEREFORE BE IT RESOLVED that the Town of Dennis BOARD OF SELECTMEN, adopts the Hazard Mitigation Plan, in accordance with M.G.L. c. 40.

ADOPTED AND SIGNED this July :26,2011

	_____	Paul, McCormick, Chairman
	_____	Sheryl McMahon
	_____	Wayne Bergeron
	_____	Heidi Schadt
	_____	Alan Tuttle

Town Seal or Notary _____

Date July 26, 2011