

# **Town of Dennis**

## **Multi-Hazard Mitigation Plan Draft**

May 4, 2016

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## **Section 1: Introduction**

### 1.1 About the Plan

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.

#### 1.1.1 Purpose

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:

- Provide a description of the planning area.
- Assess the ongoing mitigation activities in the Town of Dennis.
- Describe the planning process used to develop the mitigation plan.
- Identify and assess the hazards that pose a threat to citizens, businesses and property.
- Establish Goals and Objectives for community mitigation measures.
- Evaluate Mitigation Measures that should be undertaken to protect citizens, businesses and property.
- Identify and recommend an Action Plan for implementation of mitigation projects.
- Develop a strategy for the adoption, maintenance, upkeep, and revision of the Town of Dennis Multi-Hazard Mitigation Plan.

The objective of this plan is to provide guidance for mitigation activities for the next five years. It will ensure that the Town of Dennis implements hazard mitigation activities that are most effective and appropriate for the natural hazards that threaten the community.

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 Review through various town Board meetings and public information sessions such as those held during the review and adoption of the 2014 Flood Map Update.

<b>DEPARTMENT</b>	<b>STAFF MEMBER</b>	<b>SKILL SET</b>
<b>Planning Department</b>	Daniel Fortier	Zoning, Flood Zone, Flood Insurance
<b>Health Department</b>	Terence Hayes	Health Regulations, Septic, Flood Zone
<b>Police Department</b>	Peter DiMatteo	Emergency Operations, Evacuation Planning
<b>Fire Department</b>	John Donlan	Emergency Operations, Fire Safety
<b>Engineering</b>	Tom Andrade	Storm Water, Flood Zone Design Standards
<b>Public Works</b>	David Johanson	Emergency Operations, Evacuation Planning
<b>Natural Resources</b>	Karen Johnson	Natural Resource Protection, Wildfire Protection, Flood Zone, Wetland Protection, Beach and Dune Renourishment
<b>Beach Department</b>	Dustin Pineau	Beach and Dune Renourishment
<b>Harbormaster</b>	Dawson Farber	Dredging
<b>Building Department</b>	Brian Florence	Flood Zone Building Code, Fire Safety

The Senior Management Team meets weekly through two venues, the weekly Department Heads Meeting and Technical Project Review Team meetings. These meetings include compilation of the work efforts of the Committees and Boards. The Committees and Boards with input and oversight of the issues and projects compiled into the Multi-Hazard Mitigation Plan include:

<b>COMMITTEE</b>	<b>REGULAR MEETING DATES</b>	<b>ISSUE AREAS</b>
<b>Beach Committee</b>	2nd Wednesday	Beach Renourishment
<b>Board of Health</b>	2nd and 4th Thursday	Evacuation, Infrastructure
<b>Conservation Commission</b>	1st & 3rd Thursday	Dredging, Flood Management, Dune and Beach Renourishment, Open Space Planning and Preservation, Vegetation Management, Sea Level Rise
<b>Planning Board</b>	1st & 3rd Mondays	Flooding, Pre-Disaster Regulatory Changes, Open Space Planning, Hazard Planning, Long Range Planning, Storm Water Control, Sea Level

		Rise, Flood Zone Protection
<b>Waterways Committee</b>	2nd Wednesday	Dredging, Emergency Preparedness
<b>Barnstable County Emergency Management Committee</b>		Emergency Preparedness, Evacuation Planning and Coordination
<b>Coastal Resource Committee</b>		Beach and Dune Renourishment, Dredging
<b>Beach Management Advisory Task Force</b>		Beach and Dune Renourishment, Dredging
<b>Harbor Master Plan Committee</b>		Harbor Dredging

These committees work continuously, year-round, on issues that are ultimately combined into the Multi-Hazard Mitigation Plan. Through the efforts of these groups emergency preparation, planning and implementation have become a routine part of the Town of Dennis operating and Capital budgets.

### 1.1.2 Scope of the Plan

The scope of the Town of Dennis Multi-Hazard Mitigation Plan is townwide. It addresses natural and manmade hazards deemed a threat to the citizens of Dennis. Both short-term and long-term hazard mitigation opportunities are addressed beyond existing federal, state, and local funding programs.

### 1.1.3 Authority

The Robert T. Stafford Disaster Relief and Emergency Assistance Act, as amended, provides new and revitalized approaches to mitigation planning. In particular, Title 42 USC., Section 5165 includes as a primary requirement the development and submission for federal approval a plan that identifies the natural hazards, risks, and vulnerabilities of the respective jurisdictions and establishes specific mitigation measures and strategies. As stated above, revisions to the Act make it clear that no federal assistance is available to an otherwise eligible jurisdiction if no Hazard Mitigation Plan has been adopted and is in effect.

This requirement, in concert with other sections of the Act, provides a significant opportunity to reduce the Town of Dennis’s disaster losses through mitigation planning.

### 1.1.4 Funding

The preparation of the Town of Dennis Multi-Hazard Mitigation Plan was completely funded through the normal staffing levels of the town departments involved in the update to the plan.

### 1.1.5 Goals

#### 1.1.5.1 Existing Planning Document Goals

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). The Draft 2015 Open Space and Recreation Plan does address these issues. 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 three plans.

Both the Local Comprehensive Plan and the Opens Space and Recreation Plans 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 coastal 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, coastal 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 (roads, sewers, drainage pipes, etc) 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.

#### 1.1.5.2 Specific Community Goals for the Town of Dennis Multi-Hazard Mitigation Plan

- 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 and relevant local permitting boards/committees/agencies.

#### 1.1.6 Definition of Terms

**Anchoring:** Special connections made to ensure that a building or structure will not float off, blow off or be pushed off its foundation during a flood or storm.

**Base Flood:** Flood that has a 1 percent probability of being equaled or exceeded in any given year. Also known as the 100-year flood.

**Base Flood Elevation (BFE):** Elevation of the base flood in relation to a specified datum, such as the National Geodetic Vertical Datum of 1988. The Base Flood Elevation is used as the standard for the National Flood Insurance Program.

**Basement:** Any floor level below grade.

**Bedrock:** The solid rock that underlies loose material, such as soil, sand, clay, or gravel.

**Building:** A structure that is walled and roofed, principally above ground and permanently affixed to a site. The term includes a manufactured home on a permanent foundation on which the wheels and axles carry no weight.

**Community Rating System (CRS):** A National Flood Insurance Program (NFIP) that provides incentives for NFIP communities to complete activities that reduce flood hazard risk. When the community completes specified activities, the insurance premiums of policyholders in these communities are reduced.

**Consequences:** The damages, injuries, and loss of life, property, environment, and business that can be quantified by some unit of measure, often in economic or financial terms.

**Contour:** A line of equal ground elevation on a topographic (contour) map.

**Critical Facility:** Facilities that are critical to the health and welfare of the population and that are especially important during and following hazard events. Critical facilities include shelters, police and fire stations, schools, childcare centers, senior citizen centers, hospitals, disability centers, vehicle and equipment storage facilities, emergency operations centers, and city hall. The term also includes buildings or locations that, if damaged, would create secondary disasters, such as hazardous materials facilities, vulnerable facilities, day care centers, nursing homes, and housing likely to contain occupants who are not very mobile. Other critical city infrastructure such as telephone exchanges and water treatment plants are referred to as lifelines. See Lifelines.

**Dam Breach Inundation Area:** The area flooded by a dam failure or programmed release.

**Debris:** The scattered remains of assets broken or destroyed in a hazard event. Debris caused by a wind or water hazard event can cause additional damage to other assets.

**Development:** Any man-made change to real estate.

**Duration:** How long a hazard event lasts.

**Earthquake:** A sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of earth's tectonic plates.

**Emergency:** Any hurricane, tornado, storm, flood, high water, wind-driven water, tidal wave, tsunami, earthquake, volcanic eruption, landslide, mudslide, snowstorm, drought, fire, explosion, or other catastrophe in any part of the United States which requires federal emergency assistance to supplement State and local efforts to save lives and protect property, public health and safety,

or to avert or lessen the threat of a disaster. Defined in Title V of Public Law 93-288, Section 102(1).

***Emergency Operations Center (EOC):*** A facility that houses communications equipment that is used to coordinate the response to a disaster or emergency.

***Emergency Operations Plan (EOP):*** Sets forth actions to be taken by State or local governments for response to emergencies or major disasters.

***Emergency Response Plan:*** A document that contains information on the actions that may be taken by a governmental jurisdiction to protect people and property before, during, and after a disaster.

***Extent:*** The size of an area affected by a hazard or hazard event.

***Fault:*** A fracture in the continuity of a rock formation caused by a shifting or dislodging of the earth's crust, in which adjacent surfaces are differentially displaced parallel to the plane of fracture.

***Federal Emergency Management Agency (FEMA):*** The independent agency created in 1978 to provide a single point of accountability for all Federal activities related to disaster mitigation and emergency preparedness, response and recovery.

***FIPS:*** Stands for Federal Information Processing Standards. Under the Information Technology Management Reform Act (Public Law 104-106), the Secretary of Commerce approves standards and guidelines that are developed by the National Institute of Standards and Technology (NIST) for Federal computer systems. These standards and guidelines are issued by NIST as Federal Information Processing Standards (FIPS) for use government-wide. NIST develops FIPS when there are compelling Federal government requirements such as for security and interoperability and there are no acceptable industry standards or solutions.

***Fire Potential Index (FPI):*** Developed by United States Geological Survey (USGS) and United States Forest Service (USFS) to assess and map fire hazard potential over broad areas. Based on such geographic information, national policy makers and on-the-ground fire managers established priorities for prevention activities in the defined area to reduce the risk of managed and wildfire ignition and spread. Prediction of fire hazard shortens the time between fire ignition and initial attack by enabling fire managers to pre-allocate and stage suppression forces to high fire risk areas.

***Flash Flood:*** A flood event occurring with little or no warning where water levels rise at an extremely fast rate.

***Flood:*** A general and temporary condition of partial or complete inundation of normally dry land areas from (1) the overflow of inland or tidal waters, (2) the unusual and rapid accumulation or runoff of surface waters from any source, or (3) mudflows or the sudden collapse of shoreline land.

***Flood Depth:*** Height of the flood water surface above the ground surface.

***Flood Elevation:*** Elevation of the water surface above an established datum, e.g. North American Vertical Datum of 1988, or Mean Sea Level.

***Flood Hazard Area:*** The area shown to be inundated by a flood of a given magnitude on a map.

***Flood Insurance Rate Map (FIRM):*** Map of a community, prepared by the Federal Emergency Management Agency, which shows both the special flood hazard areas and the risk premium zones applicable to the community.

***Flood Insurance Study (FIS):*** A study that provides an examination, evaluation, and determination of flood hazards and, if appropriate, corresponding water surface elevations in a community or communities.

***Flood Mitigation Assistance Program (FMA):*** A planning and project implementation grant program funded by the National Flood Insurance Program. Provides pre-disaster grants to State and local governments for both planning and implementation of mitigation strategies. Grant funds are made available from NFIP insurance premiums, and therefore are only available to communities participating in the NFIP.

***Flood of Record:*** The highest known flood level for the area, as recorded in historical documents.

***Floodplain:*** Any land area, including watercourse, susceptible to partial or complete inundation by water from any source.

***Floodproofing:*** Protective measures added to or incorporated in a building to prevent or minimize flood damage. “Dry floodproofing” measures are designed to keep water from entering a building. “Wet floodproofing” measures minimize damage to a structure and its contents from water that is allowed into a building.

***Floodway:*** The stream channel and that portion of the adjacent floodplain which must remain open to permit conveyance of the base flood. Floodwaters are generally the swiftest and deepest in the floodway. The floodway should remain clear of buildings and impediments to the flow of water.

***Freeboard:*** A margin of safety added to a protection measure to account for waves, debris, miscalculations, lack of scientific data, floodplain fill, or upstream development.

***Frequency:*** A measure of how often events of a particular magnitude are expected to occur. Frequency describes how often a hazard of a specific magnitude, duration, and/or extent typically occurs, on average. Statistically, a hazard with a 100-year recurrence interval is expected to occur once every 100 years on average, and would have a 1 percent chance – its probability – of happening in any given year. The reliability of this information varies depending on the kind of hazard being considered.

***Fujita Scale of Tornado Intensity:*** Rates tornadoes with numeric values from F0 to F5 based on tornado wind speed and damage sustained. An F0 indicates minimal damage such as broken tree limbs or signs, while an F5 indicates severe damage sustained.

***Functional Downtime:*** The average time (in days) during which a function (business or service) is unable to provide its services due to a hazard event.

**Geographic Area Impacted:** The physical area in which the effects of the hazard are experienced.

**Geographic Information System (GIS):** A computer software application that relates physical features on the earth to a database to be used for mapping and analysis.

**Ground Motion:** The vibration or shaking of the ground during an earthquake. When a fault ruptures, seismic waves radiate, causing the ground to vibrate. The severity of the vibration increases with the amount of energy released and decreases with distance from the causative fault or epicenter, but soft soils can further amplify ground motions.

**Hazard:** A source of potential danger or adverse condition. An event or physical condition that has the potential to cause fatalities, injuries, property and infrastructure damage, agriculture loss, damage to the environment, interruption of business, or other types of harm or loss. Hazards, as defined in this study, will include naturally occurring events such as floods, dam failures, levee failures, tornadoes, high winds, hailstorms, lightning, winter storms, extreme heat, drought, expansive soils, urban fires, wildfires that strike populated areas, and earthquakes. A natural event is a hazard when it has the potential to harm people or property. For purposes of this study, hazardous materials events are also included.

**Hazard Event:** A specific occurrence of a particular type of hazard.

**Hazard Identification:** The process of defining and describing a hazard, including its physical characteristics, magnitude and severity, probability and frequency, causative factors, and locations or areas affected.

**Hazard Mitigation:** Sustained actions taken to reduce or eliminate long-term risk to human life and property from natural and technological hazards and their effects. Note that this emphasis on long-term risk distinguishes mitigation from actions geared primarily to emergency preparedness and short-term recovery.

**Hazard Mitigation Grant Program (HMGP):** Authorized under Section 404 of the Stafford Act; a FEMA disaster assistance grant program that funds mitigation projects in conformance with post-disaster mitigation plans required under Section 409 of the Stafford Act. The program is available only after a Presidential disaster declaration.

**Hazard Mitigation** is defined as: Sustained actions taken to reduce or eliminate long-term risk to human life and property from natural, man-made, and technological hazards and their effects. Note that this emphasis on “long-term” risk distinguishes mitigation from actions geared primarily to emergency preparedness and short-term recovery.

**Hazard Mitigation Plan:** The plan resulting from a systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards present in society that includes the actions needed to minimize future vulnerability to hazards. Section 409 of the Stafford Act requires the identification and evaluation of mitigation opportunities, and that all repairs be made to applicable codes and standards, as condition for receiving Federal disaster assistance. Enacted to encourage identification and mitigation of hazards at all levels of government.

**Hazard Profile:** A description of the physical characteristics of hazards and a determination of various descriptors including magnitude, duration, frequency, probability, and extent. In most cases, a community can most easily use these descriptors when they are recorded and displayed as maps.

**HAZUS (Hazards U.S.):** A GIS-based nationally standardized earthquake loss estimation tool developed by FEMA.

**Hydrology:** The science of dealing with the waters of the earth. A flood discharge is developed by a hydrologic study.

**Infrastructure:** The public services of a community that have a direct impact on the quality of life. Infrastructure includes communication technology such as phone lines or Internet access, vital services such as public water supplies and sewer treatment facilities, and includes an area's transportation system such as airports, heliports; highways, bridges, tunnels, roadbeds, overpasses, railways, bridges, rail yards, depots, and waterways, canals, locks, and regional dams.

**Insurance Service Office, Inc. (ISO):** An insurance organization that administers several programs that rate a community's hazard mitigation activities.

**Intensity:** A measure of the effects of a hazard event at a particular place.

**Landslide:** Downward movement of a slope and materials under the force of gravity.

**Lifelines:** Systems necessary for human life and urban function, especially during emergencies. Transportation and utility systems, as well as emergency service facilities are considered the lifelines of a community. Transportation systems include interstate, US, and state highways, roadways, railways, waterways, ports, harbors, and airports. Utility systems consist of electric power, gas and liquid fuels, telecommunications, water, and wastewater. Emergency service facilities include Emergency Alert System communication facilities, hospitals, and the police and fire departments.

**Liquefaction:** The phenomenon that occurs when ground shaking causes loose soils to lose strength and act like viscous fluid. Liquefaction causes two types of ground failure: lateral spread and loss of bearing strength.

**Lowest Floor:** Under the NFIP, the lowest floor of the lowest enclosed area (including basement) of a structure.

**Magnitude:** A measure of the strength of a hazard event. The magnitude (also referred to as severity) of a given hazard event is usually determined using technical measures specific to the hazard.

**Mitigation:** Sustained action taken to reduce or eliminate the long-term risk to human life and property from natural and technological hazards and their effects. Note that this emphasis on long-term risk distinguishes mitigation from actions geared primarily to emergency preparedness and short-term recovery.

**National Flood Insurance Program (NFIP):** A federal program created by Congress in 1968 that provides the availability of flood insurance to communities in exchange for the adoption and enforcement of a minimum floodplain management ordinance specified in 44 CFR §60.3. The ordinance regulates new and substantially damaged or improved development in identified flood hazard areas.

**National Weather Service (NWS):** Prepares and issues flood, severe weather, and coastal storm warnings and can provide technical assistance to Federal and state entities in preparing weather and flood warning plans.

**North American Vertical Datum of 1988 (NGVD):** Datum established in 1988 and used in the NFIP as a basis for measuring flood, ground, and structural elevations. The Base Flood Elevations shown on most of the Flood Insurance Rate Maps issued by the Federal Emergency Management Agency are referenced to NAVD.

**Planimetric:** Describes maps that indicate only man-made features like buildings.

**Planning:** The act or process of making or carrying out plans; the establishment of goals, policies and procedures for a social or economic unit.

**Planning for Post-Disaster Reconstruction:** The process of planning (preferably prior to an actual disaster) those steps the community will take to implement long-term reconstruction with one of the primary goals being to reduce or minimize its vulnerability to future disasters. These measures can include a wide variety of land-use planning tools, such as acquisition, design review, zoning, and subdivision review procedures. It can also involve coordination with other types of plans and agencies but is distinct from planning for emergency operations, such as restoration of utility services and basic infrastructure.

**Preparedness:** Activities to ensure that people are ready for a disaster and respond to it effectively. Preparedness requires figuring out what will be done if essential services break down, developing a plan for contingencies, and practicing the plan.

**Probability:** A statistical measure of the likelihood that a hazard event will occur.

**Project Impact:** A program that encourages business, government agencies and the public to work together to build disaster-resistant communities.

**Reconstruction:** The long-term process of rebuilding the community's destroyed or damaged buildings, public facilities, or other structures.

**Recovery:** The process of restoring normal public or utility services following a disaster, perhaps starting during but extending beyond the emergency period to that point when the vast majority of such services, including electricity, water, communications, and public transportation have resumed normal operations. Recovery activities necessary to rebuild after a disaster include rebuilding homes, businesses and public facilities, clearing debris, repairing roads and bridges, and restoring water, sewer and other essential services. Short-term recovery does not include the reconstruction of the built environment, although reconstruction may commence during this period.

**Recurrence Interval:** The time between hazard events of similar size in a given location. It is based on the probability that the given event will be equaled or exceeded in any given year.

**Repetitive Loss Property:** A property that is currently insured for which two or more National Flood Insurance Program losses (occurring more than ten days apart) of at least \$1000 each have been paid within any 10-year period since 1978. While Repetitive Loss Properties constitute only 2% of insured properties, they account for 40% of flood damage claims against the NFIP.

**Replacement Value:** The cost of rebuilding a structure. This is usually expressed in terms of cost per square foot, and reflects the present-day cost of labor and materials to construct a building of a particular size, type and quality.

**Retrofitting:** Modifications to a building or other structure to reduce its susceptibility to damage by a hazard.

**Richter Scale:** A numerical scale of earthquake magnitude devised by seismologist C.F. Richter in 1935.

**Risk:** The estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms such as a high, moderate or low likelihood of sustaining damage above a particular threshold due to a specific type of hazard event. It also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

**Risk Assessment:** A process or method for evaluating risk associated with a specific hazard and defined in terms of probability and frequency of occurrence, magnitude and severity, exposure and consequences. Also defined as: “The process of measuring the potential loss of life, personal property, housing, public facilities, equipment, and infrastructure; lost jobs, business earnings, and lost revenues, as well as indirect losses caused by interruption of business and production; and the public cost of planning, preparedness, mitigation, response, and recovery.

**Riverine:** Of or produced by a river.

**Scale:** A proportion used in determining a dimensional relationship; the ratio of the distance between two points on a map and the actual distance between the two points on the earth's surface.

**Scarp:** A steep slope.

**Scour:** Removal of soil or fill material by the flow of flood waters. The term is frequently used to describe storm-induced, localized conical erosion around pilings and other foundation supports where the obstruction of flow increases turbulence.

**Seismicity:** Describes the likelihood of an area being subject to earthquakes.

***Special Flood Hazard Area (SFHA):*** An area within a floodplain having a 1 percent or greater chance of flood occurrence in any given year (100-year floodplain); represented on Flood Insurance Rate Maps by darkly shaded areas with zone designations that include the letter A or V.

***Stafford Act:*** The Robert T. Stafford Disaster Relief and Emergency Assistance Act, PL 100-107 was signed into law November 23, 1988 and amended the Disaster Relief Act of 1974, PL 93-288. The Stafford Act is the statutory authority for most Federal disaster response activities, especially as they pertain to FEMA and its programs.

***State Hazard Mitigation Team:*** Composed of key State agency representatives, the team evaluates hazards, identifies strategies, coordinates resources, and implements measures that will reduce the vulnerability of people and property to damage from hazards.

***State Hazard Mitigation Officer (SHMO):*** The representative of state government who is the primary point of contact with FEMA, other state and Federal agencies, and local units of government in the planning and implementation of pre- and post-disaster mitigation activities.

***Stormwater Management:*** Efforts to reduce the impact of stormwater or snowmelt runoff on flooding and water quality.

***Stormwater Detention:*** The storing of stormwater runoff for release at a restricted rate after the storm subsides, or the flood crest passes.

***Substantial Damage:*** Damage of any origin sustained by a structure in a Special Flood Hazard Area whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage.

***Surface Faulting:*** The differential movement of two sides of a fracture – in other words, the location where the ground breaks apart. The length, width, and displacement of the ground characterize surface faults.

***Tectonic Plate:*** Torsionally rigid, thin segments of the earth's lithosphere that may be assumed to move horizontally and adjoin other plates. It is the friction between plate boundaries that cause seismic activity.

***Topographic:*** Characterizes maps that show natural features and indicate the physical shape of the land using contour lines. These maps may also include man-made features.

***Tornado:*** A violently rotating column of air extending from a thunderstorm to the ground.

***Vulnerability:*** Describes how exposed or susceptible to damage an asset is. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power – if an electric substation is flooded, it will affect not only the substation itself, but a number of businesses as well. Often, indirect effects can be much more widespread and damaging than direct ones.

**Vulnerability Assessment:** The extent of injury and damage that may result from a hazard event of a given intensity in a given area. The vulnerability assessment should address impacts of hazard events on the existing and future built environment.

**Wildfire:** An uncontrolled fire spreading through vegetative fuels, exposing and possibly consuming structures.

**Zone:** A geographical area shown on a Flood Insurance Rate Map (FIRM) that reflects the severity or type of flooding in the area.

#### 1.1.7 Point of Contact

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#### 1.1.8 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.

#### 1.1.9 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.

The Town Planner, working with the MHM Plan team, 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.

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.

<b>Hazard</b>	<b>Status</b>	<b>Hazard Identification Completion Date</b>	<b>Vulnerability Assessment Completion Date</b>
<b>Severe Weather – Hurricane</b>	Updated	2015	2015
<b>Floods</b>	Updated	2015	2015
<b>Sea Level Rise</b>	Updated	2015	2015
<b>Severe Weather – Blizzard</b>	Updated	2015	2015
<b>Earthquake</b>	Updated	2015	2015
<b>Fire – Wild Fire</b>	Updated	2015	2015
<b>Fire - Urban</b>	Updated	2015	2015

#### 1.1.10 Continued Public Involvement

The Town of Dennis, through its Planning Office, maintains an active public information program. Since the adoption of the 2011 MHM Plan the town has hosted a number of forums on hazard mitigation. Two of these forums focused on pending updates to the Flood Insurance Rate Maps. During the 2014 Flood Map Review Forum, coordinated with our neighbors in Harwich, Brewster and Yarmouth, over 1,000 people met with staff at the Dennis Senior Center over a four hour period to review the maps. During this review, the town also met one-on-one with over 2,000 additional people concerned about flood zone changes and flood insurance. The, then pending, flood maps were placed on-line and have been visited well over 10,000 times since they were first made available for public review. Since the adoption of the Flood Map revisions, staff has continued to meet with residents to assist them with flood zone concerns.

The Town also participates in the Barnstable County Emergency Operations Center, this entity provides up-to-the-minute information on pending storms, generally with releasing information to the public well in advance of the arrival of a particular storm event. Through the use of Reverse-911 (Code Red in Dennis) the town is able to provide pre-recorded information directly to residents about pending events.

The following methods are and will continue to be used for continued public involvement.

Continued regular and on-going discussions of relevant issues by the following boards and committees:

Beach Committee
Board of Health
Conservation Commission
Planning Board
Waterways Committee
Barnstable County Emergency Management Committee
Coastal Resource Committee
Beach Management Advisory Task Force
Harbor Master Plan Committee

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>).

The Hazard Mitigation Plan is also kept in the following locations:

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

Through the use of press releases, the Planning Department Weblog, Twitter (Police, Fire and Planning accounts) and Facebook (Police and Planning) the town constantly provides information to residents on critical emergency preparation and planning issues. Through these same tools, the town solicits constant feedback from residents.

On an annual basis the town reviews 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.

Dennis works directly with its neighbors (Dennis hosted two joint Flood Map Update Forums since the last MHM Plan adoption with Brewster and Harwich, and collaborated with Yarmouth on a flood map/insurance forum for instance) , the Barnstable County Emergency Planning Committee, State Representative Timothy Whelan and Congressman William Keating on emergency preparedness issues of which flooding and storm response (snow and rain) generally are the most prevalent. Dennis Planning Staff has also testified before a Massachusetts Special Legislative Committee on Climate Change regarding the impact of sea level rise on Dennis and other coastal communities.

## **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 2015 Town of Dennis Open Space and Recreation Plan Draft Update. 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**

#### **2.1.1. 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 layout lies in the diversity offered by the two distinctly different marine ecosystems (and recreational attributes of the different shorelines.).

Dennis is engaged in the natural resource and planning issues of Cape Cod through participation in the Assembly of Delegates, Cape Cod Commission, Barnstable County Health Department, Shellfish Task Force, Cape Cod Pathways, Regional Transit Authority and other regional organizations. Cooperative ventures in protecting the Bass River and Chase Garden ecosystems require partnerships with the Town of Yarmouth; protecting the Quivet Creek/Bound Brook watershed has required a partnership with the Town of Brewster, the Dennis Conservation Trust, Brewster Conservation Trust and the Cape Cod Commission; and protecting the drinking water supply of the Town of Dennis has required a partnership between the Dennis Water District and the Town of Brewster. As with the entire Cape area, Dennis is served by a sole source aquifer, the Monomoy Lens. Because public wellfields in the eastern side of town draw ground water from Dennis, Harwich and Brewster, the town participates in the Monomoy Lens Groundwater Protection Project with its municipal neighbors through the Cape Cod Commission.

Potential regional and neighboring threats to the quality of resources and open space in Dennis include continued regional development, particularly given Dennis' proximity to Hyannis, Cape Cod's commercial core and transportation hub. This growth could impact regional resources, such as groundwater quality, coastal resources and wildlife migration, which exist in Dennis. Dennis's planning districts are Dennis Village, Dennis Port, East Dennis, South Dennis, and West Dennis.

### 2.1.2. History of the Community

Archæological studies in Dennis have uncovered finds rich in Native American artifacts along the Bass River in South Dennis. 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.<sup>1</sup> 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.

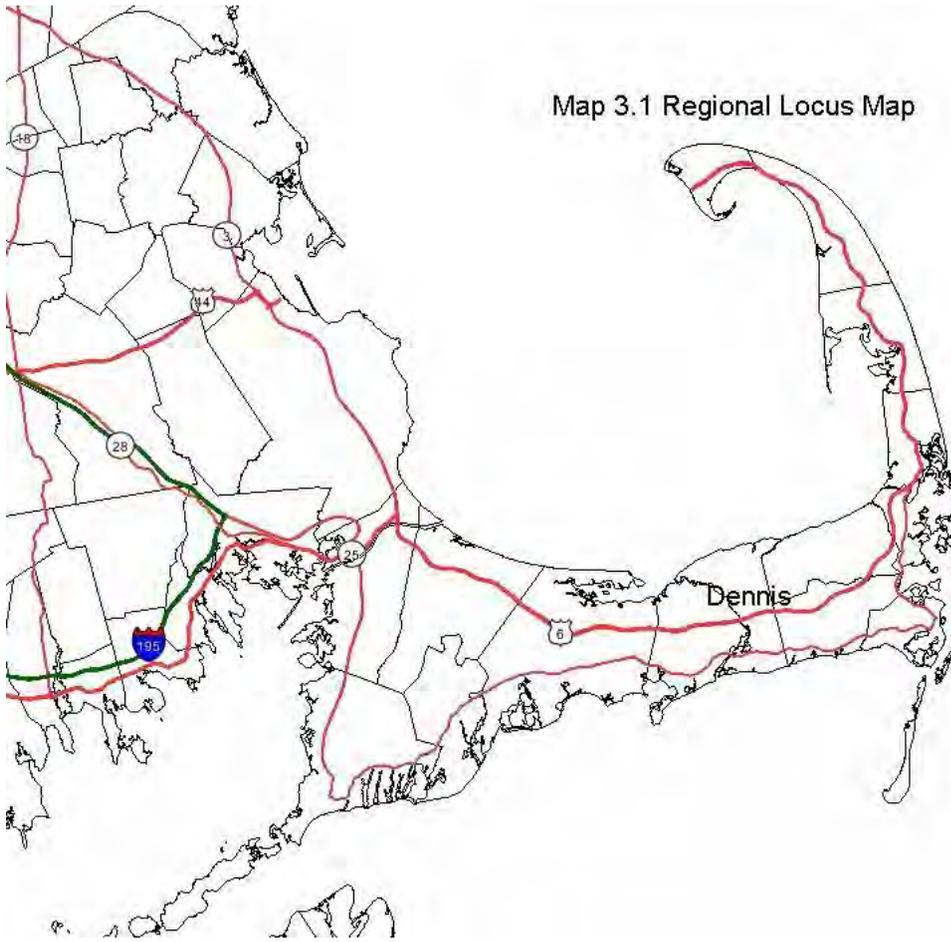
"Settlement was usually strung out around the harbor and along the roads that led to it with only a moderate commercial and institutional core at the center."<sup>1A</sup> This statement pertaining to Cape Cod in general certainly applied to colonial Dennis. In Dennis' case, the harbor was actually the 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.

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<sup>1</sup> Massachusetts Historical Commission, town map files, Contact Period overlay.

<sup>1A</sup> Massachusetts Historical Commission, Historic and Archaeological Resources of Cape Cod and the Islands, 1987, p. 90.

Map 3.1 Regional Locus Map



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 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..."<sup>2</sup> 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.<sup>3</sup> 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.<sup>3A</sup>

By 1840, Massachusetts provided half of the fishery products of the United States<sup>4</sup> 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.<sup>5</sup> 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. Dennis 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.<sup>6</sup> By century's end, though, that business fell off when inland salt mines in Pennsylvania were developed.

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<sup>2</sup> Simeon L. Deyo, History of Barnstable County, Massachusetts, 1890, p. 515.

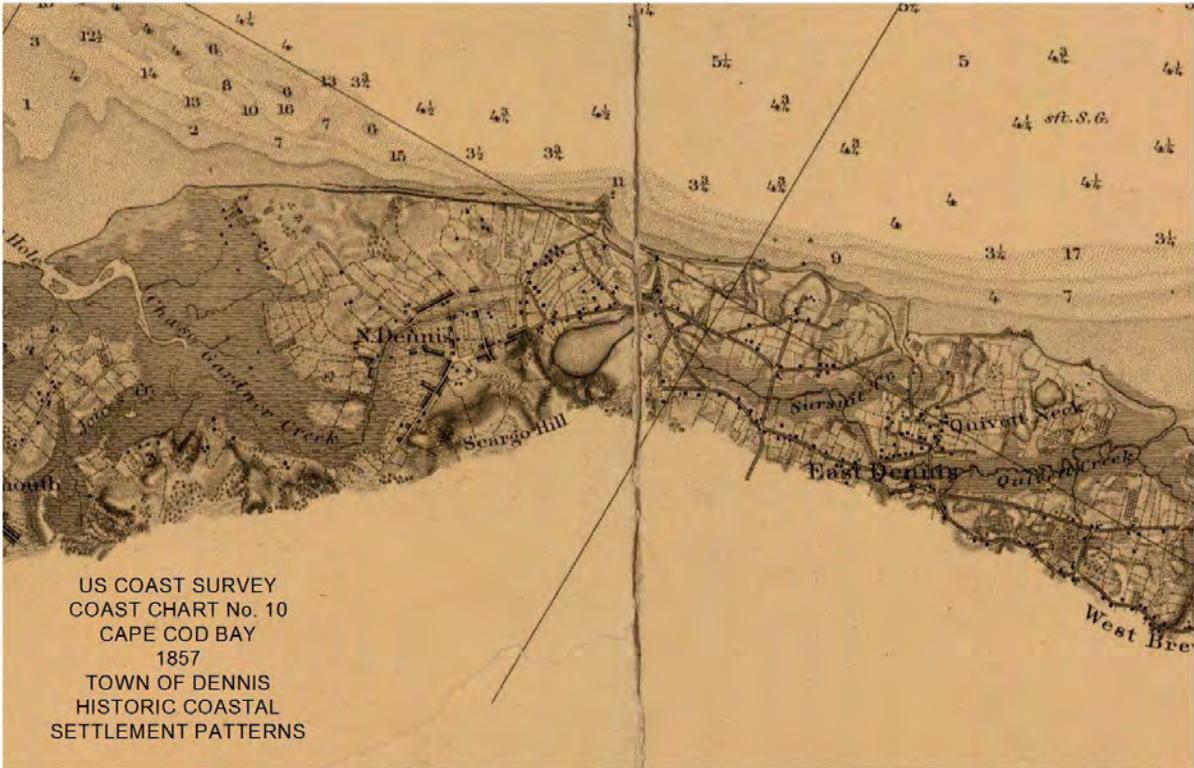
<sup>3</sup> Massachusetts Historical Commission, Historic and Archaeological Resources of Cape Cod and the Islands, 1987, p. 96.

<sup>3A</sup> Samuel Eliot Morison, The Maritime History of Massachusetts, 1783-1860, (1921, 1979), p. 300.

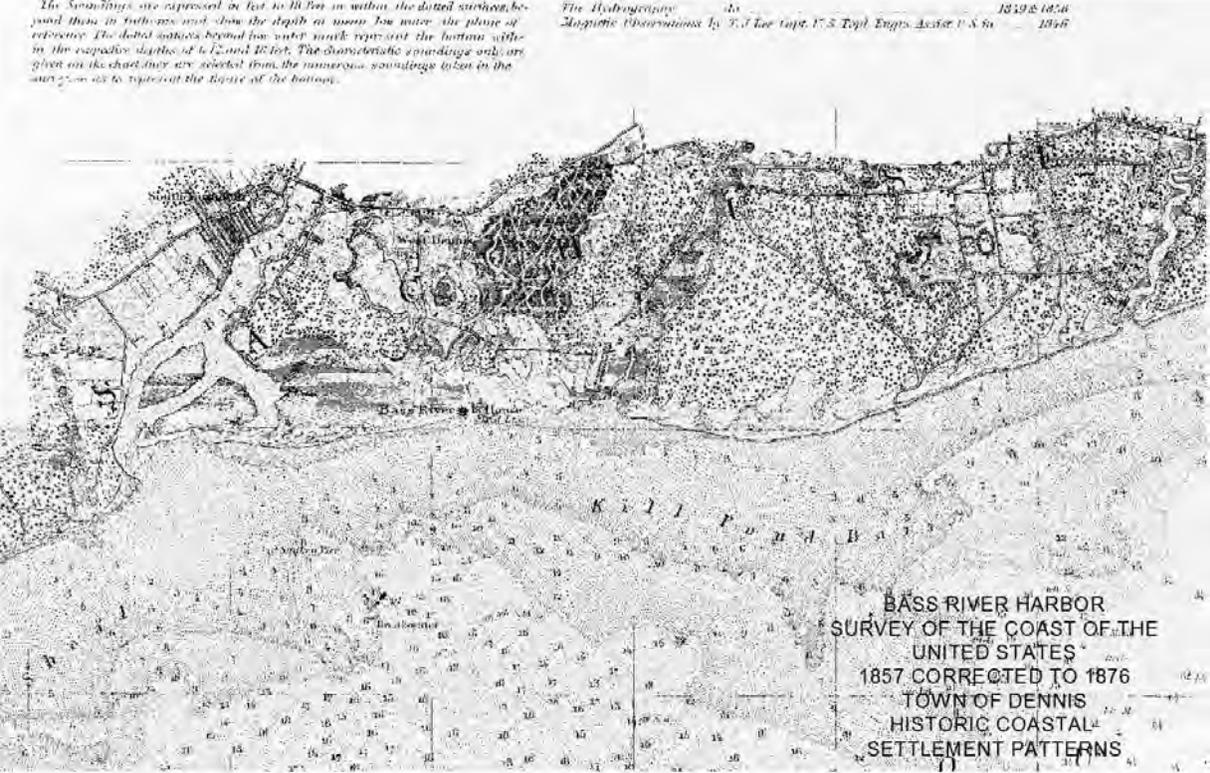
<sup>4</sup> Simeon L. Deyo, History of Barnstable County, Massachusetts, 1890, p. 138.

<sup>5</sup> Frederick Freeman, The History of Cape Cod, 1862, Vol. II, p. 179.

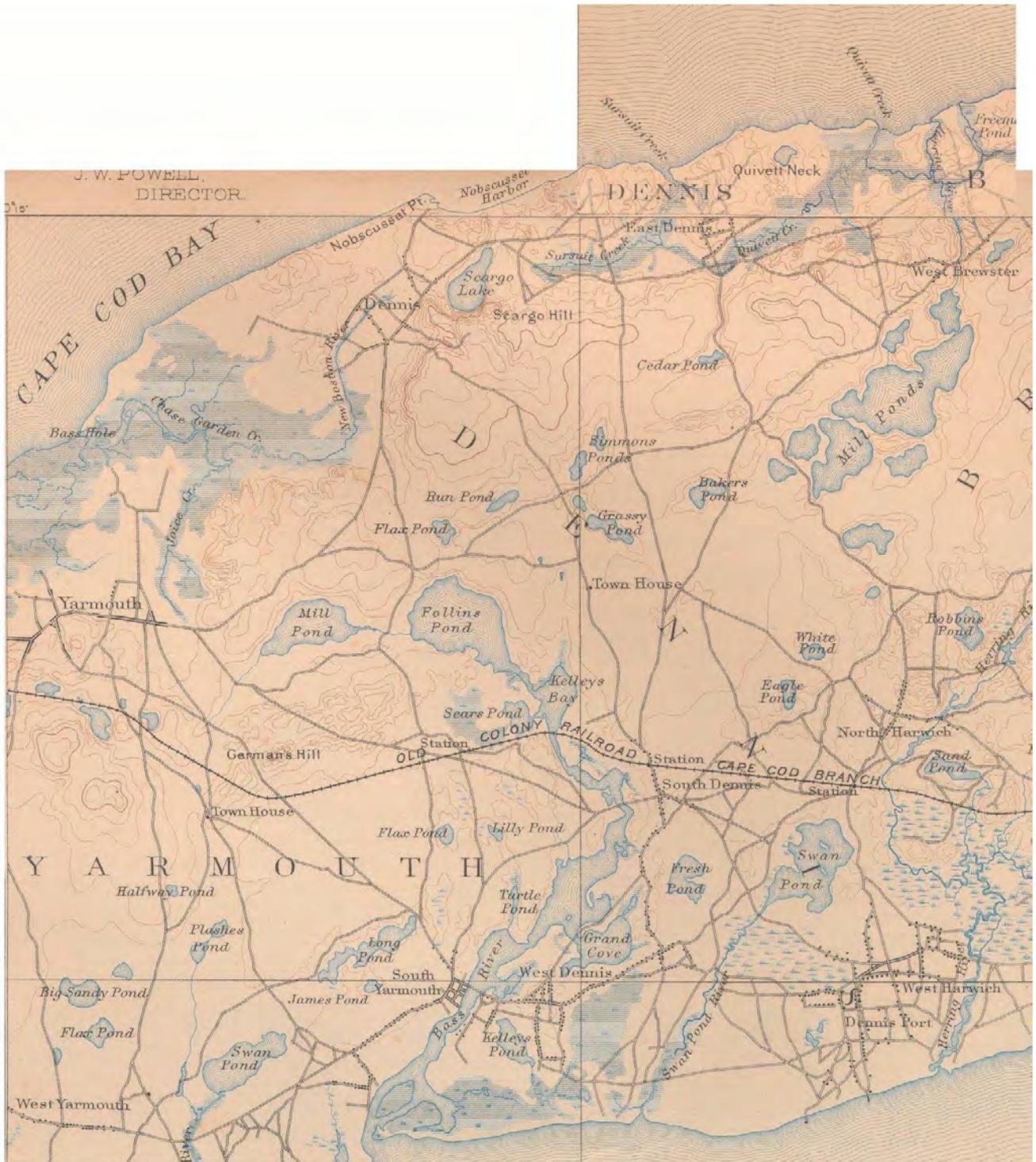
<sup>6</sup> Deyo, 1890, p. 145 and Freeman, 1862, p. 695.



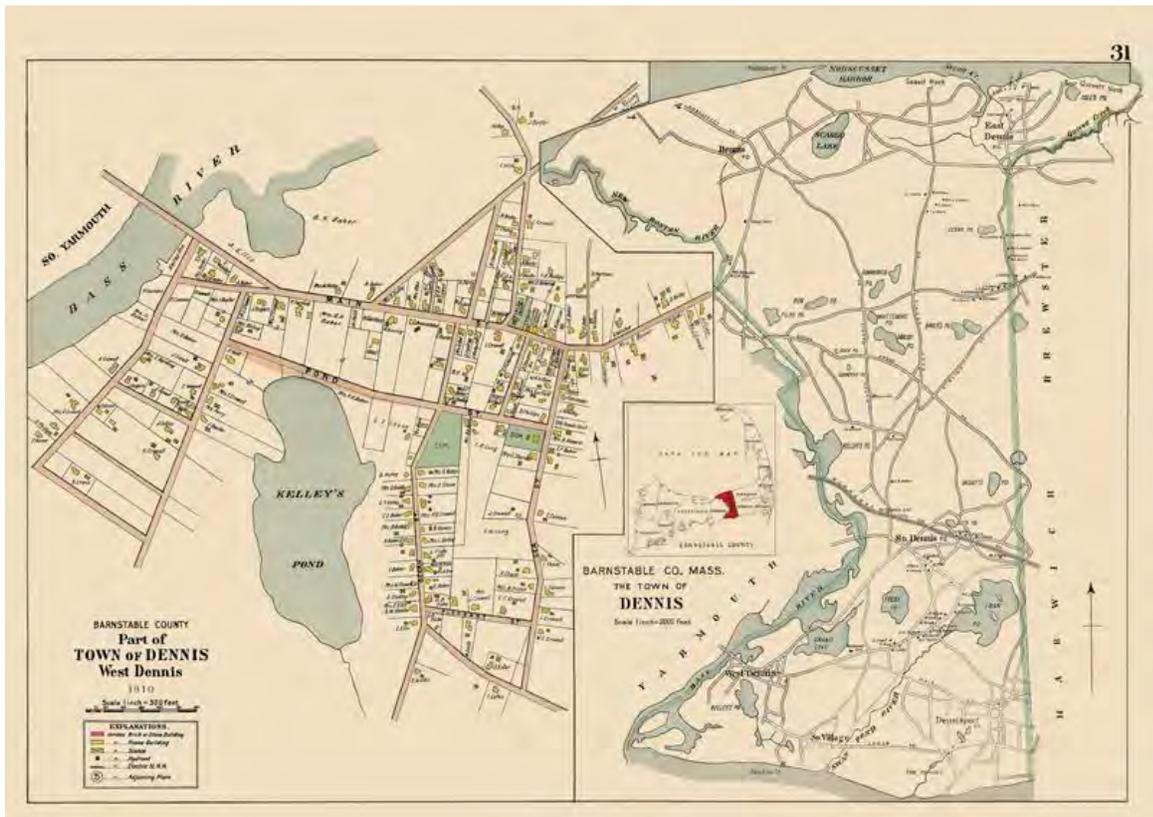
1857 Town of Dennis North Side Settlement Patterns



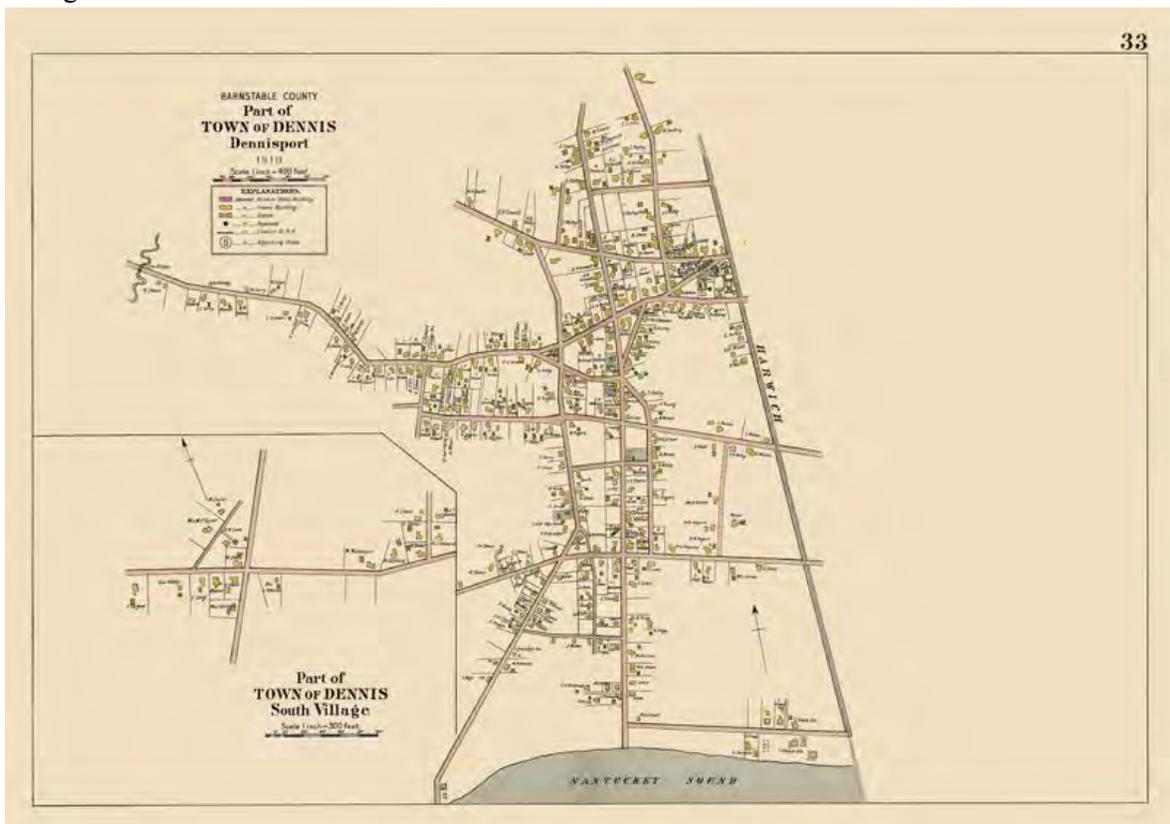
1876 Town of Dennis South Side Settlement Patterns



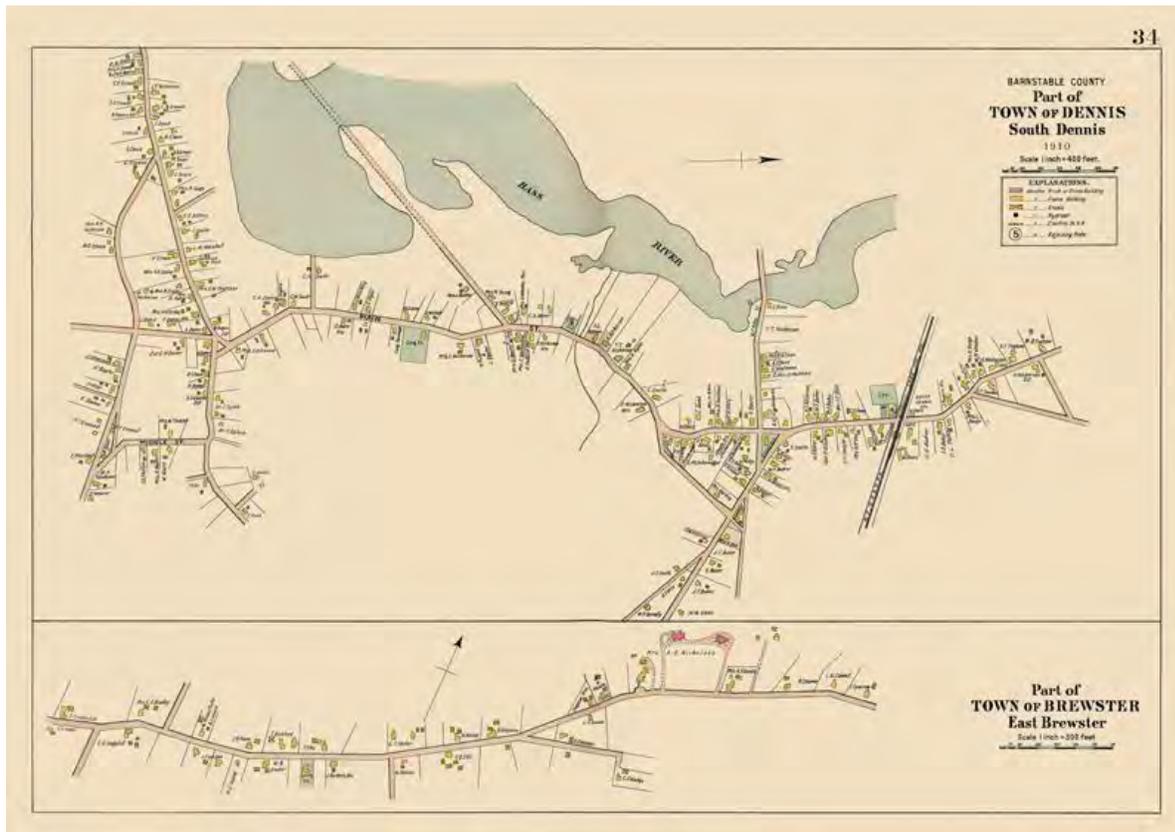
1893 USGS Map of Dennis, care of UNH Historic Map Library



Village of West Dennis 1910



Village of Dennis Port 1910



South Dennis Village 1910

Dennis turned back to the land for economic pursuits. 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.<sup>7</sup> 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.<sup>8</sup> 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.

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 Dennis Port (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

<sup>7</sup> 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.

<sup>8</sup> Simeon L. Deyo, History of Barnstable County, Massachusetts, 1890, p. 149.

Northside of the towns of Sandwich, Barnstable and Yarmouth, arched south through Dennis, perhaps reflecting the commercial importance of the Southside in the latter 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.<sup>9</sup>

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 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.<sup>10</sup>

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.<sup>11</sup> This large and still growing retirement community has produced a greater awareness about "quality of life" issues in Dennis and on the Cape.

### **2.1.3. Population Characteristics**

Dennis hosts about six and a half percent of the county's population (2010 Census) on five percent of the land in the county. Growth in Dennis, as on the rest of Cape Cod, was dramatic during the 60's and 70's. However, 2010 US Census counts illustrate a dramatic drop in year round population in the first decade of the 21<sup>st</sup> century. There are many things at play in this drop in population. These include the national economic downturn of this time period, young people leaving the area and the higher than normal housing costs on Cape Cod due to the large second home market.

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

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

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

Since 1885 the Town has experienced lows and highs in the area of year round population. In 1885 the population was 3,497. At the turn of the 20th century, Dennis was home to 2,333 people. This population dropped by 1920 due to off-Cape migration, associated with diminished Cape economic opportunities. The town population had dropped to a low of 1,536 in 1920. The Town did not regain its 1885 population count until after 1955. 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. During the 1980s when most of the Cape experienced its most recent rapid development boom the population in Dennis started to stabilize. 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, the Dennis land boom before 1980 left little land left to develop in the 1980s.

From 1980 to 2000 the Town experienced an annual population growth rate of approximately 1.5%. However, between 2000 and 2010 the town’s population dropped 1.1% annually, dropping town year-round population figures to levels not seen since the mid-1990’s. Table 2.1 shows, through the combination of United States Census, Federal Population Estimates and the Annual Town Census, the population trends from 1855 to 2010.

**TABLE 2.1**  
Population Trends of the Town of Dennis 1855 – 2010

YEAR	POPULATION	YEAR	POPULATION
1885	3,497	1965	4,374
1900	2,335	1970	6,454 (7,443)
1915	1,822	1975	9,309
1920	1,536	1980	12,709 (12,360)
1925	1,749	1985	13,040
1930	1,829	1990	13,236 (13,864)
1935	2,017	1995	13,493
1940	2,085	2000	13, 837 (15,973)
1945	2,015	2005	13,661 (15,764)
1950	2,499	2008	(15,349)
1955	3,322	2010	13,585 (14,207)
1960	3,727		

SOURCE: Annual Town Reports (U.S. Census)

In the past decade (2000-2010) Dennis lost 1,766 year-round residents, 11% of those living here in 2000. Analyzing the details behind the numbers tells us what happened and where the population shift occurred.

The under 18 population dropped by 720 people in the decade. This is nearly a 27% drop in this segment of the population in the decade. Given overall population dropped by only 11.1%, and in 2000 the under 18 population was 17% of the total population in Dennis, it is safe to say that the young people in Dennis in 2010 made up a smaller share of the town's population than in 2000.

The Census data confirms that families with young children were leaving town in the preceding decade. Age cohort analysis shows that there were 2,190 people under 15 years old in 2000. Ten years later, these children make up the Dennis population between 10 and 24 years old. The 2010 population in this age cohort drops by 613 people. Obviously some people leave for college in this age group, so, if we break it down even more finely, we see drops in every age cohort. Children under 5 in 2000 become the 10 – 14 year old age group in 2010, this age cohort drops by 146 children. Similarly the 5 – 9 year age cohort in 2000 sees 239 of these children gone in the 15 to 19 age cohort.

The 18 and over population dropped as well, by 1,046 people, or 6.5%. This drop in year-round population is nowhere near as dramatic as in the younger age group.

The population that was between 20 and 39 years old in 2000 make up the 30 to 49 age cohort in 2010, this age cohort, those most likely to have had children living in Dennis in 2000, saw a drop of 895 people. Essentially this illustrates a significant out-migration of people of child bearing age leaving the town.

Interestingly, Dennis lost significant population in the oldest age cohorts, decade over decade as well. The 70 plus population in 2010, which represents the 60 plus age cohort in 2000, shows a drop of 1,248 people. This change includes, obviously deaths, but is also represents others who have simply chosen to not winter on the Cape any longer. Looking at it closely, we see that the 60-64 age cohort in 2000, drops by 179 people by 2010 when they are between 70 and 74. Similarly, the 65 -69 age cohort in 2000 drops by 327 people by 2010 when they are 75 – 79 years of age.

So, with all these people leaving, where did Dennis gain population? That would fall squarely in the age cohort that was between 40 and 60 years old in 2000. This age cohort grew by 509 people during the past decade, meaning more people moved into Dennis in this age cohort than left during the decade, as they all grew ten years older.

Ultimately, the loss of younger people, and the growth in people between 50 and 70, results in a significantly older Dennis. In 2000, the median age was 49.4. In 2010 the median age has jumped to 55.1. Men are younger than women, with a male median age of 53.2 (up from 47.9 in 2000) and female median age of 56.8 (up from 50.7 in 2000).

In real numbers, Dennis exceeded the population growth experienced in both Harwich and Brewster during the 1990's. This trend reversed itself during the most recent decade. While the state was growing by about 3%, Barnstable County was losing population, with nearly a 3% loss. When compared to our neighbors,

and the rest of the Cape, Dennis population figures dropped dramatically, with the largest population drop, percentage wise, on the Cape. While we lost 11.1% of our 2000 population in the decade, Harwich was only losing 1.1% in the ten years and Brewster 2.7%. Yarmouth also dropped by less than half the rate Dennis did, dropping 4.1%.

Beyond the year-round population numbers, Dennis, experiences a fairly substantial population change during the summer months. As will be discussed later, total housing units increased in Dennis between 2000 and 2010. All of this, and the housing vacated by families leaving the area in the decade were absorbed by second home owners. The net result is, if we considered only the population in housing units, Dennis had an estimated summer population of between 30,827 and 61,805 people in 2010, the lower number using the average people per housing unit for year-round occupancy and the higher number being based upon Board of Health information on seasonal housing occupancy permits. In 2000 the seasonal population ranged between 28,800 and 52,129. These figures suggest a growth in summer population of between 2,000 and 9,000 people, before counting those in hotel rooms, cottages and recreational vehicles. In the past, we had estimated total summer population at about 70,000 people, it is now likely that we are approaching 80,000 people.

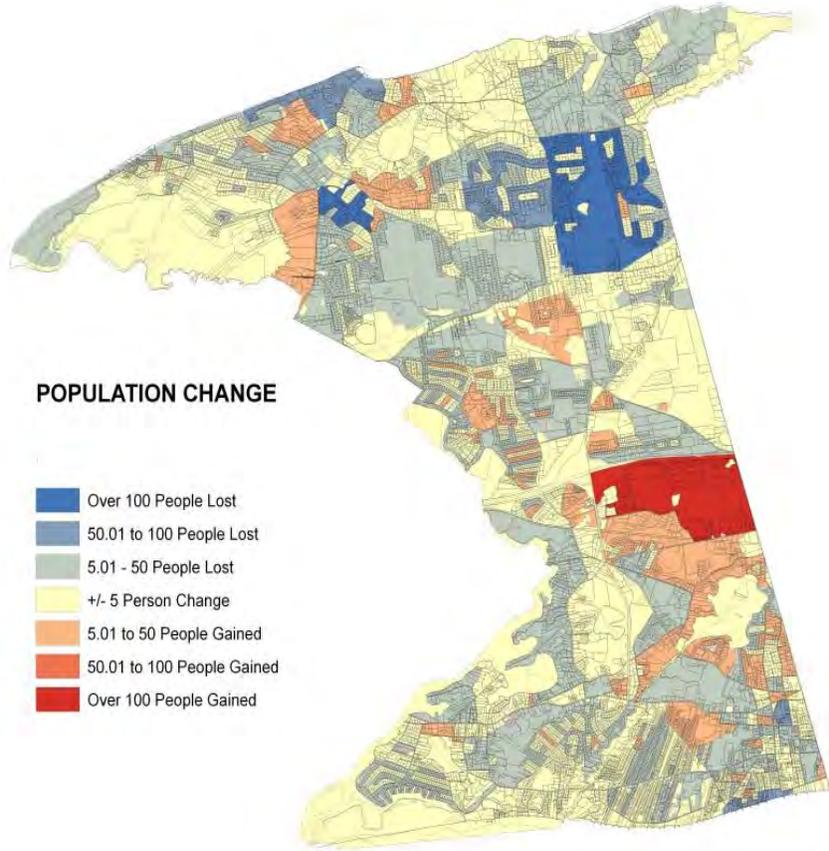
The increase in summer over winter population is more than five-fold (14,207 to an estimated 70,000 to 80,000). Excluding towns within the Cape Cod National Seashore, Dennis experiences the greatest rate of change between winter and summer populations of any town on Cape Cod. This change is due to the high rate of seasonal homes in Dennis. While Dennis has about 51% of its housing occupied seasonally, Yarmouth, for instance, only has 31%. Even in real numbers, we have about 2,500 more seasonal homes than Yarmouth

TABLE 2.2  
 POPULATION CHANGES 1980 – 2010  
 Comparisons with State, County and Other Towns

	Mass.	Barnstable County	<b>DENNIS</b>	Brewster	Harwich	Yarmouth
Census 80	5,737,037	147,925	<b>12,360</b>	5,225	9,971	18,449
Census 90	6,016,425	186,605	<b>13,864</b>	8,440	10,275	21,174
Growth 80-90	4.9%	26.1%	<b>12.2%</b>	61.5%	14.5%	14.8%
Census 2000	6,349,097	222,230	<b>15,973</b>	10,094	12,386	24,807
Growth 90-2000	5.5%	19.0%	<b>15.1%</b>	19.6%	20.5%	17.2%
Census 2010	6,547,829	215,888	<b>14,207</b>	9,820	12,243	23,793
Growth 00-10	3.1%	-2.9%	<b>-11.1%</b>	-2.7%	-1.1%	-4.1%

Census Block Level Data provides us with an interesting review of where, internally, changes took place. Map 2.1 below illustrates population changes between 2000 and 2010 in Dennis. At first glance the Dennis Industrial District jumps out, this represents a data glitch from 2000. The 2000 Census appears to have missed counting Eagle Pond Nursing Home, therefore illustrating a very large growth in population in an, otherwise non-residential district.

Strikingly, the largest concentrations of population loss occurred in areas north of Route 6, in particular around the Dennis Highlands Golf Course and in areas near Route 6A and Old Bass River Road. Population growth is illustrated in areas where newer housing projects and subdivisions occurred, in particular in Dennis Village in the block containing the new senior housing project, and along Dr. Stanton Road, an older subdivision with significant new construction in the last decade.



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Population Change 2000 - 2010  
By Census Block

Looking beyond the Census population estimates and the town census, data available at the county level from the Internal Revenue Service paints a picture of population trends on the Cape. This data actually supports the population data provided by Census Bureau. The IRS data estimated a loss of 2,673 between 2004 and 2008 for Barnstable County, a figure that is nearly one-half the population loss estimated by the Census Bureau for the County. Census Bureau interim population figures (released annually between Census Counts) suggested that Dennis alone lost 631 people in this time period. The IRS tax return data provided a strong picture, mid-decade of the out-migration trend of the population from the Cape.

Dennis year-round population (from which the remaining comparisons are drawn) continues to grow older. The town's median age jumped to 55.1 years old since 2000 (49.4 years old). This median age is significantly higher than our neighbors Yarmouth (51.4 years), Harwich (52.6 years) and Brewster (53.5 years) as well as in relation to the rest of the Cape's median (49.9 years) and the Commonwealth's (39.1 years).

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 open space and recreational services are, all else being equal, the town should perhaps emphasize more leisure activities oriented towards older citizens, such as developing pocket parks in the individual Dennis villages, walking paths, sidewalks, benches, and, handicapped access.

In addition to having an older population than other Cape towns, Dennis continues to be poorer. Household income in 2013 was \$50,672 for Dennis, the fourth lowest of the 15 towns on Cape Cod. In 2013, 12.3% of Dennis families lived below the poverty level compared to 12.8% in Barnstable County. However, 37.6% of families with children under the age of 18 live in poverty and 45.1% of all Dennis residents under age 18 lived in poverty in 2013. Implications of the town's demographics include the need to provide recreational opportunities that are affordable for most people, to look to the needs of the very young and to provide for the expanding elderly population.

Looking at these numbers in a different way, in 2013 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.

The economy of Dennis is still largely dependent upon the tourist trade and servicing retirees. In 2008, the town had 552 businesses, down from 594 in 2006, with annual total wages of \$133,059,000 again a drop from two years earlier, annual employment was at 3,732 people employed, a drop of 1,000 people in 2006. Clearly, in a short time, the impacts of the "great recession" had hit Dennis. Since 2008, while there has been some recovery however, in March of 2015 Dennis still had an unemployment rate of 9.6%, fourth highest in Barnstable County and still reflective of the lack of recovery in the year-round jobs picture.

Nearly 42% of those employed in Dennis in 2008 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

Dennis Port Culinary, Eagle Pond Rehabilitation Center, Elder Services of Cape Cod and the Dennis/Yarmouth School System.<sup>16</sup>

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. This conclusion is supported by the recent Open Space and Recreation Survey conducted by the Town of Dennis Planning Department which showed that 56% of the respondents recognize the town is a resort town and reliant upon the visitors to the town.

People are attracted to Dennis because of its proximity to the water, the views that this proximity provides and recreational opportunities that are incorporated by the town into the scheme of natural resources and man-made facilities. This, obviously, places a large number of people and structures at risk in the event of a coastal storm event, when combined with an aging and generally poorer year-round population, there is a greater need for a properly outfitted evacuation center during prolonged storm events (tropical event or winter storm).

#### **2.1.4. 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, 1889<sup>17</sup>

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.<sup>18</sup> This north-south strip pattern is still relict today in some areas along the Northside (See Figure 3. D. 1). Its significance lies in its frequent ability to frustrate land assemblage for some large-scale developments (or, conversely, for large conservation blocks).

Year-round, Dennis is a densely developed town, with 766 permanent residents per square mile. In the summer 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

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<sup>16</sup> County Business Patterns, 2008.

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

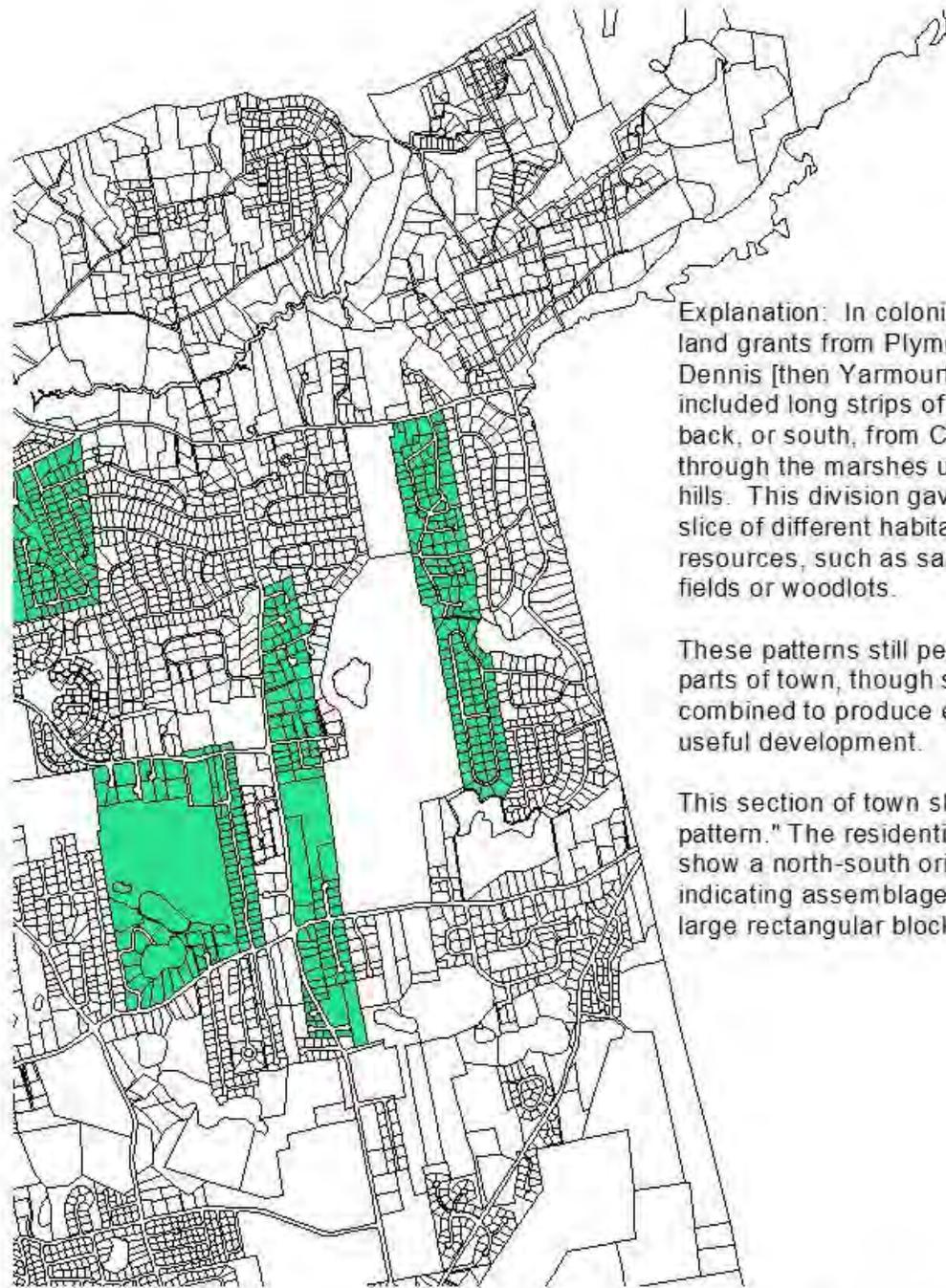
<sup>18</sup> Samuel D. Hannah, The Proprietary Lands of Plymouth Colony and Cape Cod, (Hyannis MA, 1980), p. 64.

competitor (Yarmouth) hosts less than 2,400.<sup>19a</sup> 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.<sup>20</sup> The town continues to vigorously pursue opportunities to purchase open land, since the adoption of the 2008 Open Space and Recreation Plan the town has acquired an additional 60.6 acres of open space through private donations, Community Preservation Funds, and State Self Help and Urban Self Help funds. In addition, the Dennis Conservation Trust has placed an additional 19 acres under protection. The current Draft Open Space and Recreation Plan 2015 Update establishes a priority for future land acquisition that include storm water and flood storage opportunities. Undevelopment of sites within the flood zone is also a recommendation of that plan.

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<sup>19a</sup> Cape Cod Commission, "CapeTrends: Demographic and Economic Characteristics and Trends, Barnstable County - Cape Cod, 3rd Ed.," 1996, p. 42 & 19.

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



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.

**FIGURE 3 D 1 SETTLEMENT PATTERNS**

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 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.

The town has had cluster zoning in place for many years. However, there are very few significantly sized tracts of land remaining where this type of zoning will be successful. It is unlikely that open space set-asides will grow apace with development despite the cluster zoning. Significant new acquisitions of open space must be made, through purchase or other protection means. The preservation of some of the remaining open space may be an important way to manage growth, in addition to preserving resources and providing recreation. Despite its density, Dennis still has a "small town" atmosphere appreciated by its citizens. The rural seaside charm is still extant in views of historic homes and glimpses of ponds, bogs and marshes.

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.<sup>21</sup> 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.

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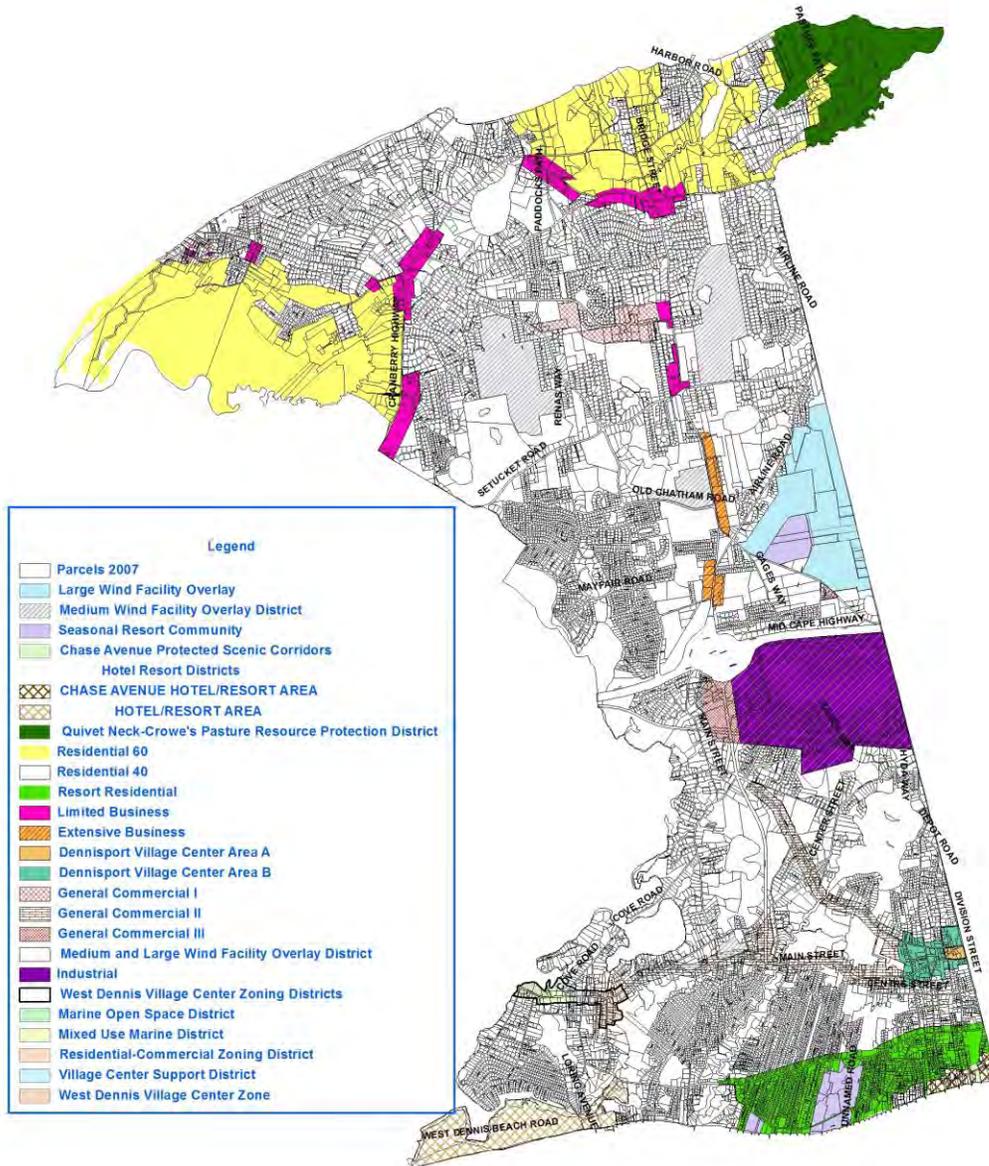
<sup>21</sup> Cape Cod Commission, Monomoy Capacity Study: Summary Report, July 1996, p. 52.

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 Dennis Port shore, where many smaller lots are still buildable owing to the zoning protection known as "grandfathering" (Map 3-1). 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. In 2010 there was about 15,035 housing units in Dennis according to the US Census. Based upon the town's review of the 2014 FIRM map updates, the town now has well over 5,000 structures located in the flood zone. These structures include year-round and second homes, cottages in cottage colonies, multi-family and hotel/motel structures. While in the winter, perhaps only a couple thousand people may lie in harms way from winter storm, in the summer time, these figures could easily reach 40,000 or 50,000 on the south side alone.

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.<sup>21b</sup> 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 its 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.

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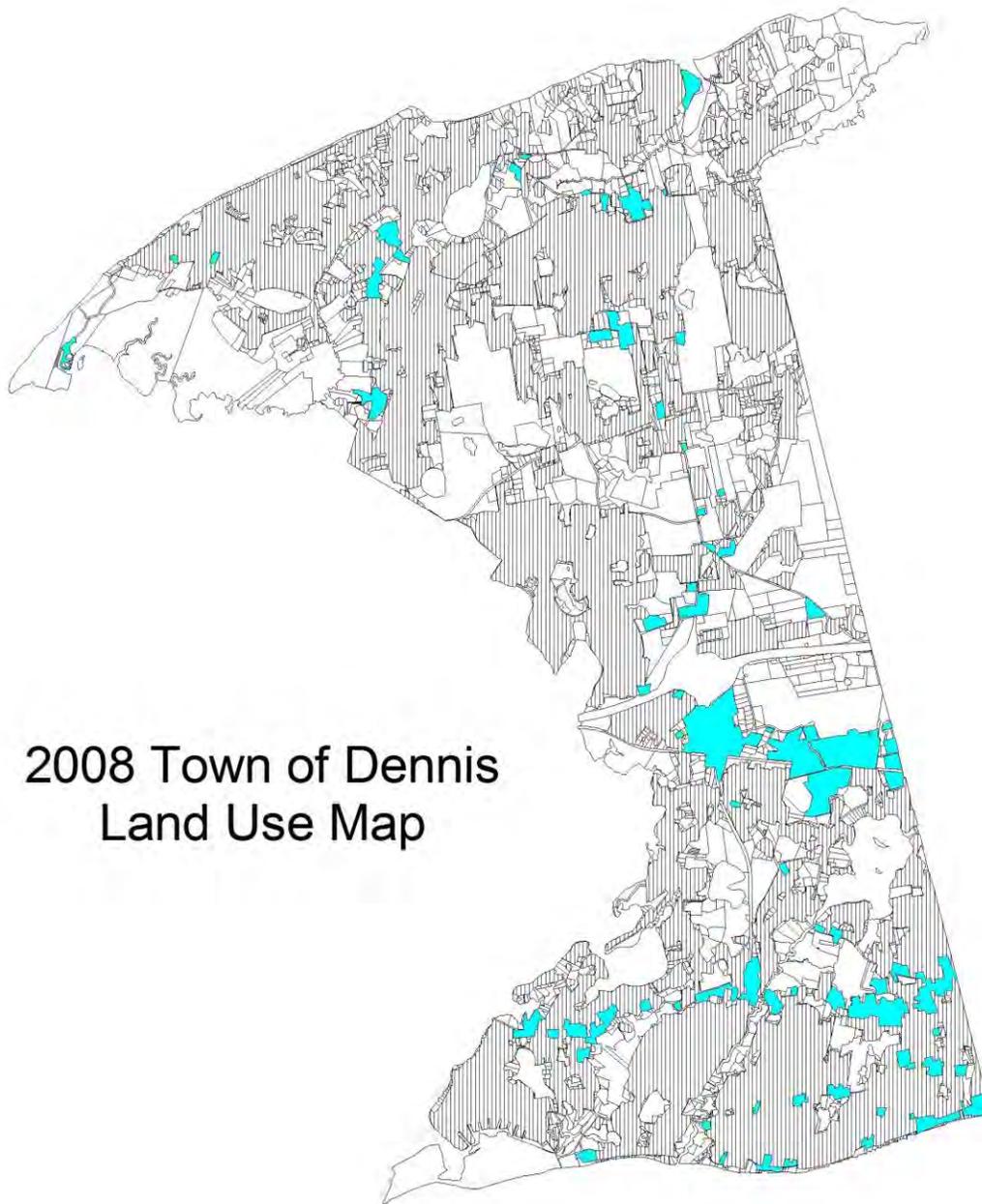
<sup>21b</sup> Cape Cod Commission, Monomoy Capacity Study: Summary Report, July 1996, Fig. III-4.



# Town of Dennis Zoning Map

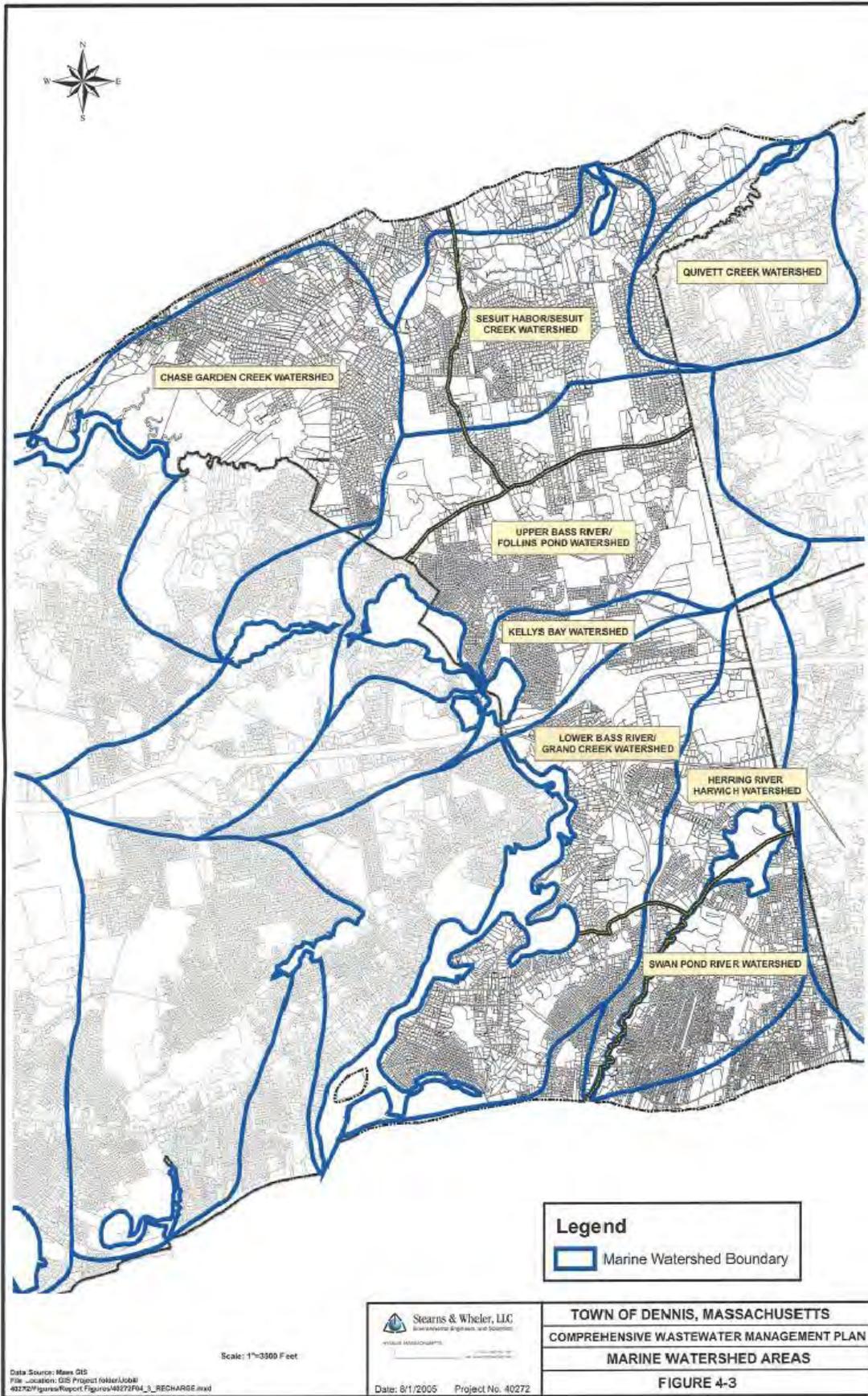
MAY 5, 2015

AS APPROVED AT THE MAY 5, 2015  
ANNUAL TOWN MEETING



## 2008 Town of Dennis Land Use Map





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.<sup>21c</sup>

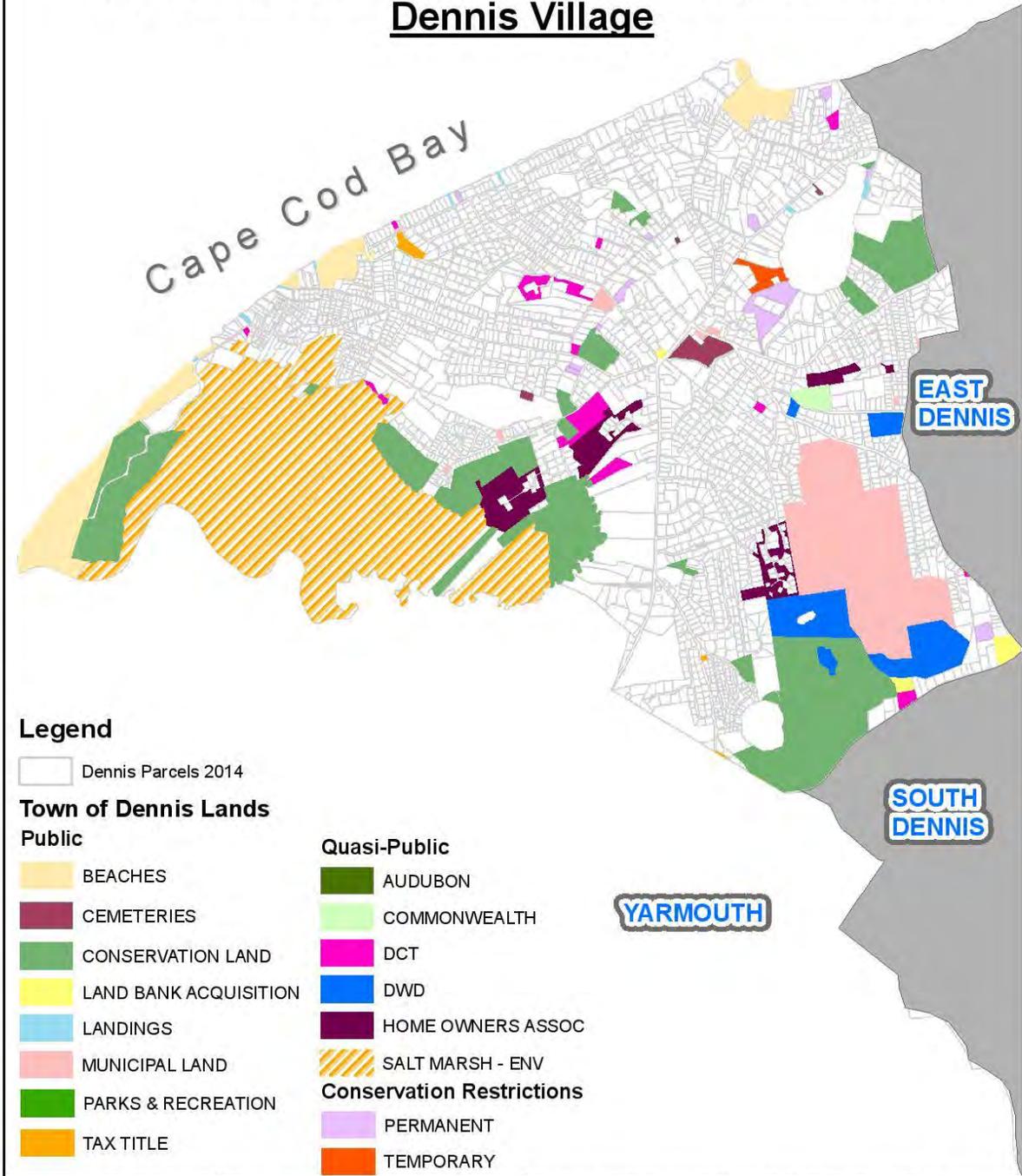
There are few places immune to development in Dennis, except wetlands, and even here emerging septic technologies may threaten them. The town must assume, therefore, that development will continue to consume open spaces throughout town. Since physical impediments no longer remain as a limiting factor,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

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. Dennis Port, 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 Dennis Port, this parcel became a priority to the town for protection. 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.

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<sup>21c</sup> Cape Cod Commission, Monomoy Capacity Study: Summary Report, July 1996, Fig. III-4.

# Town of Dennis Public & Quasi-Public Lands Dennis Village



**Legend**

Dennis Parcels 2014

**Town of Dennis Lands**  
**Public**

- BEACHES
- CEMETERIES
- CONSERVATION LAND
- LAND BANK ACQUISITION
- LANDINGS
- MUNICIPAL LAND
- PARKS & RECREATION
- TAX TITLE

**Quasi-Public**

- AUDUBON
- COMMONWEALTH
- DCT
- DWD
- HOME OWNERS ASSOC
- SALT MARSH - ENV

**Conservation Restrictions**

- PERMANENT
- TEMPORARY

**TOWN OF DENNIS**  
**GIS DEPARTMENT**  
NOT TO SCALE

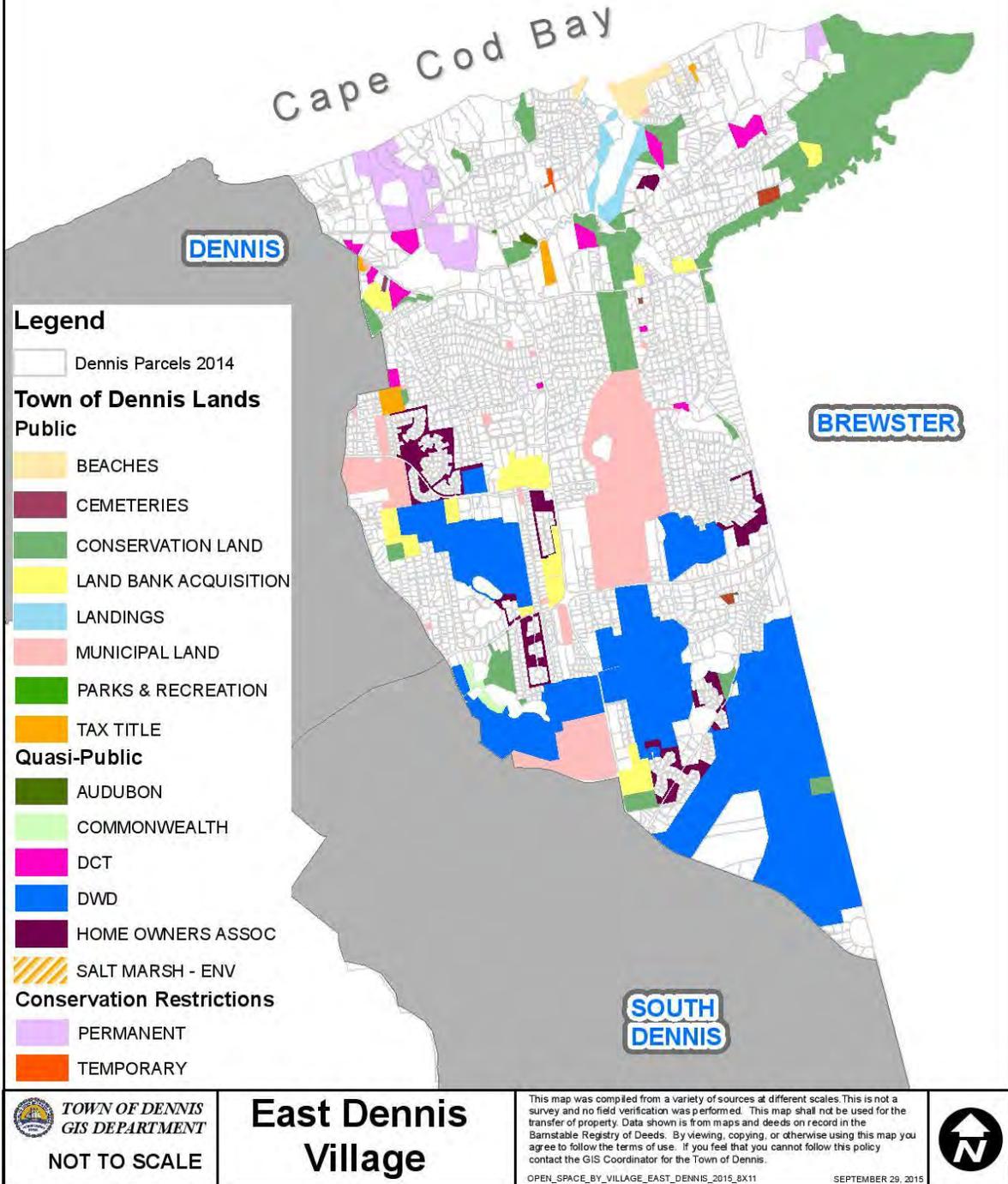
## Dennis Village

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OPEN\_SPACE\_BY\_VILLAGE\_DENNIS\_2015\_8X11      SEPTEMBER 29, 2015

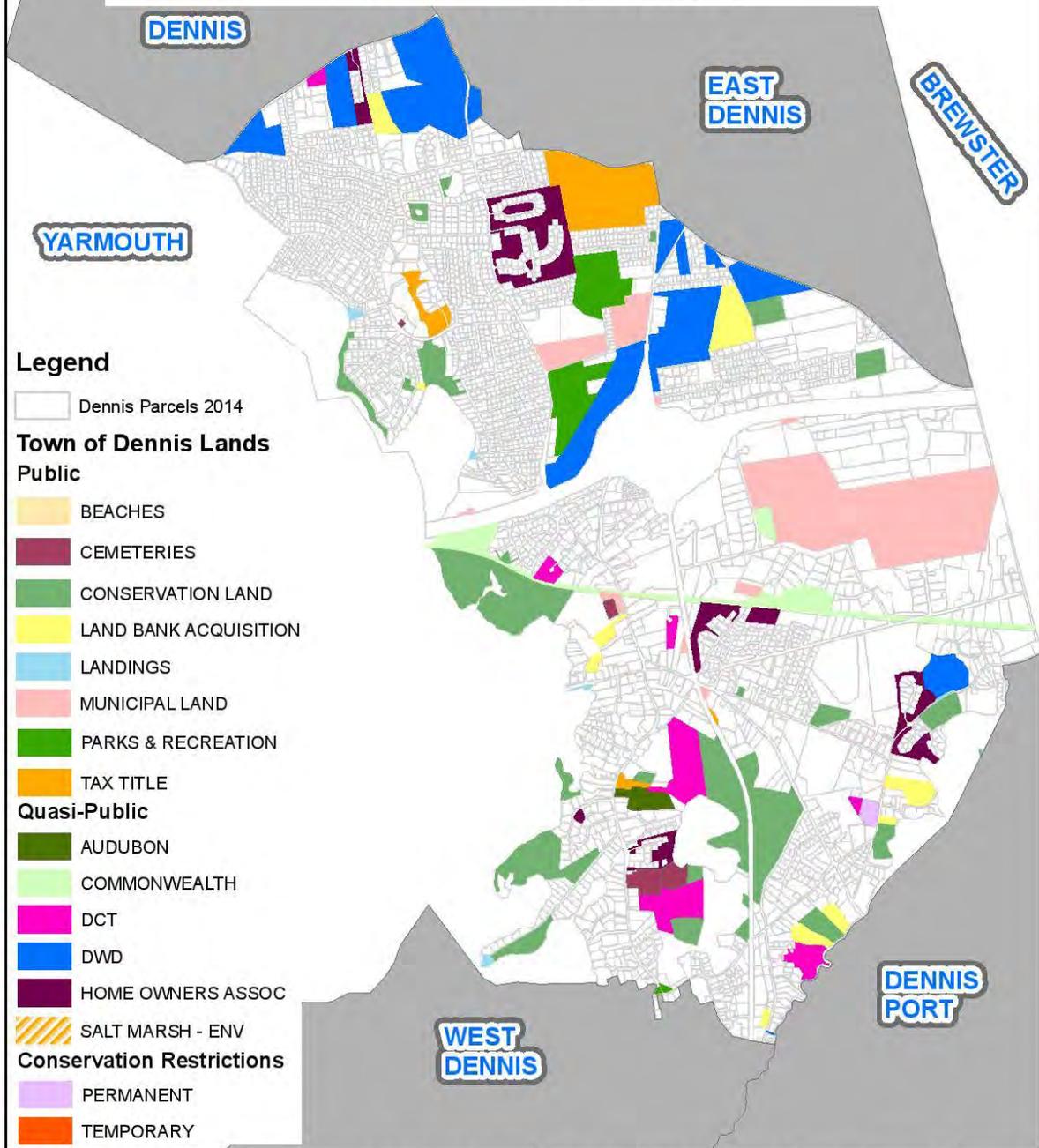


# Town of Dennis Public & Quasi-Public Lands East Dennis Village



# Town of Dennis Public & Quasi-Public Lands

## South Dennis Village



**Legend**

Dennis Parcels 2014

**Town of Dennis Lands**  
**Public**

- BEACHES
- CEMETERIES
- CONSERVATION LAND
- LAND BANK ACQUISITION
- LANDINGS
- MUNICIPAL LAND
- PARKS & RECREATION
- TAX TITLE

**Quasi-Public**

- AUDUBON
- COMMONWEALTH
- DCT
- DWD
- HOME OWNERS ASSOC
- SALT MARSH - ENV

**Conservation Restrictions**

- PERMANENT
- TEMPORARY

TOWN OF DENNIS  
GIS DEPARTMENT  
NOT TO SCALE

**South Dennis  
Village**

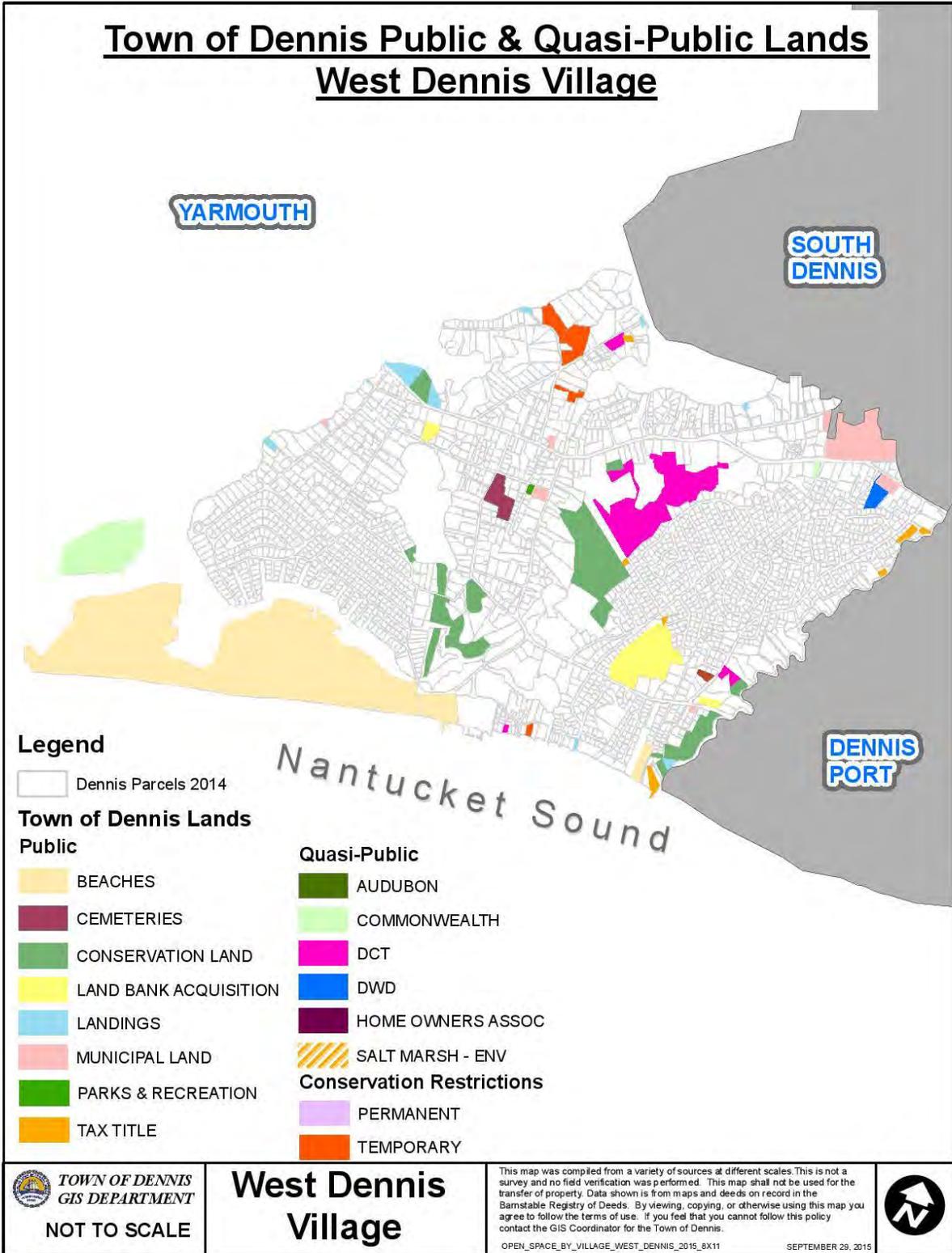
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OPEN\_SPACE\_BY\_VILLAGE\_SOUTH\_DENNIS\_2015\_6X11

SEPTEMBER 29, 2015



# Town of Dennis Public & Quasi-Public Lands West Dennis Village



**Legend**

Dennis Parcels 2014

**Town of Dennis Lands**  
**Public**

- BEACHES
- CEMETERIES
- CONSERVATION LAND
- LAND BANK ACQUISITION
- LANDINGS
- MUNICIPAL LAND
- PARKS & RECREATION
- TAX TITLE

**Quasi-Public**

- AUDUBON
  - COMMONWEALTH
  - DCT
  - DWD
  - HOME OWNERS ASSOC
  - SALT MARSH - ENV
- Conservation Restrictions**
- PERMANENT
  - TEMPORARY

**TOWN OF DENNIS**  
**GIS DEPARTMENT**  
NOT TO SCALE

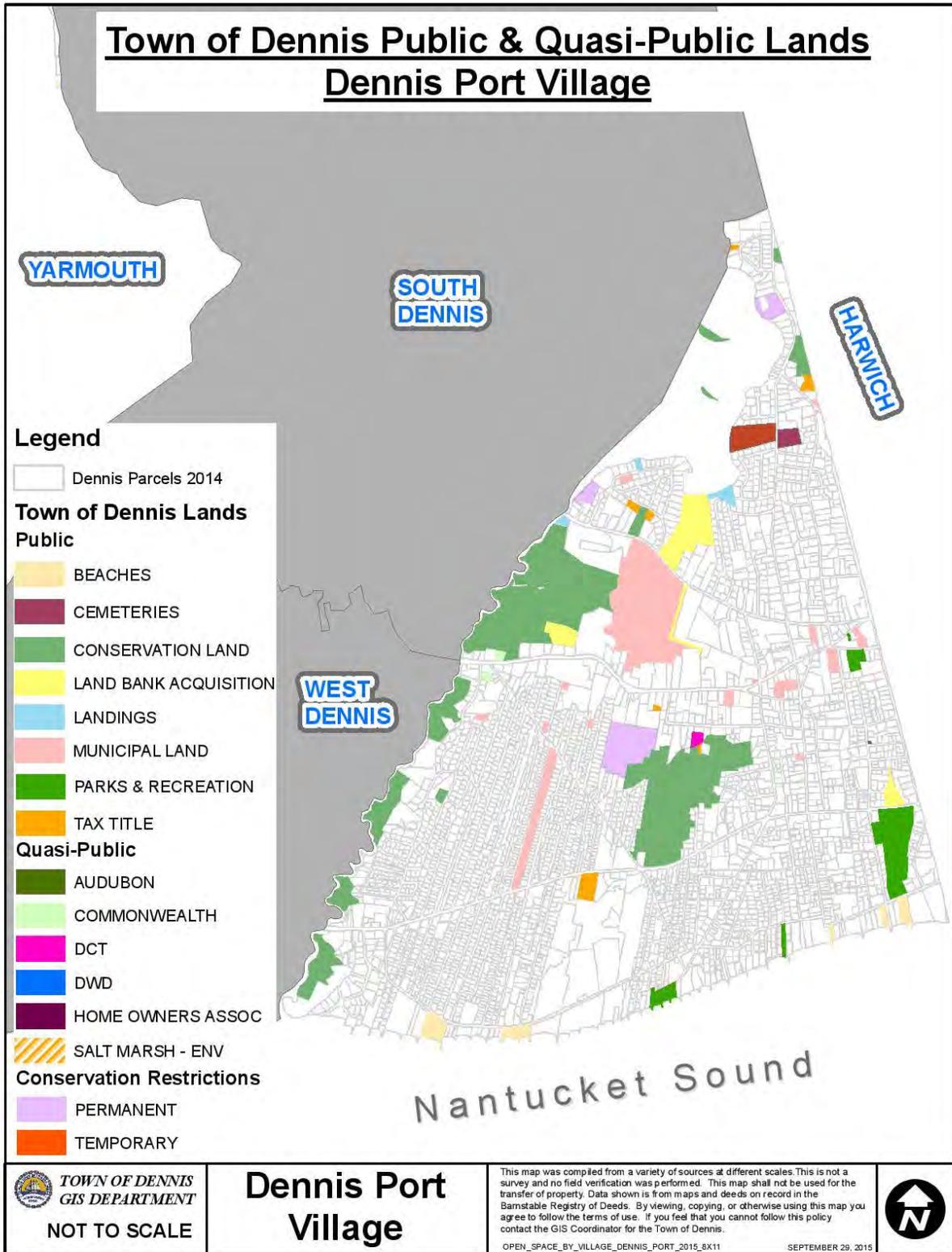
## West Dennis Village

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OPEN\_SPACE\_BY\_VILLAGE\_WEST\_DENNIS\_2015\_8X11

SEPTEMBER 29, 2015





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 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 Dennis Port will probably always lead in density.

**Table 2.3 Housing, 1990 - 2010, by Village** <sup>22</sup>

	1990	2000	2010
Dennis Port	3,773	4,103	4,771
West Dennis	2,634	2,510	2,875
South Dennis	2,423	2,626	2,770
Dennis	2,247	2,457	2,523
East Dennis	2,007	2,409	2,096

\* Census boundaries changed shifting some areas between East Dennis, Dennis and South Dennis in the 2010 census making village comparisons difficult.

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 were 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 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. In 2010 this trend reversed with just over 51% of all housing being seasonal in the 2010 Census.

Since Dennis is mostly "built-out" now, the more crucial impacts on emergency services during hazardous events are 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 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. However, this population change would dramatically increase the demand for town services, without generating any increased tax revenue.

**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, after the 2014 Firm update, over one-third of Dennis's land area is located within a regulated flood zone. Storm events, whether hurricane or blizzard are the most likely natural hazards facing Dennis. These types of events are far more

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<sup>22</sup> 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.)

“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.

### 2.2.1 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 Dennis Port 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. The 2014 FIRM update did not alter this figure significantly.

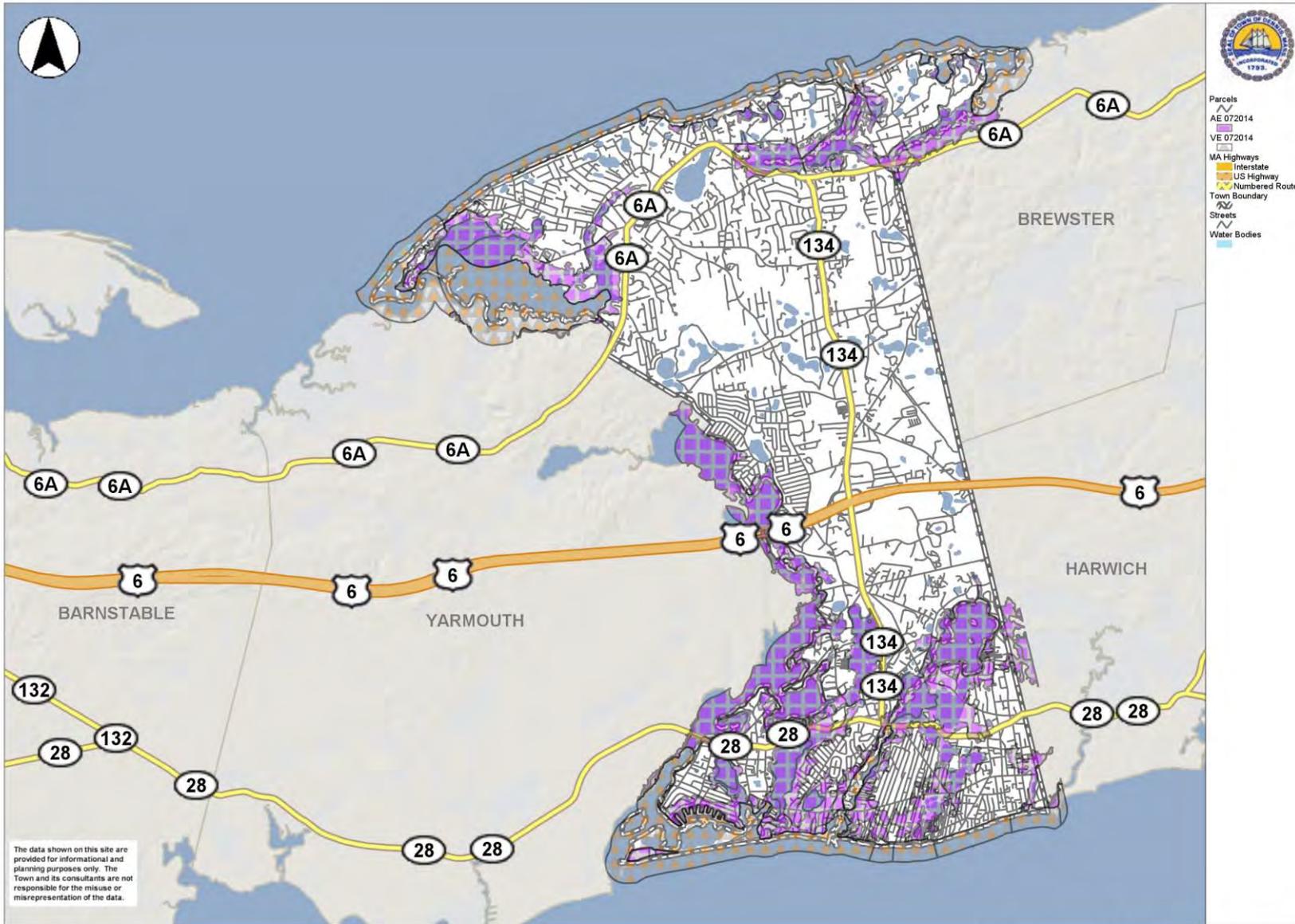
Landward of the velocity zones are other flood-prone areas (A-Zones) in which standing waters can be expected during 100-year storm events. These areas consist mostly of salt marshes and shorefront uplands up to about the 13-foot contour. Both commercial and residential developed areas, including portions of Route 28, occur in the A-Zone. As noted above, over one-third of the land in Dennis is now mapped as within a flood zone, this includes over 5,000 structures.

Looking at the 2010 US Census, the Town of Dennis had approximately 250 people living within the V Zone year-round. The Census data also reveals that there were approximately 3,600 year-round residents living within the A Zones in Dennis in 2010. This places about 3,850 year-round residents at risk of flood impacts in the event of the one percent storm. As these flood areas are predominantly representative of the portions of Dennis with seasonal populations (Dennis Port and West Dennis) the impacts of a summer-time storm even will be even more severe. In these two villages, nearly 70% 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 13,000 people living in privately owned housing within the flood-prone areas. More realistically, given data from rental permits and the number of motel properties within the flood prone area, we believe this number on an average summer week to fall between 40,000 and 50,000 people could be at risk.

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). Approximately 3,580 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 4,656 acres of land in Dennis that could be considered at risk of flooding in a 1% storm event.

The Federal Emergency Management Administration updated the Flood Insurance Rate Maps for Dennis in 2014. During the development process of these maps, large land areas were identified as being potentially at-risk of flood damage. With the completion of these maps Dennis found that

approximately 4,000 structures were added to the flood zones. These FEMA map changes resulted in slightly over 5,000 structures being at-risk of flooding, and as many as 4,000 – 4,500 residential units. Particularly, the cottage colony areas of Dennis Port were newly identified 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. It was odd that these properties were not previously identified as being within the flood zones. Photographs from the 1954 Hurricanes clearly illustrated cottages being lifted and relocated by the storm surge of Hurricanes Carol and Edna that year. The area clearly needed to be identified as a high risk area for property damage and personal casualty in a flood event.



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.

### 2.2.2 Hurricanes/Coastal Storms:

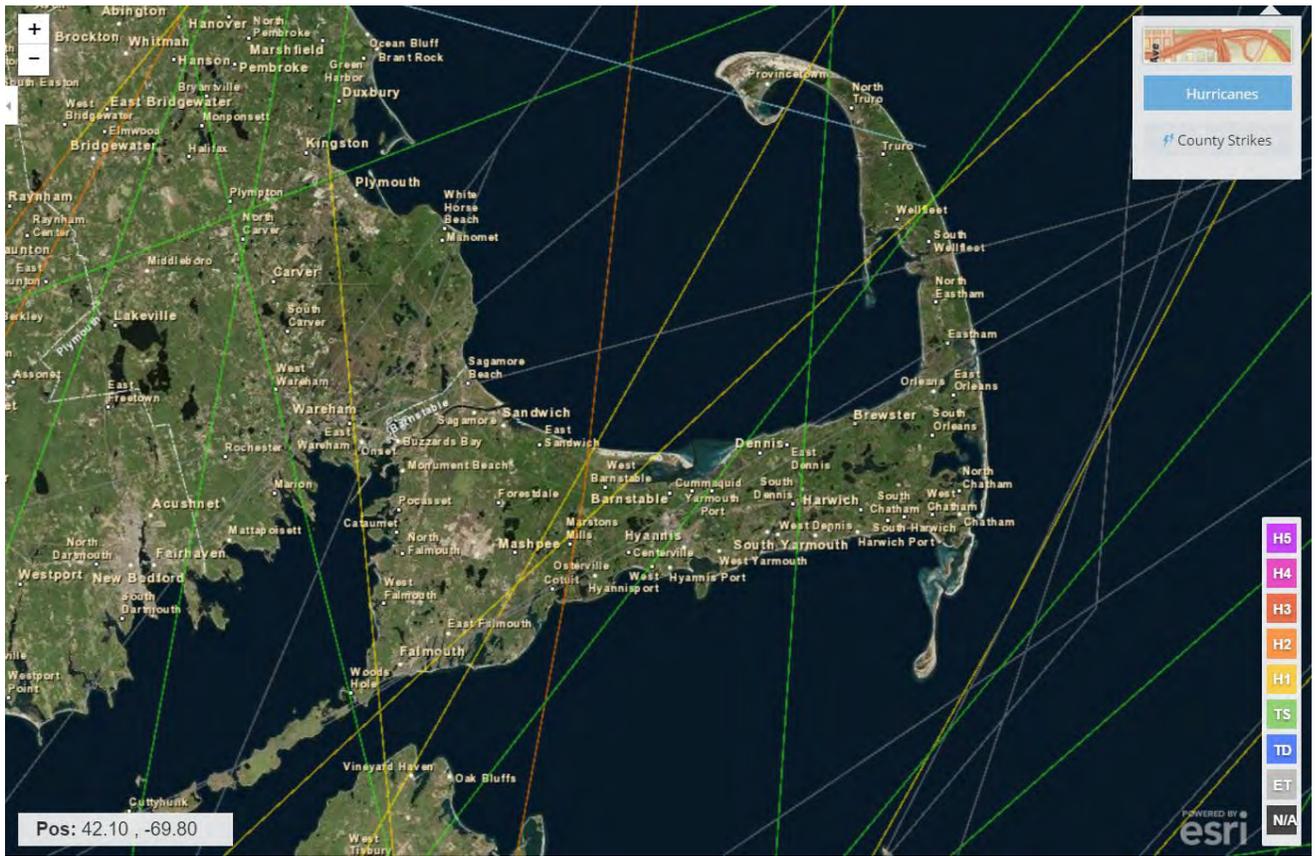
In 2004 the Cape had several near misses during Hurricane Season with Bonnie, Charley, Gaston and Hermine all passing near or over the Cape. In 2001 Tropical Storm Allison passed to the south of the Cape. In 2000 Hurricane Gordon passed over the Cape, followed shortly thereafter by Tropical Storm Helene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

Since the adoption of the 2011 MHM Plan, the town experienced near misses with Hurricane Ernie (Category 2 as it passes south of Cape Cod) and Superstorm Sandy, which but for a last minute left turn, could have left the south coast of Cape Cod looking like areas along the Connecticut shore. In particular, the resort area around Misquamicut Beach (109 miles as the crow flies) in Westerly, Rhode Island exhibits land use patterns similar to those found in West Dennis and Dennis Port, and the storm impacts could be illustrative of what these areas of Dennis could have looked like had Sandy not shifted west.

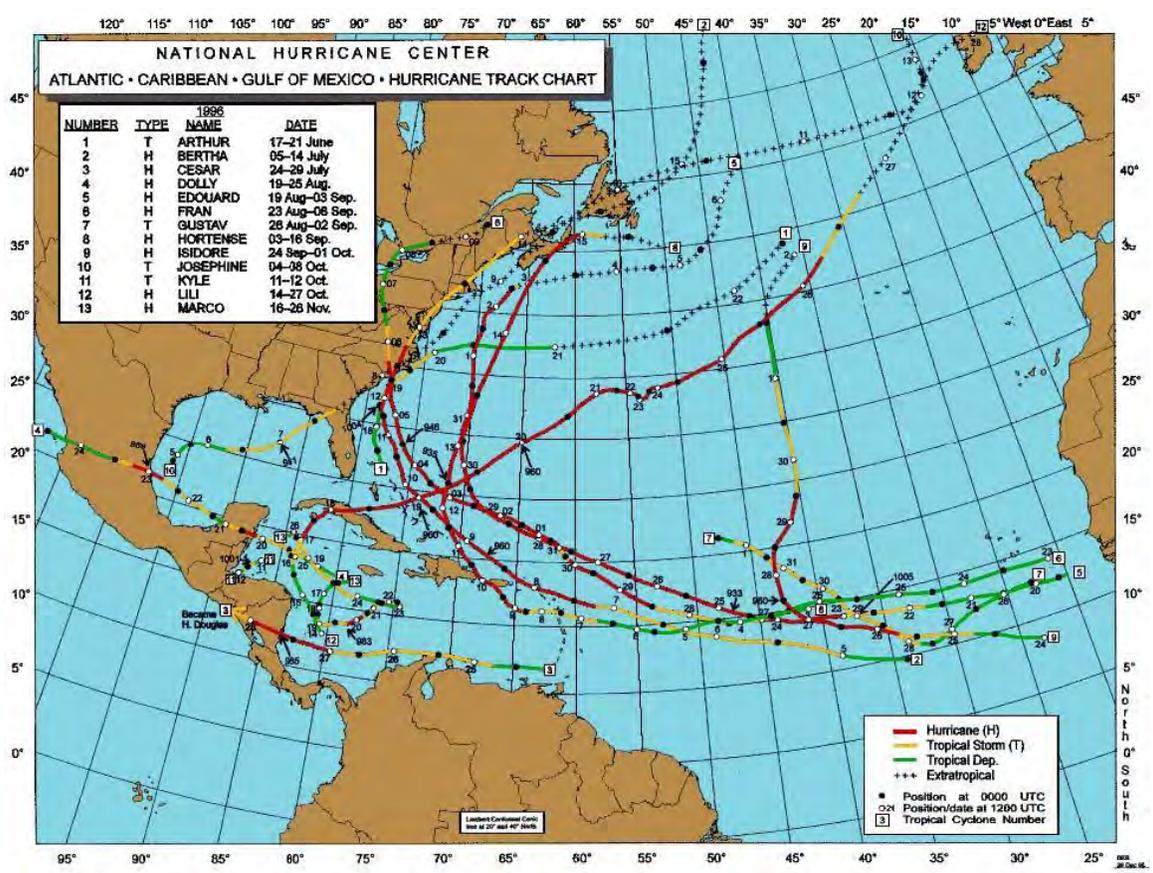
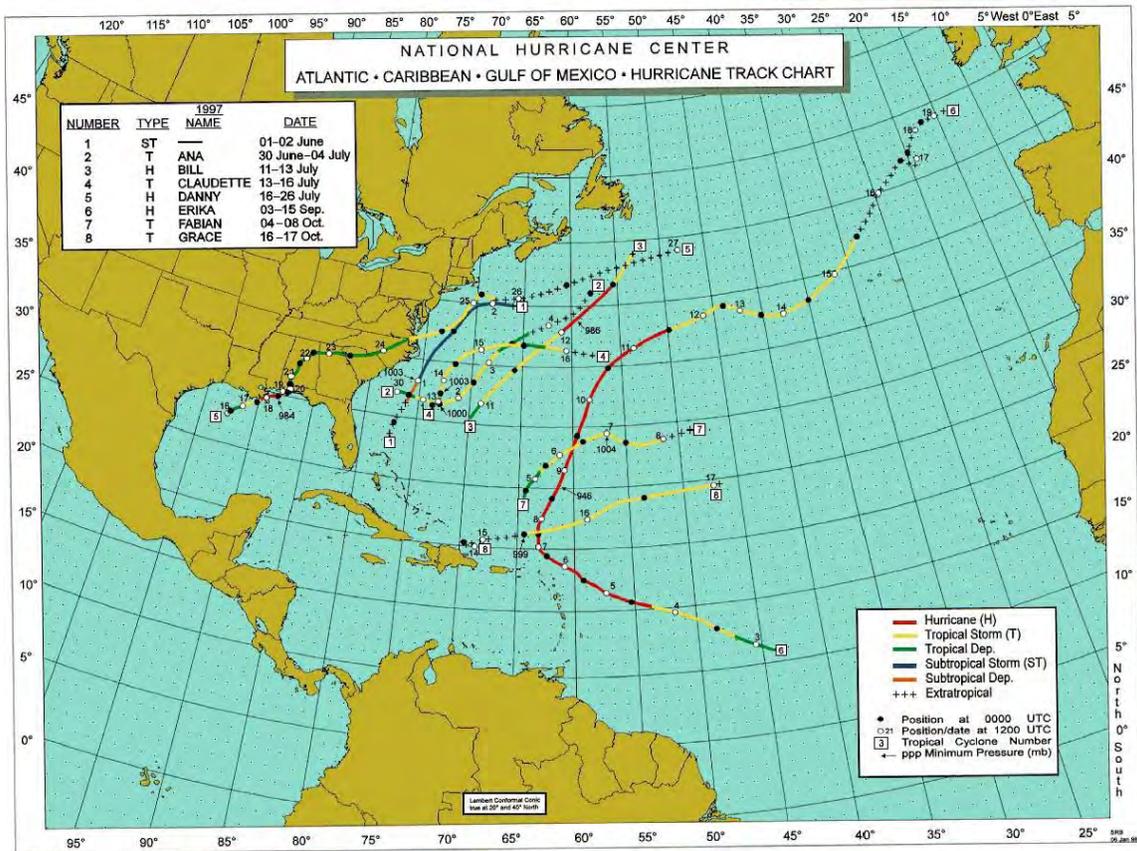
Hurricane and coastal storms bring with it the one-two punch of heavy rains and high winds, creating flooding, storm surge and wind based damage issues. With 14 tropical events over a little more than a fifteen years, the town clearly recognizes the problems associated with hurricanes and coastal storms. 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.

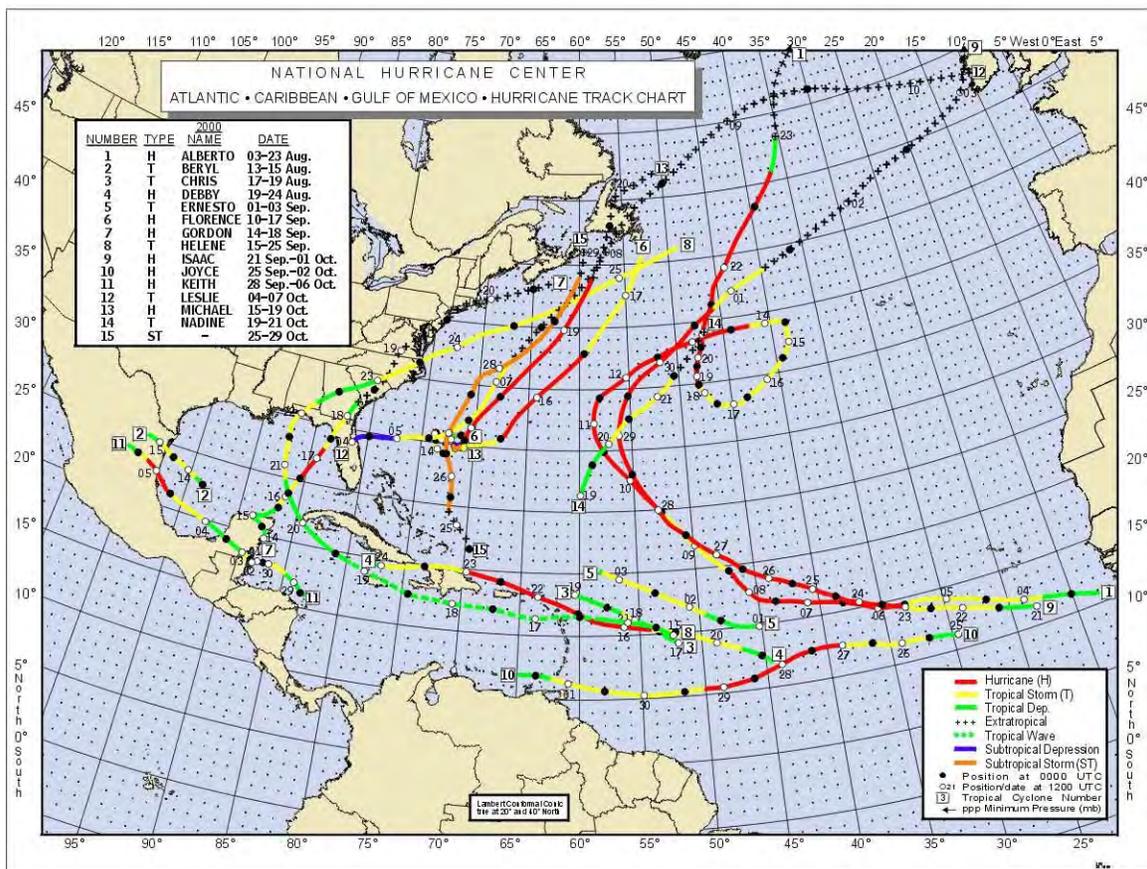
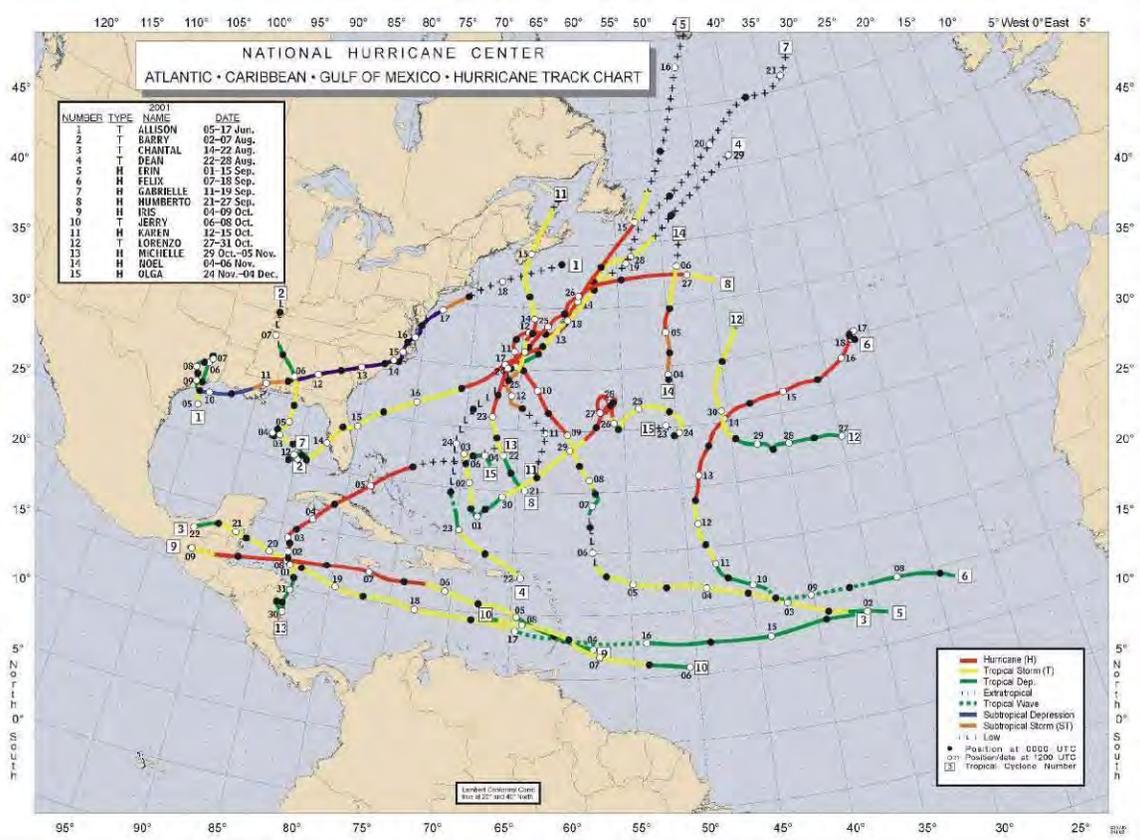
Dennis residents memories of these two storm events vary widely. Some talk about boats lifted out of the Bass River and deposited on adjacent properties, others recollect very little coastal damage. However, even moderate hurricane events can trigger significant damage. Hurricane Charley in 2004 took 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.

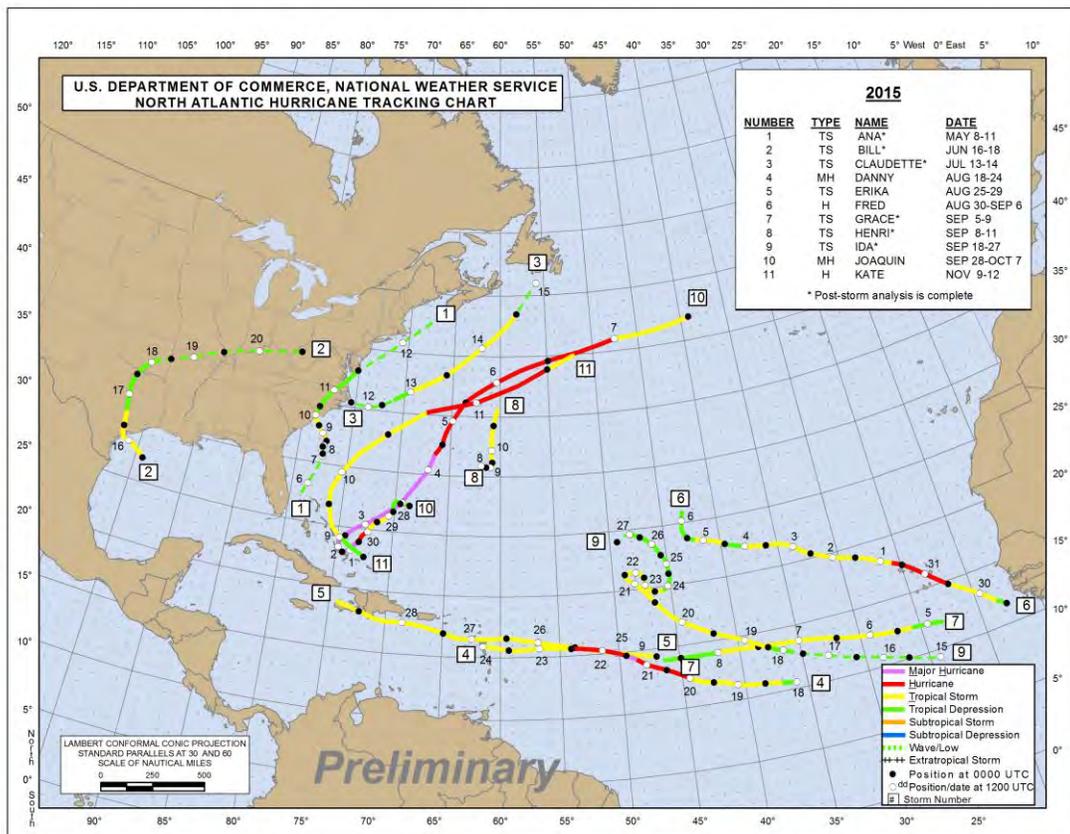
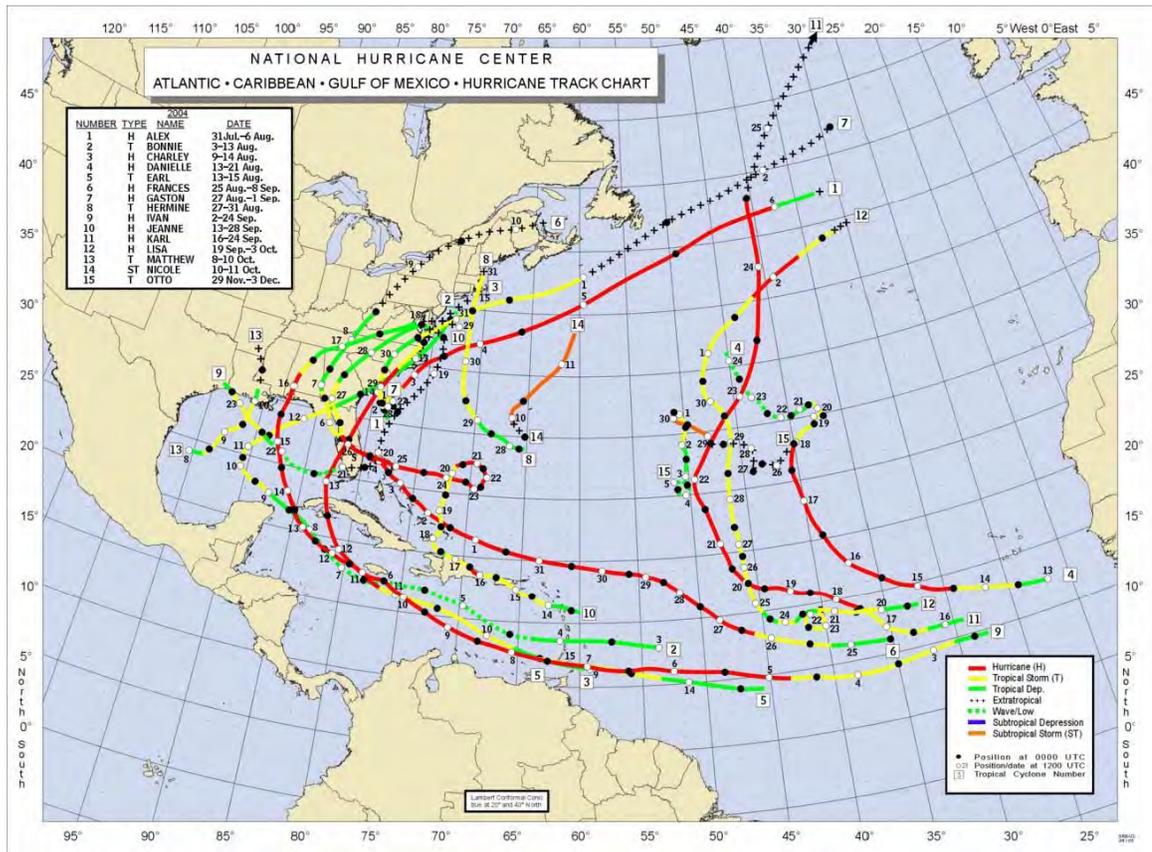
Many of Dennis’s summer residents travel here from areas around Metro-New York. Their personal experiences with Superstorm Sandy, or the impacts on areas near where they live year-round has also heightened the awareness of just how hazardous coastal living in Dennis really could be. Many of these summer residents are taking advantage of recent Dennis Zoning changes made to promote flood proofing at-risk properties.



Historical Hurricanes and Tropical Storms Affecting Cape Cod (Source NOAA.gov)







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 2014/2015 had over a month of back to back storms paralyzing much of the region. Schools in many Cape communities were closed for long periods of time due to the amount of snow left in the streets. In the two preceding winters Northeasters also pounded the Dennis coast for significant periods of time. When it was over, the town had experienced its worst barrier beach damage in three decades. For a brief period, a portion of Chapin Beach in the northwest portion of town was breached, placing significant land masses in Yarmouth at increased risk. 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.

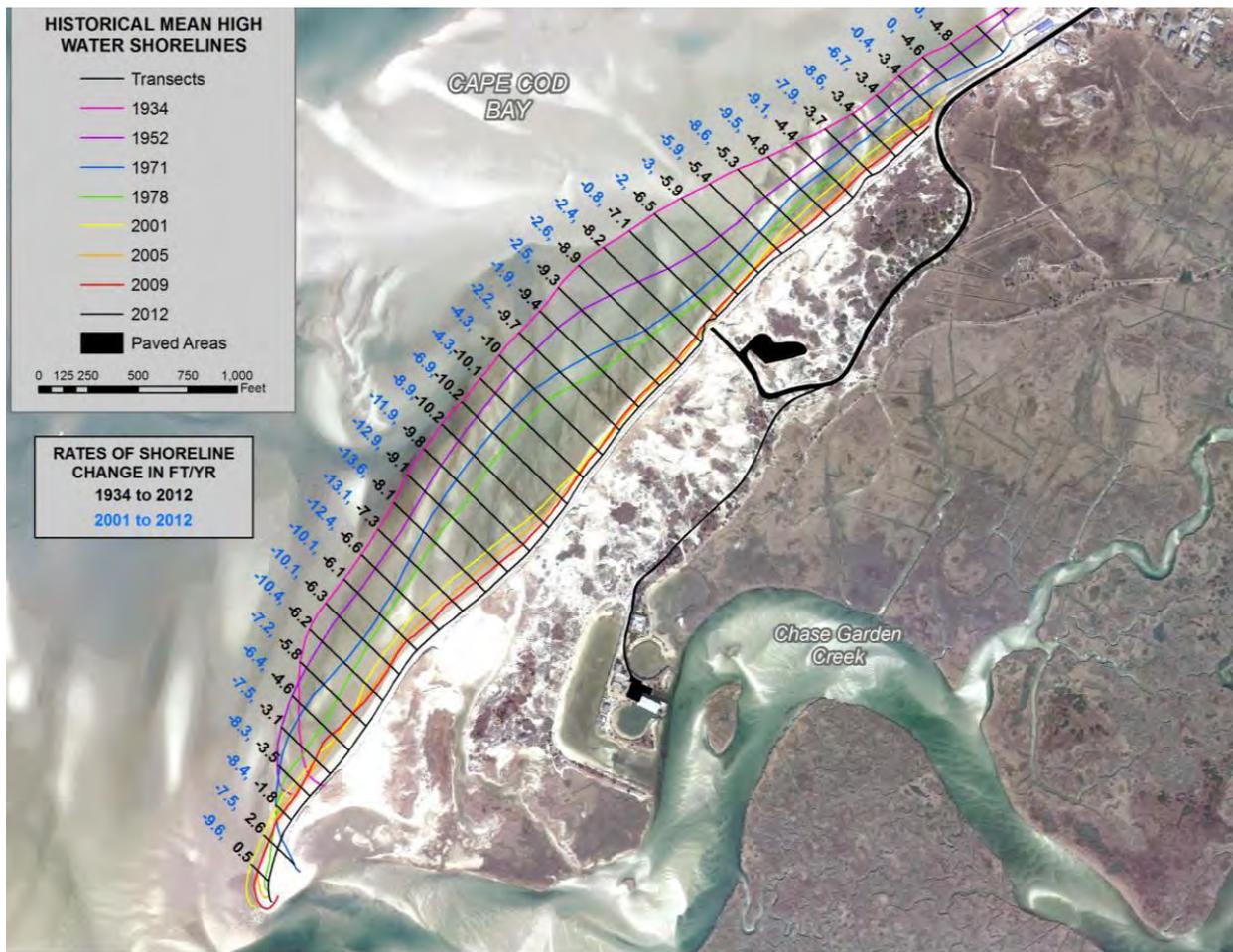
### 2.2.3 Erosion

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. Dennis and Cape Cod were formed by the deposits left behind by the last ice age. The Cape, essentially was formed by erosion and sedimentary deposits, and erosion and sedimentation continue to be important.

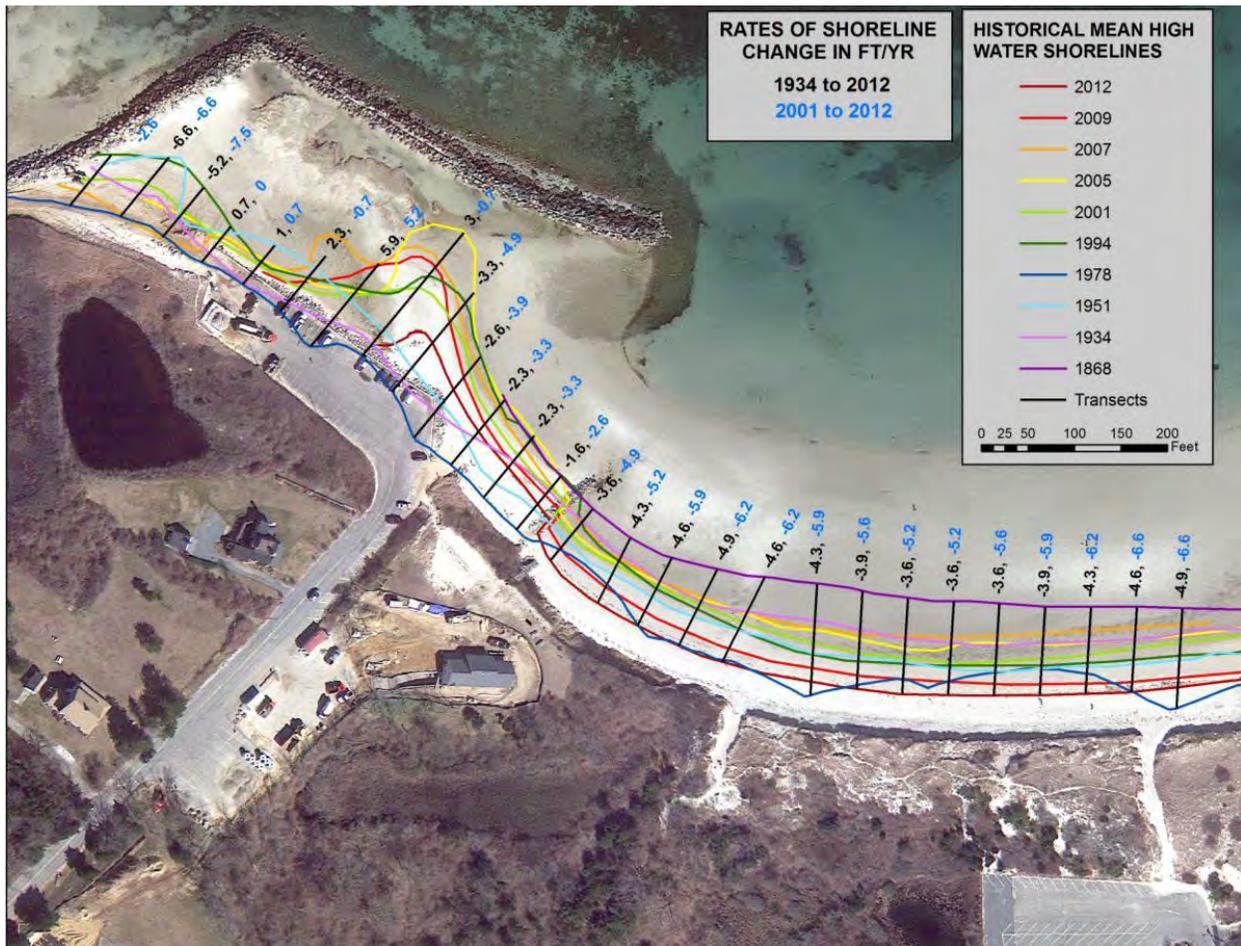
The Dennis coast line is subject to constant change due to normal erosion and sedimentation as well as significant storm events. Storm damage due to hurricanes can be drastic along the low-lying southern shoreline. A band of shore as much as 50 feet wide was removed during the 1944 hurricane.<sup>25</sup>

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<sup>25</sup> Robert Oldale, US Geological Survey, "Geologic Map of the Dennis Quadrangle, Barnstable County, Cape Cod, Massachusetts," 1974, Map GQ-1114.



The graphic above was prepared by the Woods Hole Group for Dennis as part of combating the impacts of a number of storms in the Chapin Beach Area. The map illustrates shoreline losses as high as 13.6 feet per year in this area. The same study provided the graphic below for the Corporation Beach area, which exhibits similar drastic losses of shoreline.



Fighting against coast line change is a never ending battle. The Dennis Harbormaster’s Office and Barnstable County are continuously dredging town waterways and using the dredge material to replenish the town’s eroding beaches. The above illustrations provides just a sampling of the erosion and sedimentation problems facing the town. Without continuously maintaining the town’s waterways the Dennis coastline (as with all of Cape Cod for that matter) would look tremendously different from what people see when looking at maps of the peninsula.

Coastal change at Crowe’s Pasture and West Dennis Beach illustrate similar patterns of erosion. At Crowe’s Pasture, erosion is slowed somewhat due to the town disposing of dredge spoils from Sesuit Harbor on Cold Storage Beach immediately east of the harbor and the migration of these sands easterly. West Dennis Beach also benefits from the dredging of the adjacent Bass River and Swan Pond River. Sand from these dredges have included beach and dune renourishment.

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

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

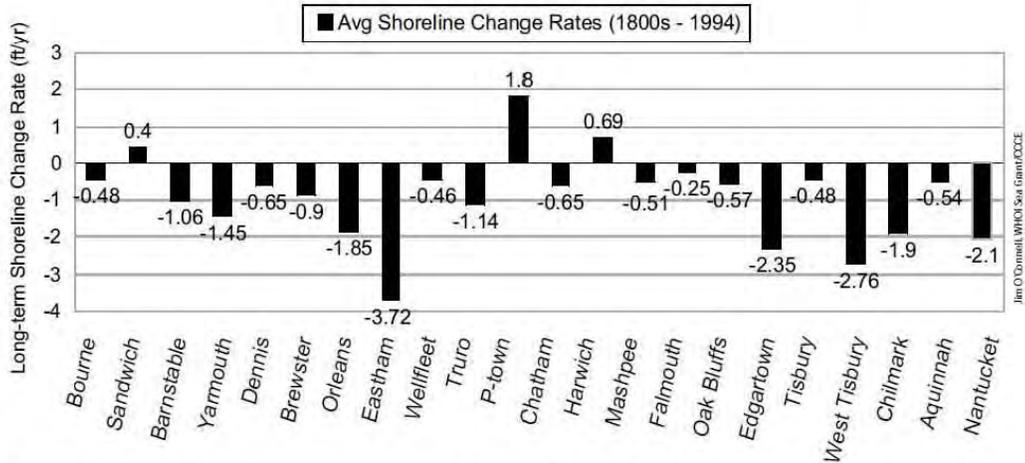


Figure 2. Long-term average annual shoreline change rates, by town, for Cape Cod, Martha's Vineyard, and Nantucket, Massachusetts.

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

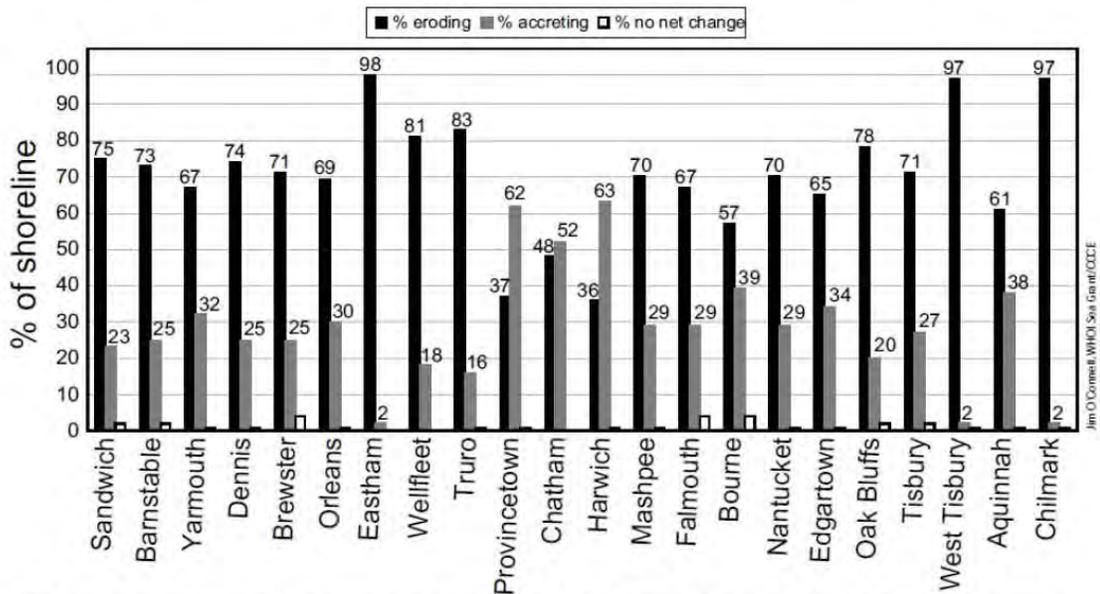
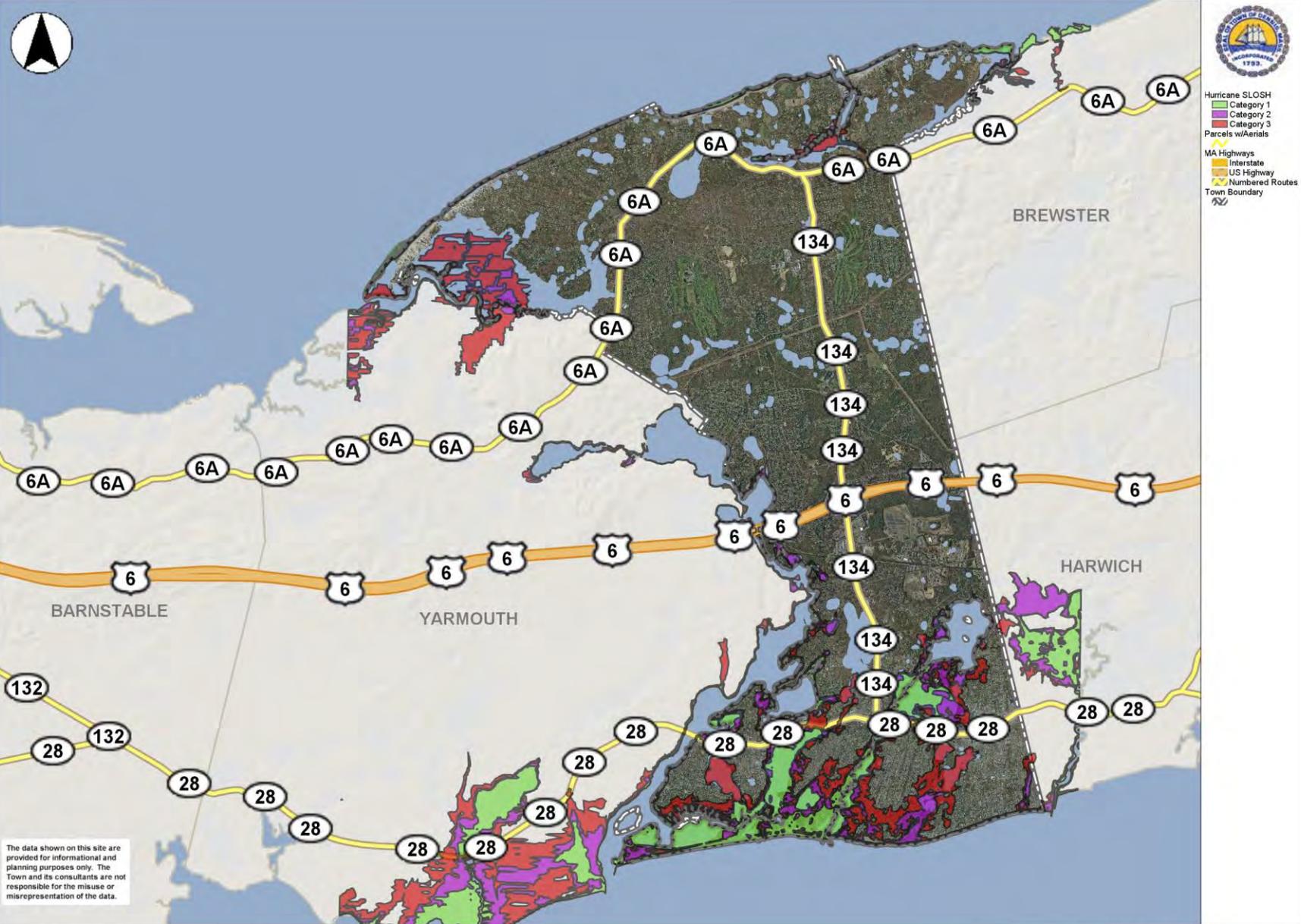


Figure 3. Percent of linear length of shoreline eroding, accreting and stable, by town, for Cape Cod, Nantucket, and Martha's Vineyard, Massachusetts, based on the long-term shoreline change data.

#### 2.2.4 Storm Surge

Sea, Lake and Overland Surge from Hurricane (SLOSH) analysis provided to Dennis by the Army Corps of Engineers 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 easily matches the reach of a 1% storm event and will add an additional almost 2,700 acres to the storm impact area, increasing flooding to about 4,656 total acres. A Category 3 Hurricane will increase this figure by an additional 950 acres, raising the storm impacted area to nearly 5,400 acres. And, a Category 4 Hurricane will add yet an additional 970 acres, increasing the total impacted area to just over 6,300 acres of land.

In population numbers, a Category 1 Hurricane could displace about 1,250 people (4,000 estimated non-hotel summer population) due to storm impacts. A Category 2 Hurricane would increase that number by 2,600 and increase the number of impacted people to 3,850 (13,000 seasonally adjusted residents). A Category 3 Hurricane would trigger the displacement of about another 1,350 people, for a total of 5,200 people (16,000 summer population). Finally, a Category 4 storm would increase the number of people displaced to 7,500 people (23,000 seasonally adjusted), an increase of almost another 2,300 people. If all the hotel properties are also displaced, these figures will range as high as 50,000+ people in need of evacuation from areas in harms way.



The data shown on this site are provided for informational and planning purposes only. The Town and its consultants are not responsible for the misuse or misrepresentation of the data.

# Town of Dennis, MA

### 2.2.5 Wild Fire:

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

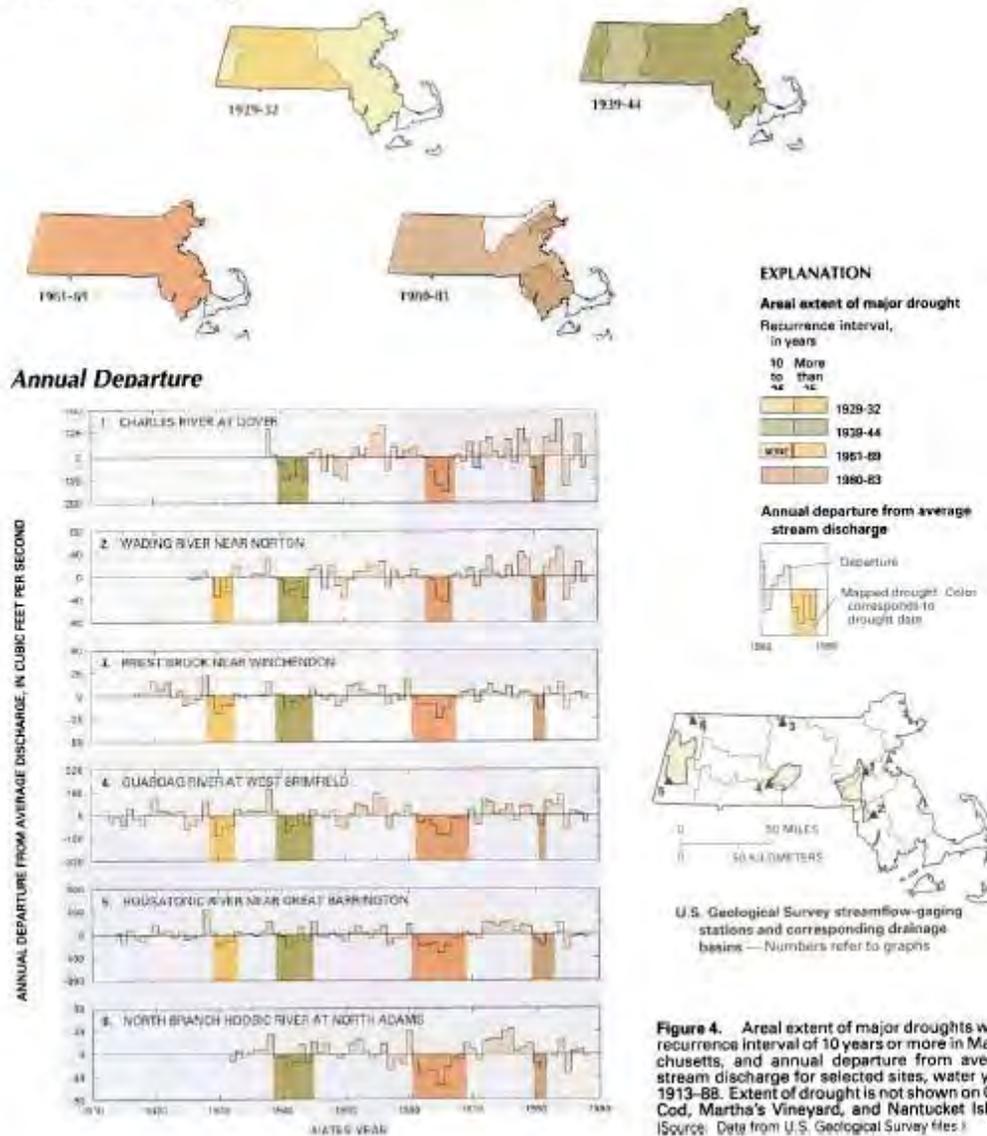
As part of the town's management of various conservation lands, the town includes both brush cutting and controlled burns to manage the available fuel as a means of reducing wildfire risks.

Urban Wild Fires: In the 1920's Dennis Port 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 Dennis Port 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.

### 2.2.6 Drought:

Drought's do not appear to be of particular concern in Dennis, while the summer of 2015 has led to lower than normal rainfall and the potential for drought, no measures needed to be instituted to manage water use. 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



### 2.2.7 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 lightning. 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. The potential for power outages due to thunderstorms have led the area utility to institute a significant vegetation management program to reduce power outage events. Even with these

measures in place, the town has the capability of sheltering small numbers of people who may need shelter during outages at the Dennis Police Station. In more significant events, the Regional EOPS will kick in and open the regional shelters.

#### 2.2.8 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 2014/2015 had a month of back to back events. Schools in many Cape communities were closed for up to a week due to the amount of snow left in the streets. When it was over, the town had experienced its worst barrier beach damage in 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. More recently, the each of the winters since 2010-2011 have brought at least one, if not several significant wind and snow events. Winter storms Juno and Nemo stand out as, perhaps, the most significant of these storms, but even the smaller named winter storms have caused 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 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.

#### 2.2.9 Geological/Earthquakes:

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.

#### 2.2.10 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 Dennis Port, 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 shifted 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.

#### 2.2.11 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.

#### 2.2.12 Dams:

The 2013 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. The Bound Brook dam is listed as a “low hazard potential dam.” This means that it is a dam whose failure would cause minimal damage or harm.

#### 2.2.13 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:

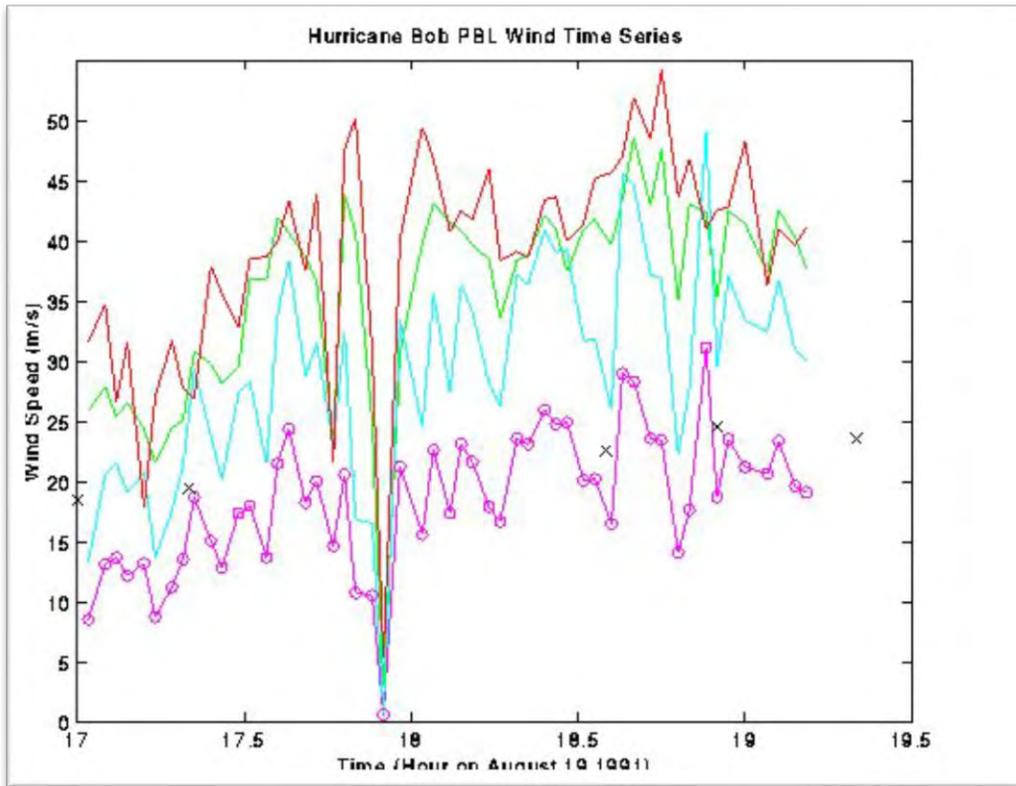
The term blow-down refers to trees which were simply blown over by straight line winds. In most instances, the trees fell with root balls intact. The blow down is believed to be the result from the combined effects of wet soils, wet leaves which add weight to the tree, and the winds. The winds cause 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*)

#### 2.2.14 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.

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.

## Areas Vulnerable to Sea Level in Barnstable County Massachusetts

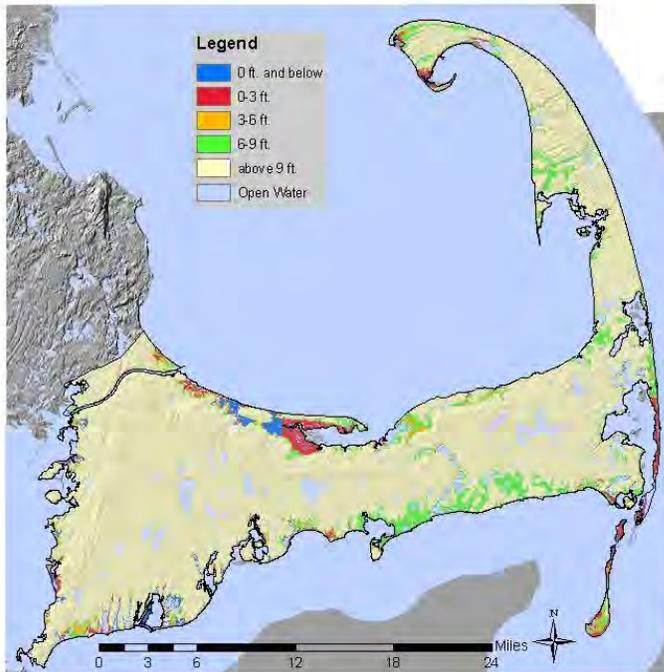


Table 1: Areas Vulnerable to Sea Level Rise

Zones	Area (sq. mi)	Area (sq. km)	% Area
<b>0 ft. and Below</b>	13.9	15.8	3.34
<b>0-3 ft.</b>	14.4	16.5	3.48
<b>3-6 ft.</b>	9.0	10.2	2.16
<b>6-9 ft.</b>	31.2	35.6	7.52
<b>Above 9 ft.</b>	346.0	395.4	83.50
<b>Total</b>	<b>414.4</b>	<b>473.6</b>	<b>100.00</b>

Table 2: Number of People Vulnerable to Sea Level Rise

Zones	# of People	% of People
<b>0 ft. and Below</b>	2288	1.1
<b>0-3 ft.</b>	2691	1.3
<b>3-6 ft.</b>	4210	2.1
<b>6-9 ft.</b>	13116	6.6
<b>Above 9 ft.</b>	199806	100.0

Table 3: Landuse in Risk Zones (sq. mi)

	0 ft. and Below	0-3 ft.	3-6 ft.	6-9 ft.	Above 9 ft.
Open Water	6.3	3.4	1.2	4.0	16.5
Developed	1.0	1.4	2.0	7.5	91.7
Barren	2.5	3.1	1.4	4.4	12.9
Forest	1.1	1.0	1.3	5.8	167.9
Shrubs	0.0	0.0	0.0	0.0	0.3
Orch/vine	0.0	0.0	0.0	0.0	0.0
Ag/pasture	0.2	0.2	0.3	1.1	22.7
Wetland	2.7	5.2	2.7	8.4	34.0

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.

The 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.

### 2.2.15 Tsunami

While there was a “meteotsunami” that affected the area from Long Island to Chatham in 2013 which created a two foot surge, there are no historic record of catastrophic tsunami’s that have affected Cape Cod in modern history. Another meteotsunami has been recorded in the east coast that affected Bath Harbor with a 4 to 12 foot wave surge. “Normal” storm tides on the south side of Dennis (Dennis Port and West Dennis) typically run six to eight feet and up to twelve feet on the north side (Dennis and East Dennis). The effects of a meteotsunami would fall within the tidal surges planned for under hurricane and winter storm planning.

Imagery ©2009 TerraMetrics, Map data ©2009 Tele Atlas -

# Sea Level Rise Existing Conditions



Imagery ©2009 TerraMetrics, Map data ©2009 Tele Atlas -

# Sea Level Rise 1 Meter Increase in Sea Level



Imagery ©2009 TerraMetrics, Map data ©2009 Tele Atlas -

## Sea Level Rise Storm Surge Conditions



### 2.2.16 Temperature Extremes

Generally, temperature shifts are not that dramatic on the Cape. The coastal nature of the area provides some level of temperature modification over more inland areas. However, climate change has affected some extreme temperature shifts in recent winters, polar vortices for instance during winter months.

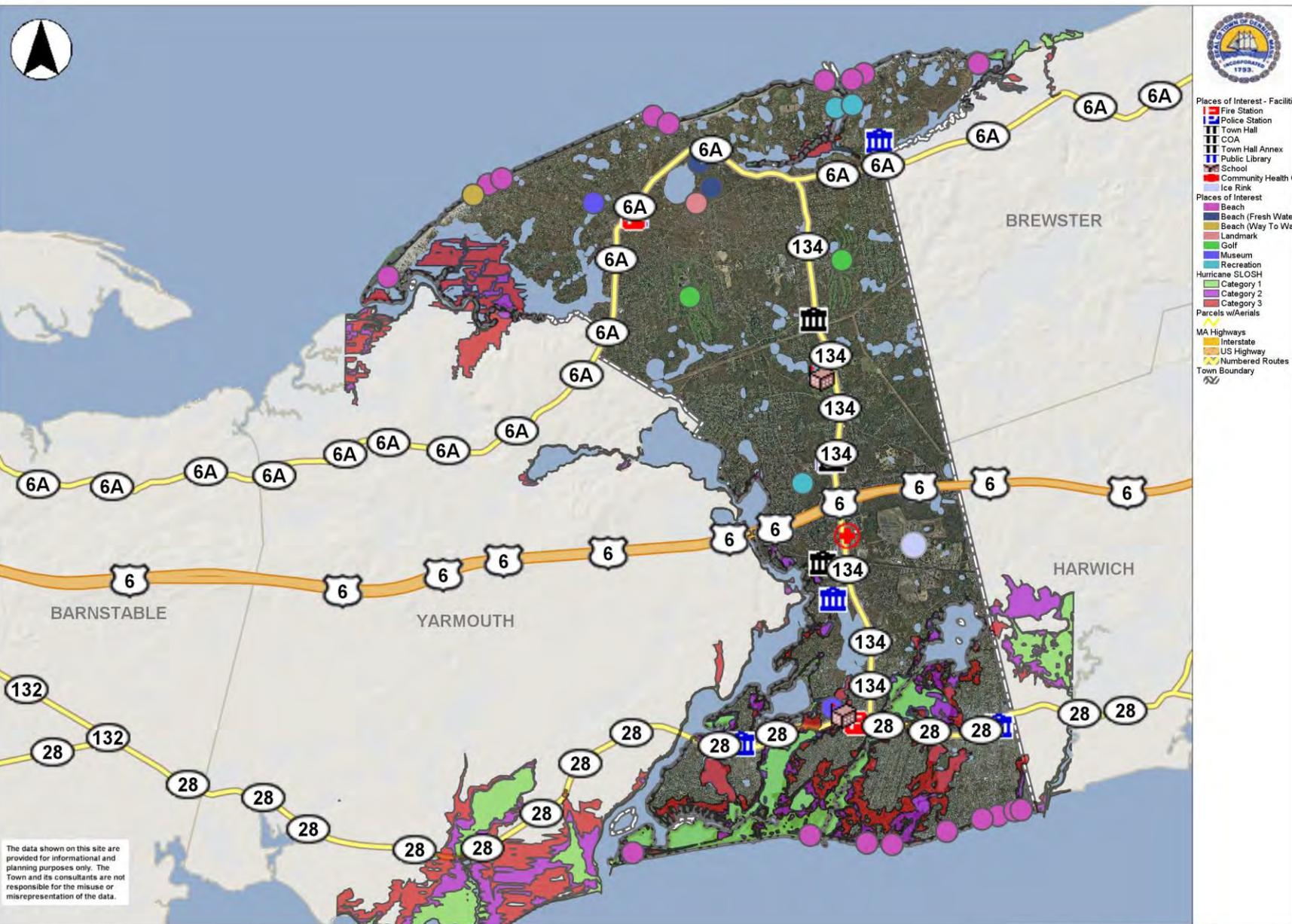
Dennis has a “Winter No Heat” policy in place to provide for emergency sheltering of people exposed to life or death situations due to the lack of adequate heat. Dennis also provides a fuel assistance program to try to head off these no heat issues. In the summer, extreme heat situations are a bit less severe. The Senior Center may remain open later to provide an air conditioned setting for those at risk, but there have been fewer heat issues than cold issues.

#### 2.2.17 Landslides

Landslides are not typically considered to be a problem in Dennis. Erosion issues, addressed above, reflect similar issues to landslides. All relevant discussion to this topic is covered as an erosion issue.

### **2.3 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.



- Town of Dennis**  
INCORPORATED 1729
- Places of Interest - Facilities**
    - Fire Station
    - Police Station
    - Town Hall
    - COA
    - Town Hall Annex
    - Public Library
    - School
    - Community Health Ctr
    - Ice Rink
  - Places of Interest**
    - Beach
    - Beach (Fresh Water)
    - Beach (Way To Water)
    - Landmark
    - Golf
    - Museum
    - Recreation
  - Hurricane SLOSH**
    - Category 1
    - Category 2
    - Category 3
  - Parcels w/Aerials**
  - MA Highways**
    - Interstate
    - US Highway
    - Numbered Routes
  - Town Boundary**

0 8700 17400 ft

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# Town of Dennis, MA

## **2.4 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 Dennis Port 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.

Updated December 2015

<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>
<b>Flood-Related Hazards</b>			
Riverine	Possible	Swan River, Bass River, Sesuit Creek, Chase Garden Creek	Limited
Coastal	High	West Dennis, Dennis Port	Critical
Erosion	High	Chapin Beach, West Dennis Beach	Critical
		Northern Coastline	Critical
		Southern Coastline	Critical
Dam Failures	Unlikely	Local	Negligible
Thunderstorms	Possible	Small	Negligible
Winter Storms	High	Regional	Limited
Coastal Storms or nor'easters	High	Regional	Limited
Hurricanes	High	Large	Critical
<b>Wind-Related Hazards</b>			
Hurricanes	High	Large	Critical
Coastal Storms	High	Regional	Critical
Winter Storms	High	Regional	Limited
Downspouts	Unlikely	Small	Limited
Tornadoes	Unlikely	Small	Negligible
Thunderstorms	Possible	Small	Limited
<b>Fire-Related Hazards</b>			
Drought	Possible	Medium	Limited
Wildfires	Possible	Local	Limited
Urban Fires	Unlikely	Local	Negligible
Flooding	Possible	Local	Critical
<b>Geologic Hazards</b>			
Earthquakes	Unlikely	Local	Negligible
Landslides	Unlikely	Small	Negligible
Sink holes	Unlikely	Small	Negligible

## 2.5 Dennis Capability Assessment

### 2.5.1 Local Resources

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

Table 5. Regulatory Tools

#### **Regulatory Tools (ordinances, codes, Status plans)**

- ❖ Building code State Building Code
- ❖ Zoning ordinance First Adopted 1951
- ❖ Subdivision ordinance or regulations Last Amended 1993
- ❖ Special purpose ordinances:
  - Flooding:
    - Zoning, Conservation and Building Code Floodplain Management
  - Stormwater Management:
    - General Town Bylaw, Wetlands Regulation, Zoning Requirements and Subdivision Control
  - Erosion:
    - Stormwater By-law, Wetland Regulations, Zoning Costal Bank setbacks
  - Fire Safety:
    - Building Code, Zoning building separation requirements
  - Health:
    - Septic design standards
- ❖ Regulation; Hillside or Steep Slope: Crowe’s Pasture only;
- ❖ Wildfire: Barnstable County Wildfire Preparedness Plan
- ❖ Growth management ordinances (Village Centers adopted, “smart growth zoning” and land acquisition programs)
- ❖ Site plan review requirements Planning Board conducts Site Plan Review
- ❖ Comprehensive plan Adopted 2002,
- ❖ A capital improvements plan 5 year plan with annual updates
- ❖ 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
- Town Planner
- GIS Coordinator
- Natural Resources/Conservation Agent

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

- Town Planner
- GIS Coordinator

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

Dennis is in a strong financial position to undertake the projects, most of which are continuing maintenance projects, in this report. The town passed a \$2,000,000 Proposition 2 ½ over-ride in 2012 with the revenue dedicated to capital improvements. In addition, Beach parking, Off-Road Vehicle and harbor fees are pumped back into capital programs such as dredging and beach and dune renourishment.

**2.5.2 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.

**2.5.3 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 (1-800-237-3239) 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) requirements (<https://www.fema.gov/media-library/resources-documents/collections/6>).
- **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.
- **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.

Other federal resources include: **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.

#### **2.5.4 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.

##### 3.1.1 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 *shall* 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 *shall* 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.

##### 3.1.2 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.

### ***3.1.3 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.

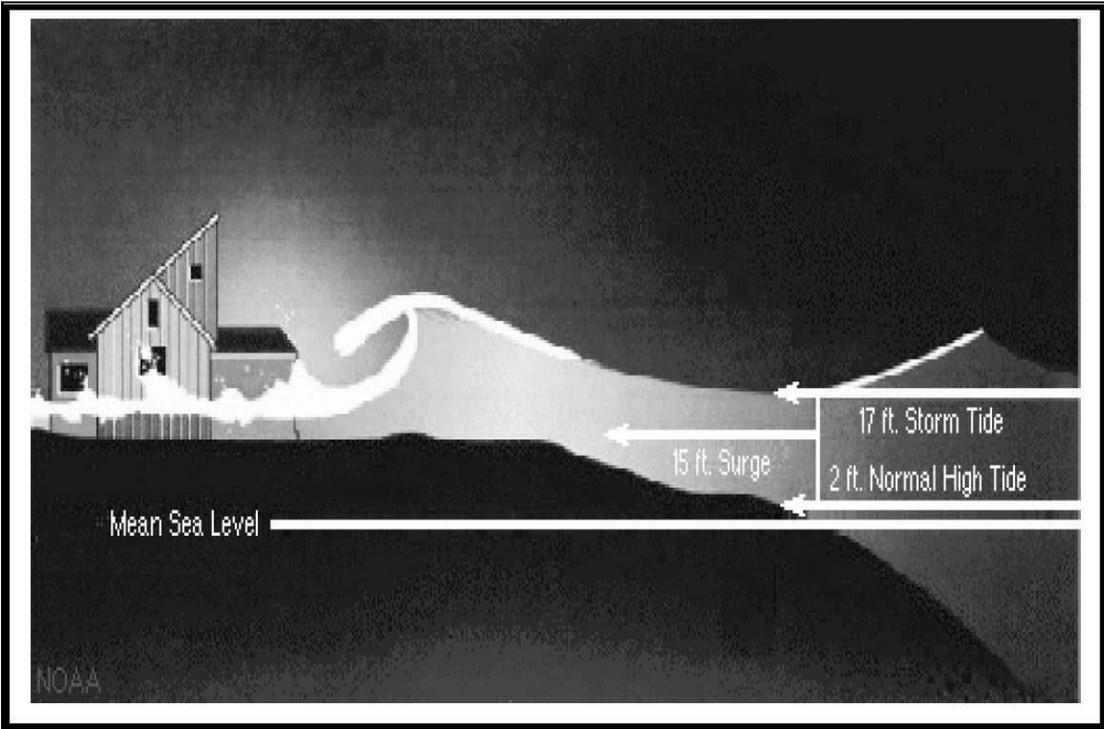
**3. Risk Analysis** – The next step is to calculate the potential losses to determine which hazard will have the greatest impact on the jurisdiction. Hazards should be considered in terms of their frequency of occurrence and potential impact on the jurisdiction. For instance, a possible hazard may pose 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 seventy (70) critical facilities were identified with twenty-four (24) 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:

<b>ID #</b>	<b>FACILITY NAME</b>	<b>STREET</b>	<b>FACILITY TYPE</b>	<b>SLOSH * Y/N</b>	<b>SFH A ** Y/N</b>
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	685 Route 134	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	Water District	80 Old Bass River Road	D	No	No
13	Department of Public Works	120 Theophilus Smith Rd	D	No	No
14	Dennis Public Library	5 Hall Street	D	Yes	No
15	South Dennis Public Library	389 Main Street	D	Yes	No
16	Dennis Free Library	272 Main Street	D	No	No
17	Dennis Memorial Library	1020 Old Bass River Road	D	No	No
18	Dennis Landfill	Theophilus Smith Rd	F	No	No
19	Dennis Head Start/VIC Hall	Depot Street	D/G/I	Yes	No
20	Sunshine and Rainbow Nursery School	713 Route 6A	G	No	No
21	Play and Learn Day Care and Pre School	434 Route 134	G/I	No	No
22	Scargo Nursery School Inc.	218 Main Street	G	Yes	No
23	Guardian Angel Daycare	16 Simmons Pond West Road	G/I	No	No
24	Windmill Children's Center	109 Route 28	G/I	No	Yes
25	The Children's Workshop - South Dennis	434 Route 134	G/I	No	No
26	Village Senior and Handicap Housing	226 Old Bass River Road	H	No	No
27	Windmill Village Senior Housing	109 Upper County Road	H	Yes	No
28	Village Senior and Handicap Housing	167 Center Street	H	Yes	Yes
29	Lewis Gordon Senior Housing Apartments	1110 Route 134	H	No	No
30	Northside Village	11 Antonelli Circle	H	Yes	Yes
31	Dennis Animal Hospital Inc.	5 Beach Street	K	Yes	No

<b>ID #</b>	<b>FACILITY NAME</b>	<b>STREET</b>	<b>FACILITY TYPE</b>	<b>SLOSH * Y/N</b>	<b>SFH A ** Y/N</b>
32	North Side Marina	377 Sesuit Neck Road	L	Yes	Yes
33	Sesuit Harbor Marina	351 Sesuit Neck Road	L	Yes	Yes
34	Bass River Marina	140 Route 28	L	Yes	Yes
35	Mayfair Boatyard	73 Old Mayfair Road	L	Yes	Yes
36	First Student Bus Operation Center	153A Upper County Road	M	Yes	Yes
37	Cape Cod Regional Transit Authority Operation Center	40 American Way	M	No	No
38	West Dennis Beach	44 Lighthouse Road	J	Yes	Yes
39	Mayflower Beach	62 Horsefoot Path	J	Yes	Yes
40	Corporation Beach	Corporation Road	J	Yes	Yes
41	Glendon Road Beach	155 Old Wharf Road	J	Yes	Yes
42	South Village Beach	South Village Road	J	Yes	Yes
43	Sea Street Beach	5 Sea Street (Dennis Port)	J	Yes	Yes
44	Sea Street Beach	Sea Street (East Dennis)	J	Yes	Yes
45	Cold Storage Beach	Cold Storage Road	J	Yes	Yes
46	Johnny Kelley Park	Bob Crowell Road	J	No	No
47	Haigis Beach	97 Old Wharf Road	J	Yes	Yes
48	Chapin Beach	Chapin's Beach Road	J	Yes	Yes
49	Verizon Central Station	1139 Route 6A	E	No	No
50	West Dennis Graded School House	67 School Street	A	No	No
51	Cranberry Knoll	59 Route 6A	H	No	No
52	Water District Offices	80 Old Bass River Road	E	No	No
53	Well Sta 7, 8 & 10	200 Airline Road	E	No	No
54	Well Sta 4 & 11	525 Old Bass River Road	E	No	No
55	North Water Plant	425 Old Bass River Road	E	No	No
56	Well Sta 19 & 20	156 Setucket Road	E	No	No
57	Well Sta 18	28 Commodity Rd	E	No	No
58	Well Sta 14	99 Bakers Pond Road	E	No	No
59	Well Sta 15	111 Bakers Pond Road	E	No	No
60	Well Sta 12 & 23	450 Old Chatham Road	E	No	No
61	Well Sta 9	109 Grassy Pond Road	E	No	No
62	Well Sta 21	712 Route 134	E	No	No
63	Hokum Rock Tank	301 Paddocks Path	E	No	No
64	Booster Station	760 Route 134	E	No	No
65	South Water Plant	940 Route 134	E	No	No

<b>ID #</b>	<b>FACILITY NAME</b>	<b>STREET</b>	<b>FACILITY TYPE</b>	<b>SLOSH * Y/N</b>	<b>SFH A ** Y/N</b>
66	Well Sta 16	40 Timber Lane	E	No	No
67	Old Bass Tank	900 Old Bass River Road	E	No	No
68	Well Sta 5	625 Route 134	E	No	No
69	Well Sta 1, 2 & 3	270 Old Chatham Road	E	No	No
70	West Dennis Tank	875 Main Street	E	No	No

**Critical Facilities and Infrastructure Key:**

**A** Emergency Facilities/Shelters

**B** Public Safety Facilities

**C** Hospitals/ Acute Care Facilities

**D** Town Government

**E** Infrastructure

**F** Hazardous Material

**G** Schools

**H** Nursing Homes/Elderly Housing

**I** Group Day Care Facilities

**J** Senior/Youth/Recreation Centers Facilities

**K** Designated Emergency Animal Shelters/Hospitals

**L** Marinas/Boat Yards Facilities

**M** Transportation Facilities

\* **SLOSH** = Sea, Lake, & Overland Surges from Hurricanes

\*\* **SFHA** = Special Flood Hazards Area designated on the Flood Insurance Rate Map hurricanes (FIRM)

Of the twenty-four facilities located within the high hazard areas nineteen 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.

NATURAL HAZARD	CAUSE & EFFECT	LOCATION
<b>FLOOD</b>	<p><b>Natural Inundation</b> in the floodplain(caused by coastal storms; winter storms; northeasters; hurricanes)</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Coastal Flooding</li> <li><input type="checkbox"/> Episodic Erosion</li> <li><input type="checkbox"/> River Flooding</li> <li><input type="checkbox"/> Pond Flooding</li> <li><input type="checkbox"/> Infrastructure Failure</li> <li><input type="checkbox"/> Siltation</li> </ul> <p><b>Infrastructure Failure</b> (caused by coastal storms; winter storms; northeasters; hurricanes; ice/snow melt)</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Bridge Failure</li> <li><input type="checkbox"/> Storm Drain Failure</li> <li><input type="checkbox"/> Culvert Failure</li> <li><input type="checkbox"/> Dam Failure</li> <li><input type="checkbox"/> Dike Failure</li> </ul>	<p><b>Areas of Coastal Flooding</b></p> <ul style="list-style-type: none"> <li>• West Dennis Beach</li> <li>• Chapin Beach</li> <li>• Mayflower Beach</li> <li>• North Side Marina</li> <li>• Haigis Beach</li> <li>• South Village Beach</li> <li>• Glendon Road Beach</li> <li>• Sea Street Beach</li> <li>• Cold Storage Beach</li> <li>• Sea Street Beach</li> <li>• Corporation Beach</li> </ul> <p><b>Areas of River Flooding</b></p> <ul style="list-style-type: none"> <li>• Upper County Road Bridge over the Swan River</li> <li>• Bass River Marina</li> <li>• Mayfair Boatyard</li> </ul> <p><b>Areas of Episodic Erosion</b></p> <ul style="list-style-type: none"> <li>• Mayflower Beach</li> <li>• Chapin’s Beach</li> <li>• Crowe’s Pasture</li> <li>• West Dennis Beach</li> </ul> <p><b>Areas of Episodic Siltation</b></p> <ul style="list-style-type: none"> <li>• Sesuit Harbor</li> <li>• Bass River</li> <li>• Swan River</li> <li>• Chase Garden Creek</li> </ul> <p><b>Deficient Infrastructure</b></p> <ul style="list-style-type: none"> <li>• Dr Bottero Road</li> <li>• Lighthouse Road</li> </ul>

NATURAL HAZARD	CAUSE & EFFECT	LOCATION
WIND	<p><b>Hurricanes Northeasters</b>  <b>Tornadoes</b> Roofs Blowing Off  Trees Downed</p>	<p><b>Roof Damage</b></p> <ul style="list-style-type: none"> <li>• Town Hall</li> <li>• Ezra Baker School</li> <li>• Nathaniel Wixon School</li> <li>• Dennis Memorial Library</li> <li>• Dennis Public Library</li> <li>• Town wide</li> </ul> <p><b>Trees Downed</b> - Locations proximal to wind activity:  <input type="checkbox"/> Town wide</p>
FIRE	<p><b>Drought Wildfire Lightning Strikes Urban Fire</b></p>	<p><b>Wildfire</b> Developed land / forested area interfaces:</p> <ul style="list-style-type: none"> <li>• Crowes Pasture</li> <li>• Princess Beach/Scargo Hill</li> <li>• Old Chatham Rd Water District Lands</li> <li>• The Plashes</li> <li>• Shoop Gardens</li> </ul> <p><b>Urban Fire</b> • Dennis Port 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.</p> <ul style="list-style-type: none"> <li>• West Dennis, while not as compact as Dennis Port 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.</li> <li>• Cottage Colonies, predominantly along the south side of town, these locations exhibit buildings constructed in close proximity with no fire breaks or fire resistant construction.</li> </ul>

NATURAL HAZARD	CAUSE & EFFECT	LOCATION
GEOLOGI C	Earthquakes Landslides Sink Holes	<p><b>Structural Damage</b> - Locations proximal to seismic activity: According to Regional Hazard Risk Map II geologic activities have not been recorded.</p> <p><b>Loss of Land</b> 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 Northeasters in June of 2009 and during the winters of 2013, 2014 and 2015 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><b>Wave Inundation</b> Dennis has several areas protected by barrier beaches. These barrier beaches protect lands in Dennis, Yarmouth and 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>

NATURAL HAZARD	CAUSE & EFFECT	LOCATION
OTHER	<b>Snow &amp; Ice Accumulation</b> <b>Chronic Erosion</b> <b>Sea Level Rise</b> <b>Sediment Deposition</b>	<b>Snow and Ice Accumulation</b> <ul style="list-style-type: none"> <li>• Most Private Roads</li> <li>• Trees along Scenic Roads</li> </ul> <b>Street Flooding/ Impassable Roads</b> <ul style="list-style-type: none"> <li>• Lower County Road</li> <li>• Route 28 at Bass River</li> <li>• Lighthouse Road</li> <li>• Route 28 at Swan River</li> <li>• Swan Pond Road</li> <li>• Old Main Street, So Dennis</li> <li>• Bridge Street</li> <li>• Nobscusset Road,</li> <li>• Beach Street</li> <li>• Upper County Road</li> <li>• Uncle Barney’s Road</li> </ul> <b>Structural damage</b> • Docks, piers town wide  <b>Sediment Deposition</b> <ul style="list-style-type: none"> <li>• Sesuit Harbor</li> <li>• Bass River</li> <li>• Swan River</li> <li>• Chase Garden Creek</li> </ul>

**Table 10:** Descriptive Location Chart

Population						
Population				Vulnerable Population**		
Census	Permanent	Seasonal	Total	Permanent	Seasonal	Total
2010	14,207	~65,800*	~80,000*	3,850	~36,200*	~40,000*

\*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. .

**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 11 depicts the existing shelter facilities and capacities; Table 10 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	Evacuation Capacity @20 sq. ft / person	Shelter Capacity @40 sq ft / person
A) Nathaniel Wixon Middle School 901 Route 134	None	Y	Y	Y	7,082	3,541
B) Ezra Baker School 810 route 28	Yes SLOSH	Y	Y	Y	2,731	1,340
C) Dennis Senior Center 1045 Route 134	None	Y	Y	Y	959	479
D) Carleton Hall 1006 Bass River Road	None	N	N	Y	309	154
E) Dennis Police Station	None	Y	N	Y	50	25
F) Jacob Sears Memorial Library 23 Center Street	None	N	N	Y	215	107
G) VIC Hall Depot Street	Yes SLOSH	N	N	Y	124	62
H) Dennis Yarmouth High School Regional Shelter Station Avenue, Yarmouth	None	Y	Y	Y	500	250
I) Cape Cod Regional Technical High School 351 Pleasant Lake Ave Harwich, MA	None	Y	Y	Y	??	
<b>Total Capacity</b>					<b>11,907</b>	<b>5,954</b>

The Dennis Police Station is used for small sheltering situations that do not call for a regional shelter to be opened. 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.

As discussed earlier, there are about 3,850 people living year-round within the flood prone areas of Dennis. This figure increases dramatically in the summer time when 9,150 additional residents move into their seasonal homes. When the motel rooms and cottages are occupied – mostly within the waterfront areas of Dennis Port and West Dennis – The number of people boost the summertime figure by some estimates to over 40,000 people in vulnerable locations Dennis in July or August. Most of these hotel rooms, timeshares, cottages and condominium rentals are located in the most storm prone areas of Dennis Port. 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. However, with a winter population of 14,207, or less, the shelters seem capable of accommodating those in need of evacuation in a winter storm.

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 Emergency Planning Committee has since held exercises using an Upper Cape Facility (Oak Ridge School in Sandwich) and 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 Dennis Port 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**  
**Insurance Loss Properties, Barnstable County (updated, 2015)**

<b>Loss Statistics of the National Flood Insurance Program (NFIP), Cape Cod, Massachusetts: 1978 (start NFIP) – September 30, 2015</b>					
<b>Town</b>	<b>Total Loss Claims</b>	<b>Closed Losses</b>	<b>Open Losses</b>	<b>CWOP Losses</b>	<b>Total Payments (\$)</b>
Barnstable	301	204	1	96	3,030,770.77
Bourne	481	389	0	92	5,499,302.87
Brewster	19	10	1	8	55,730.53
Chatham	148	111	0	37	3,304,223.88
Dennis	235	156	0	79	1,462,739.00
Eastham	69	54	0	15	411,761.46
Falmouth	643	489	0	154	9,446,300.60
Harwich	48	32	1	15	661,148.26
Mashpee	70	40	0	30	296,150.28
Orleans	61	46	1	14	923,521.74
Provincetown	174	108	0	66	1,329,416.80
Sandwich	183	128	0	55	1,608,178.71
Truro	27	10	0	17	87,343.68
Wellfleet	33	19	0	14	308,068.66
Yarmouth	242	134	0	108	965,806.52
<b>Total for MA</b>	<b>31,694</b>	<b>25,140</b>	<b>26</b>	<b>6,528</b>	<b>357,284,070.55</b>

CWOP – closed without payment

Source: <http://bsa.nfipstat.fema.gov/reports/1040.htm#25>

Table 14: Repetitive Losses (current through August 30, 2015)

Village	Losses	Paid	Type	Flood Zone
E DENNIS	7	35,671.51	SINGLE FMLY	A13
WEST DENNIS	3	11,373.15	SINGLE FMLY	A12
DENNIS PORT	2	4,440.20	SINGLE FMLY	V12/A10
W DENNIS	2	14,139.41	SINGLE FMLY	V13/A10
W DENNIS	2	3,240.00	SINGLE FMLY	A11
W DENNIS	3	49,019.45	SINGLE FMLY	V13/A12
DENNIS PORT	3	31,379.70	OTHER RESID	V15
DENNIS PORT	2	9,634.74	OTHER RESID	V13
DENNIS PORT	2	23,818.78	SINGLE FMLY	V13
DENNIS PORT	4	108,882.36	SINGLE FMLY	V13
W DENNIS	5	87,911.06	CONDO	V13
W DENNIS	2	9,158.65	SINGLE FMLY	A12
W DENNIS	3	42,595.55	SINGLE FMLY	V133
W DENNIS	2	12,980.73	SINGLE FMLY	V13
DENNIS PORT	2	8,079.44	SINGLE FMLY	A10
DENNIS	3	7,898.54	SINGLE FMLY	A14
<b>TOTALS</b>	<b>47</b>	<b>460,223.27</b>		

Table 15

<b>Policy Statistics of the National Flood Insurance Program (NFIP), Cape Cod, Massachusetts: 1978 (start NFIP) – September 30, 2015</b>			
Town	Policies In-Force	Insurance In-Force (whole \$)	Written Premium In-Force
Barnstable	1,204	345,316,800	1,526,236
Bourne	1,122	267,892,600	2,205,563
Brewster	107	32,646,500	70,422
Chatham	508	153,296,200	531,696
Dennis	1,564	350,889,300	1,532,557
Eastham	213	61,065,400	225,953
Falmouth	2,453	652,569,700	4,120,995
Harwich	775	220,177,900	718,755
Mashpee	661	188,151,200	715,398
Orleans	259	76,930,300	277,180
Provincetown	1,118	259,290,300	1,233,464
Sandwich	448	118,233,800	729,919
Truro	330	64,493,500	355,647
Wellfleet	238	63,092,600	265,034
Yarmouth	1,557	395,843,400	2,130,084
Total for Barnstable County	12,557	3,249,889,500	16,638,903
<b>Total for MA</b>	<b>63,801</b>	<b>15,820,594,100</b>	<b>76,755,309</b>

### **3.6.1 Summary of Repetitive Loss Areas**

Dennis is a coastal community with significant low lying areas. There is one concentrated area of repetitive loss properties out of the properties listed in Table 14 above. This cluster is located in an area to the east of the Lighthouse Inn and, for the most part, reflects properties along the frontal edge of the coastline, seven of the properties listed above are in this cluster. Several of these properties have been elevated over the past fifteen years. This should reduce future damage potential, however, most of these homes were elevated prior to the 2014 Flood Map Update.

In Dennis Port, the only commonality among the properties are that four of the properties are located in the Velocity Zone, however, unlike West Dennis, these properties are not located in any real cluster.

The remaining properties are scattered around other areas of town with no common features.

### **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 estimates that the replacement value of the structures located within the 1% storm event flood zone to be about \$1.3 billion. At present, only about 31% of these structures carry flood insurance and flood insurance would only cover about 27% of the value exposed to flooding.

The last major urban fire to occur in Dennis was in 1920. In that year an entire urban block in Dennis Port was destroyed. Land development patterns in Dennis Port and West Dennis continue to illustrate areas which could be subject to such fires. In particular, in Dennis Port 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 Dennis Port 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:

Dennis Port Village Center \$4.4 million  
Dennis Port Cottage Colony Area \$25 million  
West Dennis Village Center \$2.5 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, and Health Regulations. This multi-prong approach has put into place measures to ensure that structures are constructed or reconstructed in a flood safe manner.

As of the 2014 Flood Maps, the Town of Dennis has 11,234 parcels of land located within the 1% flood zone. Of these, over 5,000 have structures located on them. These parcels comprise 4,656 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 illustrate that, and Census data corroborates, that of the over 5,000 residential structures located within the flood zone, greater than 80% 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. In 2013, Dennis adopted zoning building height standards that measure building height in the flood zone from Base Flood Elevation (BFE) by doing so, the town took a step away from zoning that penalized elevating structures above BFE. A handful of structures have taken advantage of this zoning change since it took effect.

**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 Barrier Beaches 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 Eversource provides a similar plan to remove trees that could threaten the town's power grid. Eversource'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 Crowe's Pasture and several other large town owned properties, the town works with county and state agencies to manage these properties through brush cutting and 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:

Dennis Port 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, 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. 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 Dennis Port 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.



### Dennis Port 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 worked with the cottage owners and property owners on a plan for reinvestment. One property to date has started to replace the old cottages and recreational vehicles with newer, more modern cottages. These new cottages will meet all modern building code requirements.



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**

<b>Existing Protection</b>	<b>Description</b>	<b>Area Covered</b>	<b>Enforcement and/or Effectiveness</b>
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 and residential subdivisions	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	Town wide	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 Dennis Port.”

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.

When the Town of Dennis first set out to do the Multi-Hazard Mitigation Plan, the concept of task identification, project identification, programming, scheduling and timetable was overwhelming. In fact, the first attempt in 2005 was stalled due to this issue as the town needed to look at the actions and determine what the impact would be on municipal resources. Between 2005 and the 2011 MHM Plan adoption, the town reviewed the strategies available to us, and realized that most, if not all, of these were part of our current annual operating and capital budgets. For instance, the town appropriates nearly \$500,000 annually for waterway dredging, dredge material is used for beach and dune renourishment and restoration. The Dennis Fire and Building Departments aggressively review proposals for fire safety needs, this has led to sprinklers being incorporated into renovation and reconstruction projects in Dennis Port Village Center, which should reduce the urban wildfire risk. The Dennis Planning Department crafted, and Town Meeting adopted a new zoning for the cottage colony areas of Dennis Port, which promotes both flood and fireproofing these at risk areas. Hazard management has become a part of everyday life in Dennis town government. Outside of large scale projects, such as relocating Doctor Boterero Road or dredging the Inner Basin of Sesuit Harbor, the strategies listed in this document (neither of these projects are actually spelled out in this report) expenditures are within the regular town operating budget or are recurring items in the Dennis Capital Plan and receive annual allotments of funds.

#### **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.

2b Continue the town's involvement with the Barnstable County Local Emergency Planning Committee.

**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 preservation funds, including Community Preservation Act funding, to acquire critical repetitive loss parcels to return to open space/upgrade public facilities.

3c Coordinate with state and other agencies to acquire funding that can be targeted to low income homeowners living within the flood zone, to subsidize the elevating of flood prone structures.

**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." As of December 2015, five of the eighteen identified repetitive loss properties have taken steps to mitigate.

**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 and members of boards, commissions and committees 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
- Septic facilities upgrades
- 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 coastal dunes. Parks, recreation or conservation agencies and organizations often implement these measures. Examples include:

- Floodplain protection
- Beach and dune preservation
- Riparian buffers
- Coastal bank buffers
- Bordering vegetated wetland 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. In updating the STAPLEE scores, the town found that, based upon having this plan in place for five years, prioritizing its implementation, and actively promoting these hazard mitigation strategies, public support has grown, and the STAPLEE scores have increased dramatically for some initiatives over the scores in the 2011 MHM Plan.

STAPLEE RANKING OF STRATEGIES

Updated December 2015

<b>STRATEGY</b>	<b>HAZARDS ADDRESSED</b>	<b>STAPLEE SCORE</b>	<b>RESPONSIBLE AGENCY</b>
Regulating construction projects within and adjacent to protected wetlands.	<i>Flood (coastal storm surge, storm tides &amp; wave action, erosion, and sea level rise)</i>	65	Conservation Commission, Planning Department
Increase public awareness of Flood Zone Issues, including use of town website and Dennis Planning Department Weblog	<i>Flood (coastal storm surge, storm tides &amp; wave action, erosion, and sea level rise)</i>	64	Planning Department
Inform public about new building code requirements	<i>Wind (from hurricanes, coastal storms, nor'easters)</i>	64	Building Department, Planning 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>	64	Planning Department, Building Department, Fire Department
Code Red, Portable Message Boards and Police Department Web Site	<i>Flood (coastal storm surge, storm tides &amp; wave action, erosion, and sea level rise); Wind (from hurricanes, coastal storms, nor'easters) Flood (hurricanes)</i>	64	Police Department
Regulatory – Coastal Bank/Dune Setbacks	<i>Flood (coastal storm surge, storm tides &amp; 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
Flood Zone Construction Standards.	<i>Flood (coastal storm surge, storm tides &amp; wave action, erosion, and sea level rise)</i>	62	Building Department
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>	62	Conservation Commission
Reduce Fuel Sources through mechanical devices, prescribed burns or selective cutting	<i>Wildfire</i>	61	Natural Resources, Department of Public Works
Building Standards	<i>Wind (from hurricanes, coastal storms, nor'easters) Flood (hurricanes)</i>	60	Building Department

STRATEGY	HAZARDS ADDRESSED	STAPLEE SCORE	RESPONSIBLE AGENCY
Promote strategies that lead to reinvestment of older properties in at risk areas, i.e. village centers and cottage colony areas	<i>Flood,</i>	60	Planning Department, Building Department, Fire Department
Barrier Beach Management Plan Committee	<i>Flood (coastal storm surge, storm tides &amp; wave action, erosion, and sea level rise)</i>	58	Barrier Beach Restoration Committee, Natural Resources Department, Conservation Commission, Board of Selectmen
Pursue available funding for retrofits of private and public facilities.	<i>Wind (from hurricanes, coastal storms, nor'easters)</i>	Wind 58	Planning Department, Natural Resources Department, Board of Selectmen, Community Preservation Committee
Beach and Dune Replenishment	<i>Flood (coastal storm surge, storm tides &amp; wave action, erosion, and sea level rise); Wind (from hurricanes, coastal storms, nor'easters); Shoreline erosion (from shoreline change)</i>	58	Barrier Beach Restoration Committee, Natural Resources Department, Harbormaster, Department of Public Works, Engineering Department, Conservation Commission, Waterways, Board of Selectmen
Pursue available grants for retrofits of private and public facilities.	<i>Flood (coastal storm surge, storm tides &amp; wave action, erosion, and sea level rise)</i>	57	Planning Department, Natural Resources Department, Board of Selectmen

<b>STRATEGY</b>	<b>HAZARDS ADDRESSED</b>	<b>STAPLEE SCORE</b>	<b>RESPONSIBLE AGENCY</b>
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
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
Land Acquisition within floodplain/Ongoing.	<i>Flood (coastal storm surge, storm tides &amp; wave action, erosion, and sea level rise)</i>	56	Board of Selectmen, Community Preservation Committee, Dennis Land Trust
Physical intervention – restoring river flow (culverts)	<i>Flood (coastal storm surge, storm tides &amp; wave action, erosion, and sea level rise)</i>	54	Department of Public Works, Engineering Department, Natural Resources, Conservation Commission
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 &amp; wave action, erosion, and sea level rise)</i>	52	FEMA, Congress, Mass Legislature
Storm water Control	<i>Flood (coastal storm surge, storm tides &amp; wave action, erosion, and sea level rise)</i>	50	Building Department, Engineering Department, Planning Board
Beach armoring	<i>Flood (coastal storm surge, storm tides &amp; wave action, erosion, and sea level rise)</i>	44	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 worked with FEMA in from 2009 through 2014 to coordinate the public review and adoption of flood boundary changes. In 2014 Dennis adopted Zoning By-laws and Board of Health Regulations in early May to continue this participation. This participation is based on an agreement between Dennis and FEMA which will be renewed 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 2009-2014 floodplain changes); 2) floodplain management (as documented in Dennis Zoning, Wetlands and Health Regulations); and 3) flood insurance (a major component of the floodplain revisions review).

As part of the town's participation in NFIP Dennis has adopted the current 2014 flood maps in May of 2014. 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 workshops hosted by the town in the summer of 2009 and winter of 2013/2014 held with FEMA to explain NFIP and the map revision process and on-going information being provided to the community through the Dennis Planning Department Weblog.

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;
- Work with FEMA and state officials on floodplain identification and mapping, as necessary the town will initiate requests for map updates; and
- Provide community assistance and monitoring activities to FEMA, state officials and local residents as it applies to floodplain management.
- Aggressively enforce building code standards for projects located in the flood zone.

The strategies identified in Appendix 4.1 which follows are all built into the regular work efforts of the Town of Dennis Departments. These strategies are all, for the most part carried over from the 2011 plan. They represent annual, on-going efforts of our town Departments. A few bulleted highlights illustrate the nature of these actions:

- Wildfire
  - Dennis Natural Resources Department, working with AmeriCorps annually trims and removed brush from town open lands.
  - Dennis Natural Resources Department, working with the County has a controlled burn program that rotates annually among Dennis open lands to manage vegetation that is not capable of being removed by hand.
  - Dennis Fire and Building Departments actively and strictly enforce the state Building and Fire Codes to broadly implement sprinkler systems in older buildings.
- Flooding
  - Dennis Planning Department coordinated the review and adoption of the 2014 FEMA Flood Maps.
  - Dennis adopted a new standard for construction in flood zones, measuring building height from Base Flood Elevation rather than natural grade to encourage homeowners in the Flood Zone to proactively elevate their homes.
  - Dennis adopted the Seasonal Resort Community Zoning By-law targeted at the Dennis Port Cottage Colonies which are located in the flood zone and are risks for urban wildfire. One colony has proceeded through the modernization path and has removed older cottages and replaced them with ones meeting all meeting today's flood and fire safety standards.
- Storm Preparation (Hurricane, Blizzard etc)
  - Dennis participated in the Barnstable County Emergency Management Committee and also maintains its own Local Emergency Management Center for storm events. Over the past 5 years the town has:
    - Participated in regional exercises for emergency preparedness from hurricane and blizzard to chemical spills.
    - Opened the Local Emergency Center for at least five storms events annually.
- Public Education
  - The Dennis Planning Department uses continuous outreach on issues such as flooding, flood insurance etc.
  - The Dennis Fire Department uses continuous outreach through its webpage and bulletin board to keep the community informed of impending

**APPENDIX 4-1  
TOWN OF DENNIS IMPLEMENTING STRATEGIES EVALUATION  
MATRIX UPDATED DECEMBER 2015**

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 &amp; wave action, erosion, and sea level rise)</i>	
PREVENTION	
ACTION/TIMEFRAME	SCORE
Land Acquisition within floodplain/Ongoing.	56
<b>SOCIAL</b>	
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 coastal floodplain as well as 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 to flooding will not displace homeowners and will provide flood storage for nearby properties.	3
<b>TECHNICAL</b>	
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	1

tax load on other properties	
<b>ADMINISTRATIVE</b>	
<b>STAFFING</b>	
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.	2
<b>FUNDING ALLOCATED</b>	
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
<b>MAINTENANCE OPERATIONS</b>	
Maintenance (picking up litter) will be an issue on any empty parcel.	1
<b>POLITICAL</b>	
<b>POLITICAL SUPPORT</b>	
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
<b>LOCAL SUPPORT</b>	
The town leaders have generally supported land acquisitions	3
<b>PUBLIC SUPPORT</b>	
Town Meeting has supported land acquisitions	3
<b>LEGAL</b>	
<b>STATE AUTHORITY</b>	
State law authorizes the town to acquire property.	3
<b>EXISTING LOCAL AUTHORITY</b>	
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
<b>ECONOMIC</b>	
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
<b>ENVIRONMENTAL</b>	
EFFECTS ON LAND/WATER	
Protects land and water.	3
EFFECTS OF HAZMAT WASTE SITES	
None	3
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Yes	3
CONSISTENT WITH FEDERAL LAWS	
Yes	3
HAZARD	
<b><i>Flood (coastal storm surge, storm tides &amp; wave action, erosion, and sea level rise)</i></b>	
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. Requires changes at the federal level and is outside town control.	52
<b>SOCIAL</b>	
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
<b>TECHNICAL</b>	
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
<b>ADMINISTRATIVE</b>	
STAFFING	
Would require federal staffing	1
FUNDING ALLOCATED	
None	1
MAINTENANCE OPERATIONS	
None	3
<b>POLITICAL</b>	
POLITICAL SUPPORT	
Unknown, support was clearly voiced at Coastal Zone 2009 in Boston. Massachusetts Legislative support has also been stated as part of the State's Climate Change Action Plan	3

LOCAL SUPPORT	
May be opposed by homeowners in the most at risk areas, however some have shown interest in areas affected by storms like Hurricane Sandy	2
PUBLIC SUPPORT	
Possibly quite large when the costs are explained	2
<b>LEGAL</b>	
STATE AUTHORITY	
Consistent with State Climate Change Action Plan	2
EXISTING LOCAL AUTHORITY	
No, none needed	3
POTENTIAL LEGAL CHALLENGE	
Possible if not targeting willing sellers	2
<b>ECONOMIC</b>	
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, but would come from insurance policies	2
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	
<b><i>Flood (coastal storm surge, storm tides &amp; wave action, erosion, and sea level rise)</i></b>	
PROPERTY PROTECTION	
ACTION/TIMEFRAME	SCORE
Pursue available grants for retrofits of private and public facilities.	57
<b>SOCIAL</b>	
COMMUNITY ACCEPTANCE	
The Planning Department has had several requests for assistance with pursuing FEMA funding for protection against hurricanes damage. .	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	3
<b>TECHNICAL</b>	
TECHNICAL FEASIBILITY	
Grants for retrofits are available, however funding is limited	2
LONG TERM SOLUTION	
Retrofits provide a short term solution which may be off-set by sea level rise.	2
SECONDARY IMPACTS	
Reinvestment in properties exposed to strong storm impacts will ensure that structures remain in at risk areas	2
<b>ADMINISTRATIVE</b>	
STAFFING	
Town will need to provide staff to seek and oversee grants	1

FUNDING ALLOCATED	
None	1
MAINTENANCE OPERATIONS	
None	3
<b>POLITICAL</b>	
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 as protecting properties at risk will ensure economic stability.	3
<b>LEGAL</b>	
STATE AUTHORITY	
Yes	3
EXISTING LOCAL AUTHORITY	
Yes	3
POTENTIAL LEGAL CHALLENGE	
None	3
<b>ECONOMIC</b>	
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
<b>ENVIRONMENTAL</b>	
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	
<b><i>Flood (coastal storm surge, storm tides &amp; wave action, erosion, and sea level rise)</i></b>	
PROPERTY PROTECTION	
ACTION/TIMEFRAME	SCORE
Flood Zone Construction Standards. On-going.	62
<b>SOCIAL</b>	
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. Dennis has unanimously adopted zoning that encourages homes to be elevated in flood zones by measuring building height from Base Flood Elevation.	3
EFFECTS ON SEGMENT OF POPULATION	
The target population, owners of properties within the flood zone have have started to warm to the idea of elevating structures as the Biggert Waters Act has drastically affected flood insurance costs.	3

<b>TECHNICAL</b>	
TECHNICAL FEASIBILITY	
Raising first floor elevation to above base flood elevation is technically feasible. With rising flood insurance costs homeowners have warmed to elevating homes. Over 100 homes have been elevated since the last MHM plan was adopted.	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
<b>ADMINISTRATIVE</b>	
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
<b>POLITICAL</b>	
POLITICAL SUPPORT	
The town has supported establishing flood standards for new construction. Town Meeting also unanimously adopted zoning standards that encourage, rather than penalize those seeking to elevate their homes.	3
LOCAL SUPPORT	
Local support was unanimous at th most recent Town Meeting vote on a zoning change designed to encourage house lifting in the flood zone.	3

<b>PUBLIC SUPPORT</b>	
Public support by residents outside the flood zone has been positive.	3
<b>LEGAL</b>	
<b>STATE AUTHORITY</b>	
Standards are set within the state building code and the zoning act.	3
<b>EXISTING LOCAL AUTHORITY</b>	
Local authority is through the local zoning and implementation of the state building code.	3
<b>POTENTIAL LEGAL CHALLENGE</b>	
Legal challenge would only come if the town were to seek to exceed state building code requirements	3
<b>ECONOMIC</b>	
<b>BENEFIT OF ACTION</b>	
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
<b>COST OF ACTION</b>	
Construction costs can be significant, especially for senior citizens who own many smaller, older homes within the flood zone. The town is pursuing a variety of funding sources to address these costs including the use of CDBG funds to assist with these costs.	2
<b>CONTRIBUTES TO ECONOMIC GOALS</b>	
Protecting the town from economic problems caused by major flooding can be accomplished with adherence to this requirement.	3
<b>OUTSIDE FUNDING REQUIRED</b>	
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
<b>ENVIRONMENTAL</b>	
<b>EFFECTS ON LAND/WATER</b>	

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. Town Boards are directing property owners away from fill and towards measures that promote dune formation and shifting sands.	3
<b>EFFECTS OF HAZMAT WASTE SITES</b>	
None	3
<b>CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS</b>	
When the Conservation Commission is involved in reviewing a project, the goals of improved dune formation and shifting sands are more easily accomplished.	3
<b>CONSISTENT WITH FEDERAL LAWS</b>	
Yes	3
<b>HAZARD</b> <i><b>Flood (coastal storm surge, storm tides &amp; wave action, erosion, and sea level rise)</b></i>	
<b>PUBLIC EDUCATION AND AWARENESS</b>	
<b>ACTION/TIMEFRAME</b>	<b>SCORE</b>
Increase public awareness of Flood Zone Issues, including use of town website and Dennis Planning Department Weblog Ongoing, the Weblog proved very successful in publicizing changes to the FEMA flood zones in 2009 and 2013/4.	64
<b>SOCIAL</b>	
<b>COMMUNITY ACCEPTANCE</b> 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
<b>EFFECTS ON SEGMENT OF POPULATION</b>	
Dennis year round and seasonal residents make up the bulk of visitors to the flood information on the weblog.	3
<b>TECHNICAL</b>	
<b>TECHNICAL FEASIBILITY</b>	

The weblog exists	3
<b>LONG TERM SOLUTION</b>	
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
<b>SECONDARY IMPACTS</b>	
The web presence for the Planning Department has increase the interaction between the Planning Department and the general public.	3
<b>ADMINISTRATIVE</b>	
<b>STAFFING</b>	
Administered within existing staffing levels	3
<b>FUNDING ALLOCATED</b>	
The town has not allocated any extra funds for this outreach effort. Existing free resources have met the needs of this effort.	3
<b>MAINTENANCE OPERATIONS</b>	
The outreach on flood issues are one more burden on the Town Planner, with no increase in support for the department.	1
<b>POLITICAL</b>	
<b>POLITICAL SUPPORT</b>	
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
<b>LOCAL SUPPORT</b>	
The residents have welcomed the public outreach currently being used, and we would expect that continued public support for future efforts.	3
<b>PUBLIC SUPPORT</b>	
Tremendous support	3
<b>LEGAL</b>	
<b>STATE AUTHORITY</b>	
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

<b>EXISTING LOCAL AUTHORITY</b>	
The town seeks to reach out to residents by all means available.	3
<b>POTENTIAL LEGAL CHALLENGE</b>	
None	3
<b>ECONOMIC</b>	
<b>BENEFIT OF ACTION</b>	
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
<b>COST OF ACTION</b>	
Free internet services are used	3
<b>CONTRIBUTES TO ECONOMIC GOALS</b>	
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
<b>OUTSIDE FUNDING REQUIRED</b>	
Free resources have been used	3
<b>ENVIRONMENTAL</b>	
<b>EFFECTS ON LAND/WATER</b>	
None	3
<b>EFFECTS OF HAZMAT WASTE SITES</b>	
None	3
<b>CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS</b>	
Yes, we have a tool available to share information with residents without generating additional waste (paper).	3
<b>CONSISTENT WITH FEDERAL LAWS</b>	
Yes	3
<b>HAZARD</b>	

<b><i>Flood (coastal storm surge, storm tides &amp; wave action, erosion, and sea level rise)</i></b>	
NATURAL RESOURCE PROTECTION	
ACTION/TIMEFRAME	SCORE
Beach and Dune Replenishment. Committee formed 2009, strategy developed 2010, implementation on-going.	58
<b>SOCIAL</b>	
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
<b>TECHNICAL</b>	
TECHNICAL FEASIBILITY	
The town has updated its ten year dredge permit for town waters. The sand that is dredged is used for beach nourishment. The use of the dredge spoils are reviewed as part of this ten year permit.	3
LONG TERM SOLUTION	
Beach and dune replenishment must be an annual program to be most effective. The armoring of many beaches has impacted natural sand migration, which increases the need for human intervention.	3
SECONDARY IMPACTS	
Can reduce erosion issues (discussed elsewhere)	3
<b>ADMINISTRATIVE</b>	
STAFFING	
Town collects funds through the beach, harbor and off-road vehicle accounts to fund necessary engineering efforts. The town contracts with the County Dredge to undertake the work.	3
FUNDING ALLOCATED	
The town dedicates a portion of their beach, harbor and off-road vehicle	3

funds for dredge and beach nourishment.	
<b>MAINTENANCE OPERATIONS</b>	
Annual dredging and beach nourishment	3
<b>POLITICAL</b>	
<b>POLITICAL SUPPORT</b>	
There is political support. The town relies heavily on visitors to our beaches and harbor during the summer months to support the local economy. Maintaining the harbor and the beaches is a must to protecting this economic interest.	3
<b>LOCAL SUPPORT</b>	
There is support for maintaining the beaches and dunes. Public education has helped to reduce opposition to this allocation of funds.	3
<b>PUBLIC SUPPORT</b>	
Support comes from users when they are adversely impacted by reduced beach area for swimmers and four-wheel drive.	3
<b>LEGAL</b>	
<b>STATE AUTHORITY</b>	
State regulates beach and dune restoration through environmental permitting process. The town has successfully completed a ten-year dredge permit renewal. Some hurdles raised by environmental and regional regulatory agencies slowed this process, but the issues raised were not insurmountable.	2
<b>EXISTING LOCAL AUTHORITY</b>	
Town oversees replenishment efforts through Conservation and Beach staff.	3
<b>POTENTIAL LEGAL CHALLENGE</b>	
Incorrect permitting submittals, endangered species, etc. can all lead to legal challenges.	1
<b>ECONOMIC</b>	
<b>BENEFIT OF ACTION</b>	
Beach and dune replenishment preserves what Dennis is all about, our beaches. In addition, these efforts protect nearby properties from	3

flooding. The benefit of the actions are tremendous.	
<b>COST OF ACTION</b>	
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
<b>CONTRIBUTES TO ECONOMIC GOALS</b>	
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
<b>OUTSIDE FUNDING REQUIRED</b>	
Outside funding comes from Barnstable County. Other resources are needed as well.	2
<b>ENVIRONMENTAL</b>	
<b>EFFECTS ON LAND/WATER</b>	
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
<b>EFFECTS OF HAZMAT WASTE SITES</b>	
Dredge materials need to be tested to ensure it is not contaminated.	1
<b>CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS</b>	
Protecting the dunes and beaches are consistent with the environmental goals of Dennis.	3
<b>CONSISTENT WITH FEDERAL LAWS</b>	
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
<b>HAZARD</b>	
<b><i>Flood (coastal storm surge, storm tides &amp; wave action, erosion, and sea level rise)</i></b>	
<b>STRUCTURAL PROJECTS</b>	

ACTION/TIMEFRAME	SCORE
Storm water Control Adopted October 2009	50
<b>SOCIAL</b>	
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
<b>TECHNICAL</b>	
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
<b>ADMINISTRATIVE</b>	
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
<b>POLITICAL</b>	

<b>POLITICAL SUPPORT</b>	
Political support exists for storm water regulations and proper storm water design.	3
<b>LOCAL SUPPORT</b>	
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
<b>PUBLIC SUPPORT</b>	
Overall there is public support for the concept of storm water control.	3
<b>LEGAL</b>	
<b>STATE AUTHORITY</b>	
EPA Storm Water Control requirements have established a mandate for the state and town to meet storm water control guidelines.	3
<b>EXISTING LOCAL AUTHORITY</b>	
The town has existing regulations on the books for storm water improvements	3
<b>POTENTIAL LEGAL CHALLENGE</b>	
Storm water controls may lead to legal challenges as we dictate who must control water run-off.	1
<b>ECONOMIC</b>	
<b>BENEFIT OF ACTION</b>	
Controlling storm water will protect property investments	3
<b>COST OF ACTION</b>	
Storm water control systems are costly in regards to construction and maintenance costs.	1
<b>CONTRIBUTES TO ECONOMIC GOALS</b>	
Protecting properties from flooding promotes the town's economic goals.	3
<b>OUTSIDE FUNDING REQUIRED</b>	
Yes	2
<b>ENVIRONMENTAL</b>	

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 &amp; wave action, erosion, and sea level rise)</i>	
STRUCTURAL PROJECTS	
ACTION/TIMEFRAME	SCORE
Physical intervention – restoring river flow (culverts) Ongoing	53
<b>SOCIAL</b>	
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
<b>TECHNICAL</b>	
TECHNICAL FEASIBILITY	
Dennis has completed several projects.	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	2

vegetation. There have also been complaints that work on at least one culvert has increased siltation of Sesuit Harbor.	
<b>ADMINISTRATIVE</b>	
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
<b>POLITICAL</b>	
POLITICAL SUPPORT	
Support has been present.	3
LOCAL SUPPORT	
Split decision for affected neighborhoods.	2
PUBLIC SUPPORT	
Existing projects have been well received.	3
<b>LEGAL</b>	
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
<b>ECONOMIC</b>	
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
<b>ENVIRONMENTAL</b>	
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><b>Flood (coastal storm surge, storm tides &amp; wave action, erosion, and sea level rise)</b></i>	
PREVENTION/PROPERTY PROTECTION	
ACTION/TIMEFRAME	SCORE
Regulatory – Coastal Bank Setbacks Adopted 2005.	63
<b>SOCIAL</b>	
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
<b>TECHNICAL</b>	

<b>TECHNICAL FEASIBILITY</b>	
By-law presently on the books and enforced by Building Commissioner and Board of Appeals	3
<b>LONG TERM SOLUTION</b>	
Protects these areas from encroachment and from being undermined.	3
<b>SECONDARY IMPACTS</b>	
Leaves some older structures in ill-advised areas, however has also promoted strategic retreat of structures within these setback areas	2
<b>ADMINISTRATIVE</b>	
<b>STAFFING</b>	
Handled through existing zoning channels (Building Department and Board of Appeals Office)	3
<b>FUNDING ALLOCATED</b>	
Existing	3
<b>MAINTENANCE OPERATIONS</b>	
None	3
<b>POLITICAL</b>	
<b>POLITICAL SUPPORT</b>	
Strong	3
<b>LOCAL SUPPORT</b>	
Everyone knows what to expect	3
<b>PUBLIC SUPPORT</b>	
Adopted unanimously at Town Meeting	3
<b>LEGAL</b>	
<b>STATE AUTHORITY</b>	
State Zoning Act	3
<b>EXISTING LOCAL AUTHORITY</b>	
Zoning By-law	3

POTENTIAL LEGAL CHALLENGE	
Typical of any zoning decision	2
<b>ECONOMIC</b>	
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
<b>ENVIRONMENTAL</b>	
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	
<b><i>Flood (coastal storm surge, storm tides &amp; wave action, erosion, and sea level rise)</i></b>	
PUBLIC EDUCATION AND AWARENESS	
ACTION/TIMEFRAME	SCORE
Barrier Beach Management Plan Committee - Committee created 2009	58
<b>SOCIAL</b>	

<b>COMMUNITY ACCEPTANCE</b>	
Erosion at Chapin’s Beach over the past several years from summer and winter storms has raised awareness of the problems faced by these sensitive areas.	3
<b>EFFECTS ON SEGMENT OF POPULATION</b>	
Erosion of barrier beaches affect beach users as well as property owners behind the beach. The Committee, with the assistance of the Dennis Natural Resources Department have effectively transmitted the message to all town residents of the risks the town faces if the barrier beaches are broached by flooding.	3
<b>TECHNICAL</b>	
<b>TECHNICAL FEASIBILITY</b>	
The educational aspect of this project is do-able. The challenge will be in restoring and maintaining these areas.	3
<b>LONG TERM SOLUTION</b>	
Public education will need to be an ongoing effort.	3
<b>SECONDARY IMPACTS</b>	
Failure to educate the public could have dire impacts.	2
<b>ADMINISTRATIVE</b>	
<b>STAFFING</b>	
Efforts fall to the Natural Resources Department.	1
<b>FUNDING ALLOCATED</b>	
No new funding allocated.	1
<b>MAINTENANCE OPERATIONS</b>	
Ongoing costs will be incurred.	1
<b>POLITICAL</b>	
<b>POLITICAL SUPPORT</b>	
Strong support	3
<b>LOCAL SUPPORT</b>	
Users understand the issues	3

PUBLIC SUPPORT	
Strong.	3
<b>LEGAL</b>	
STATE AUTHORITY	
None needed	3
EXISTING LOCAL AUTHORITY	
Yes	3
POTENTIAL LEGAL CHALLENGE	
Possible over environmental permitting	2
<b>ECONOMIC</b>	
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
<b>ENVIRONMENTAL</b>	
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	
<b><i>Flood (coastal storm surge, storm tides &amp; wave action, erosion, and sea level rise)</i></b>	
PUBLIC EDUCATION AND AWARENESS	
ACTION/TIMEFRAME	SCORE
Code Red, Electronic Message Board, Police Department Website	64
<b>SOCIAL</b>	
COMMUNITY ACCEPTANCE	
After initial negative reaction before Code Red was implemented, the deployment of the system to warn neighborhoods, or the entire town of possible storms has been well received.	3
EFFECTS ON SEGMENT OF POPULATION	
Benefits all residents	3
<b>TECHNICAL</b>	
TECHNICAL FEASIBILITY	
All items are easily implemented and have been implemented by the Dennis Police Department	3
LONG TERM SOLUTION	
Public education is an ongoing effort.	3
SECONDARY IMPACTS	
Failure to educate the public leaves the public unprepared.	2
<b>ADMINISTRATIVE</b>	
STAFFING	
Efforts fall to the Dennis Police Department.	2
FUNDING ALLOCATED	
Funded at Town Meeting	3
MAINTENANCE OPERATIONS	
Ongoing costs are within the Dennis Police Budget	3
<b>POLITICAL</b>	

POLITICAL SUPPORT	
Strong support	3
LOCAL SUPPORT	
Users understand the issues	3
PUBLIC SUPPORT	
Strong.	3
<b>LEGAL</b>	
STATE AUTHORITY	
None needed	3
EXISTING LOCAL AUTHORITY	
Yes	3
POTENTIAL LEGAL CHALLENGE	
None	3
<b>ECONOMIC</b>	
BENEFIT OF ACTION	
Positive on all levels	3
COST OF ACTION	
Education is cost effective	3
CONTRIBUTES TO ECONOMIC GOALS	
Yes	3
OUTSIDE FUNDING REQUIRED	
Not for education	3
<b>ENVIRONMENTAL</b>	
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	
<b><i>Flood (coastal storm surge, storm tides &amp; wave action, erosion, and sea level rise)</i></b>	
NATURAL RESOURCE PROTECTION	
ACTION/TIMEFRAME	SCORE
Regulating construction projects within and adjacent to protected wetlands. Ongoing	65
<b>SOCIAL</b>	
COMMUNITY ACCEPTANCE	
Dennis was the first community to adopt its own local wetland regulations. These regulations have been generally well received since adoption.	3
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 since the development of the 2011 MHM Plan has become more aggressive regarding what occurs 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.	3
<b>TECHNICAL</b>	
TECHNICAL FEASIBILITY	
Wetland regulations is doable and has been undertaken for many years. Since the development of the 2011 MHM Plan enforcement of violations has been ramped up.	3
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

<b>SECONDARY IMPACTS</b>	
Wetland regulations generally direct development efforts away from these protected resources. Secondary impacts include protecting wildlife corridors.	3
<b>ADMINISTRATIVE</b>	
<b>STAFFING</b>	
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.	3
<b>FUNDING ALLOCATED</b>	
Funding for technical review comes from applicants, funding for enforcement must come from the town.	3
<b>MAINTENANCE OPERATIONS</b>	
The town must oversee and enforce the by-law as it relates to illegal activities within wetland resource areas. Since the completion of the 2011 MHM Plan the Natural Resources Staff has become more aggressive in ensuring that applicants for work within setback areas have submitted appropriate Certificates of Compliance.	3
<b>POLITICAL</b>	
<b>POLITICAL SUPPORT</b>	
Political support is strong	3
<b>LOCAL SUPPORT</b>	
Local support is strong	3
<b>PUBLIC SUPPORT</b>	
Public support is strong	3
<b>LEGAL</b>	
<b>STATE AUTHORITY</b>	
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
<b>EXISTING LOCAL AUTHORITY</b>	

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
<b>ECONOMIC</b>	
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
<b>ENVIRONMENTAL</b>	
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	
<b><i>Flood (coastal storm surge, storm tides &amp; wave action, erosion, and sea level rise)</i></b>	
STRUCTURAL PROJECTS	

ACTION/TIMEFRAME	SCORE
Beach armoring Ongoing	44
<b>SOCIAL</b>	
COMMUNITY ACCEPTANCE	
Beach armoring has been used by the town and residents to attempt to protect properties adjacent to the beaches. Hardscape treatments (revetments and such) are no longer permitted under state wetlands provisions except in special cases. Softscape treatments (choir rolls and fabric) are permissible.	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. The town is moving forward with the use of softscape approaches to areas that have been hard hit in recent winters.	2
<b>TECHNICAL</b>	
TECHNICAL FEASIBILITY	
Softscape 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
<b>ADMINISTRATIVE</b>	
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	
On a project by project basis	2

<b>MAINTENANCE OPERATIONS</b>	
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
<b>POLITICAL</b>	
<b>POLITICAL SUPPORT</b>	
Political support for armoring has been strong	3
<b>LOCAL SUPPORT</b>	
Residents want their beaches protected so they are supportive of these efforts	3
<b>PUBLIC SUPPORT</b>	
The larger public supports these efforts as well	3
<b>LEGAL</b>	
<b>STATE AUTHORITY</b>	
Significant permitting efforts are required for armoring projects. Revetments and similar treatments can only be maintained or permitted in limited applications. Softscape treatments are more acceptable and permissible.	2
<b>EXISTING LOCAL AUTHORITY</b>	
Local wetland permitting is also needed	2
<b>POTENTIAL LEGAL CHALLENGE</b>	
As the adverse, secondary impacts are identified for armoring projects, especially due to erosion on nearby properties, the risk of challenge will increase	1
<b>ECONOMIC</b>	
<b>BENEFIT OF ACTION</b>	
Protecting beaches is critical in Dennis as tourism is the key to the local economy	3
<b>COST OF ACTION</b>	
Armoring is very costly	1
<b>CONTRIBUTES TO ECONOMIC GOALS</b>	

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	
<b>Wind (from hurricanes, coastal storms, nor'easters)</b>	
PREVENTION	
ACTION/TIMEFRAME	SCORE
Building Standards - Ongoing	60
<b>SOCIAL</b>	
COMMUNITY ACCEPTANCE	
The State Building Code was amended prior to the 2011 MHM Plan 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.	3
EFFECTS ON SEGMENT OF POPULATION	
Everyone who builds or undertakes renovations over a particular percentage of property value.	3

<b>TECHNICAL</b>	
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
<b>ADMINISTRATIVE</b>	
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
<b>POLITICAL</b>	
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
<b>LEGAL</b>	
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
<b>ECONOMIC</b>	
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	
<b>Wind (from hurricanes, coastal storms, nor'easters)</b>	
PUBLIC EDUCATION AND AWARENESS	
ACTION/TIMEFRAME	SCORE
Code Red, Electronic Message Board, Police Department Website	64
<b>SOCIAL</b>	
COMMUNITY ACCEPTANCE	
After initial negative reaction before Code Red was implemented, the deployment of the system to warn neighborhoods, or the entire town of possible storms has been well received.	3
EFFECTS ON SEGMENT OF POPULATION	
Benefits all residents	3
<b>TECHNICAL</b>	
TECHNICAL FEASIBILITY	
All items are easily implemented and have been implemented by the Dennis Police Department	3
LONG TERM SOLUTION	
Public education is an ongoing effort.	3
SECONDARY IMPACTS	
Failure to educate the public leaves the public unprepared.	2
<b>ADMINISTRATIVE</b>	
STAFFING	
Efforts fall to the Dennis Police Department.	2
FUNDING ALLOCATED	
Funded at Town Meeting	3
MAINTENANCE OPERATIONS	
Ongoing costs are within the Dennis Police Budget	3
<b>POLITICAL</b>	

POLITICAL SUPPORT	
Strong support	3
LOCAL SUPPORT	
Users understand the issues	3
PUBLIC SUPPORT	
Strong.	3
<b>LEGAL</b>	
STATE AUTHORITY	
None needed	3
EXISTING LOCAL AUTHORITY	
Yes	3
POTENTIAL LEGAL CHALLENGE	
None	3
<b>ECONOMIC</b>	
BENEFIT OF ACTION	
Positive on all levels	3
COST OF ACTION	
Education is cost effective	3
CONTRIBUTES TO ECONOMIC GOALS	
Yes	3
OUTSIDE FUNDING REQUIRED	
Not for education	3
<b>ENVIRONMENTAL</b>	
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	
<b>Wind (from hurricanes, coastal storms, nor'easters)</b>	
NATURAL RESOURCE PROTECTION	
ACTION/TIMEFRAME	SCORE
Beach and Dune Replenishment Committee formed 2009, strategy developed 2010, implementation ongoing since 2010.	58
<b>SOCIAL</b>	
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
<b>TECHNICAL</b>	
TECHNICAL FEASIBILITY	
The town has updated its ten year dredge permit for town waters. The sand that is dredged is used for beach nourishment. The use of the dredge spoils are reviewed as part of this ten year permit.	3
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.	3
SECONDARY IMPACTS	
Can reduce erosion issues (discussed elsewhere)	3
<b>ADMINISTRATIVE</b>	
STAFFING	
Town collects funds through the beach, harbor and off-road vehicle accounts to fund necessary engineering efforts. The town contracts with the County Dredge to undertake the work.	3
FUNDING ALLOCATED	

The town dedicates a portion of their beach, harbor and off-road vehicle funds for dredge and beach nourishment.	3
<b>MAINTENANCE OPERATIONS</b>	
Annual dredging and beach nourishment	3
<b>POLITICAL</b>	
<b>POLITICAL SUPPORT</b>	
There is political support. The town relies heavily on visitors to our beaches and harbor during the summer months to support the local economy. Maintaining the harbor and the beaches is a must to protecting this economic interest.	3
<b>LOCAL SUPPORT</b>	
There is support for maintaining the beaches and dunes. Public education has helped to reduce opposition to this allocation of funds.	3
<b>PUBLIC SUPPORT</b>	
Support comes from users when they are adversely impacted by reduced beach area for swimmers and four-wheel drive.	3
<b>LEGAL</b>	
<b>STATE AUTHORITY</b>	
State regulates beach and dune restoration through environmental permitting process. The town has successfully competed a ten-year dredge permit renewal. Some hurdles raised by environmental and regional regulatory agencies slowed this process, but the issues raised were not insurmountable.	2
<b>EXISTING LOCAL AUTHORITY</b>	
Town oversees replenishment efforts through Conservation and Beach staff.	3
<b>POTENTIAL LEGAL CHALLENGE</b>	
Incorrect permitting submittals, endangered species, etc. can all lead to legal challenges.	1
<b>ECONOMIC</b>	
<b>BENEFIT OF ACTION</b>	
Beach and dune replenishment preserves what Dennis is all about, our	3

beaches. In addition, these efforts protect nearby properties from flooding. The benefit of the actions are tremendous.	
<b>COST OF ACTION</b>	
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
<b>CONTRIBUTES TO ECONOMIC GOALS</b>	
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
<b>OUTSIDE FUNDING REQUIRED</b>	
Outside funding comes from Barnstable County. Other resources are needed as well.	2
<b>ENVIRONMENTAL</b>	
<b>EFFECTS ON LAND/WATER</b>	
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
<b>EFFECTS OF HAZMAT WASTE SITES</b>	
Dredge materials need to be tested to ensure it is not contaminated.	1
<b>CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS</b>	
Protecting the dunes and beaches are consistent with the environmental goals of Dennis.	3
<b>CONSISTENT WITH FEDERAL LAWS</b>	
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
<b>HAZARD</b>	
<b><i>Wind (from hurricanes, coastal storms, nor'easters)</i></b>	
<b>PROPERTY PROTECTION</b>	

ACTION/TIMEFRAME	SCORE
Pursue available grants for retrofits of private and public facilities	58
<b>SOCIAL</b>	
COMMUNITY ACCEPTANCE	
The Planning Department has had several requests for assistance with pursuing FEMA funding for protection against hurricanes damage.	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	3
<b>TECHNICAL</b>	
TECHNICAL FEASIBILITY	
Grants for retrofits are available, however funding is limited	2
LONG TERM SOLUTION	
Wind damage is pervasive throughout town. CDBG grants have been used for assisting low income households update roofs to modern standards.	2
SECONDARY IMPACTS	
Reinvestment in properties exposed to strong storm impacts will ensure that structures remain in at risk areas	2
<b>ADMINISTRATIVE</b>	
STAFFING	
Town will need to provide staff to seek and oversee grants	1
FUNDING ALLOCATED	
CDBG funds	2
MAINTENANCE OPERATIONS	
None	3
<b>POLITICAL</b>	
POLITICAL SUPPORT	
The town recognizes the need to help people and properties in at risk	3

areas	
<b>LOCAL SUPPORT</b>	
The residents in the most at-risk areas are beginning to solicit the town to pursue these type of grants	3
<b>PUBLIC SUPPORT</b>	
The general public will support protecting their neighbors investments, to a point.	3
<b>LEGAL</b>	
<b>STATE AUTHORITY</b>	
Yes	3
<b>EXISTING LOCAL AUTHORITY</b>	
Yes	3
<b>POTENTIAL LEGAL CHALLENGE</b>	
None	3
<b>ECONOMIC</b>	
<b>BENEFIT OF ACTION</b>	
Protects property values	3
<b>COST OF ACTION</b>	
Funding needs will be significant	2
<b>CONTRIBUTES TO ECONOMIC GOALS</b>	
Protecting property values promotes the town's economic goals	3
<b>OUTSIDE FUNDING REQUIRED</b>	
Yes	2
<b>ENVIRONMENTAL</b>	
<b>EFFECTS ON LAND/WATER</b>	
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
<b>EFFECTS OF HAZMAT WASTE SITES</b>	

Could reduce risk of toxic releases	3
CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS	
Yes	3
CONSISTENT WITH FEDERAL LAWS	
Yes	3
HAZARD	
<b>Wind (from hurricanes, coastal storms, nor'easters)</b>	
PUBLIC EDUCATION AND AWARENESS	
ACTION/TIMEFRAME	SCORE
Inform public about building code requirements - Ongoing	64
<b>SOCIAL</b>	
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 provides information to the public about these new standards	3
EFFECTS ON SEGMENT OF POPULATION	
The wind standards affect all residents.	3
<b>TECHNICAL</b>	
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
<b>ADMINISTRATIVE</b>	

<b>STAFFING</b>	
Planning Staff maintains the town Planning Weblog and also regularly issues press releases on important subjects in town.	3
<b>FUNDING ALLOCATED</b>	
Regular department budget	2
<b>MAINTENANCE OPERATIONS</b>	
No long term maintenance requirements, once the piece is written it will not need much up-keep	3
<b>POLITICAL</b>	
<b>POLITICAL SUPPORT</b>	
There is political support in town for educating the public on important information	3
<b>LOCAL SUPPORT</b>	
Yes	3
<b>PUBLIC SUPPORT</b>	
Yes	3
<b>LEGAL</b>	
<b>STATE AUTHORITY</b>	
Yes	3
<b>EXISTING LOCAL AUTHORITY</b>	
Yes	3
<b>POTENTIAL LEGAL CHALLENGE</b>	
None	3
<b>ECONOMIC</b>	
<b>BENEFIT OF ACTION</b>	
Positive as better public awareness may remove fears of improving older homes	3
<b>COST OF ACTION</b>	
Cost benefit will be positive as this would be a low cost item for the town	3

which would be outweighed by long term savings to just a single homeowner	
CONTRIBUTES TO ECONOMIC GOALS	
Yes	3
OUTSIDE FUNDING REQUIRED	
Possibly	2
<b>ENVIRONMENTAL</b>	
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	
<b>Wildfire</b>	
PREVENTION	
ACTION/TIMEFRAME	SCORE
Reduce Fuel Sources through mechanical devices, prescribed burns or selective cutting - Ongoing	61
<b>SOCIAL</b>	
COMMUNITY ACCEPTANCE	
Mechanical and selective cutting along with targeted controlled burns are a regular part of the Town of Dennis open lands maintenance program. Natural Resources staff works with public and private agencies to determine the needs and proper approach. No town opposition has arisen to these strategies and they have become popular with the Dennis Conservation Trust.	3
EFFECTS ON SEGMENT OF POPULATION	
No opposition has been voiced. Users of the properties support the maintenance programs in place.	3
<b>TECHNICAL</b>	
TECHNICAL FEASIBILITY	
Ongoing as part of routine property maintenance.	3
LONG TERM SOLUTION	
On-going routine maintenance, not a long term one time only fix	1
SECONDARY IMPACTS	
Minimal	3
<b>ADMINISTRATIVE</b>	
STAFFING	
Activities have become a part of routing Natural Resources property management efforts and are assisted by AmeriCorps personnel on a seasonal basis.	3
FUNDING ALLOCATED	
Regular staff budget supplemented with special project requests and	2

grants	
<b>MAINTENANCE OPERATIONS</b>	
Since the 2011 MHM Plan adoption this has become a part of the town's on-going maintenance commitment	3
<b>POLITICAL</b>	
<b>POLITICAL SUPPORT</b>	
Strong support including from private conservation groups	3
<b>LOCAL SUPPORT</b>	
Strong support including from private conservation groups	3
<b>PUBLIC SUPPORT</b>	
Strong support including from private conservation groups	3
<b>LEGAL</b>	
<b>STATE AUTHORITY</b>	
Yes	3
<b>EXISTING LOCAL AUTHORITY</b>	
Yes	3
<b>POTENTIAL LEGAL CHALLENGE</b>	
Minimal possibility	2
<b>ECONOMIC</b>	
<b>BENEFIT OF ACTION</b>	
Fire protection provides economic benefit	3
<b>COST OF ACTION</b>	
Cost of inaction could dramatically affect the summer tourist experience	3
<b>CONTRIBUTES TO ECONOMIC GOALS</b>	
Supports resident and tourist activities.	3
<b>OUTSIDE FUNDING REQUIRED</b>	
Yes would definitely help	2

<b>ENVIRONMENTAL</b>	
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	
<b>Wildfire</b>	
PUBLIC EDUCATION AND AWARENESS	
ACTION/TIMEFRAME	SCORE
Conduct informational workshops regarding strategies to reduce wildfire risk within wildland and residential interface - ongoing	56
<b>SOCIAL</b>	
COMMUNITY ACCEPTANCE	
Educational activities are well received	3
EFFECTS ON SEGMENT OF POPULATION	
Would provide positive information for population	3
<b>TECHNICAL</b>	
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

<b>ADMINISTRATIVE</b>	
STAFFING	
Uses existing staff	1
FUNDING ALLOCATED	
Regular department budget	1
MAINTENANCE OPERATIONS	
None	3
<b>POLITICAL</b>	
POLITICAL SUPPORT	
Supported by town bodies	3
LOCAL SUPPORT	
Supported by residents in the affected areas	3
PUBLIC SUPPORT	
Supported town wide	3
<b>LEGAL</b>	
STATE AUTHORITY	
Yes	3
EXISTING LOCAL AUTHORITY	
Yes	3
POTENTIAL LEGAL CHALLENGE	
None	3
<b>ECONOMIC</b>	
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
<b>ENVIRONMENTAL</b>	
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	
<b>Wildfire</b>	
PUBLIC EDUCATION AND AWARENESS	
ACTION/TIMEFRAME	SCORE
Conduct informational workshops regarding strategies to reduce urban wildfire risk - ongoing	56
<b>SOCIAL</b>	
COMMUNITY ACCEPTANCE	
Educational activities are well received	3
EFFECTS ON SEGMENT OF POPULATION	
Would provide positive information for residents and businesses	3
<b>TECHNICAL</b>	
TECHNICAL FEASIBILITY	
Definitely can be done	3
LONG TERM SOLUTION	

Provides short term information and would need to be repeated	1
<b>SECONDARY IMPACTS</b>	
Raises public awareness	2
<b>ADMINISTRATIVE</b>	
<b>STAFFING</b>	
Uses existing staff	1
<b>FUNDING ALLOCATED</b>	
Existing departmental budgets	1
<b>MAINTENANCE OPERATIONS</b>	
None	3
<b>POLITICAL</b>	
<b>POLITICAL SUPPORT</b>	
Supported by town bodies	3
<b>LOCAL SUPPORT</b>	
Supported by residents in the affected areas	3
<b>PUBLIC SUPPORT</b>	
Supported town wide	3
<b>LEGAL</b>	
<b>STATE AUTHORITY</b>	
Yes	3
<b>EXISTING LOCAL AUTHORITY</b>	
Yes	3
<b>POTENTIAL LEGAL CHALLENGE</b>	
None	3
<b>ECONOMIC</b>	
<b>BENEFIT OF ACTION</b>	
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
<b>ENVIRONMENTAL</b>	
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	
<b>Wildfire</b>	
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 - Ongoing	64
<b>SOCIAL</b>	
COMMUNITY ACCEPTANCE	
Generally this will result in up-zoning properties to allow increased economic return from a property. Dennis has adopted two Village Center By-laws affecting the two village most at risk of wildfires. These rezonings have led to reinvestment and upgrading of fire suppression in these areas. The town has also adopted a zoning change affecting the densest cottage areas, one property has moved forward with upgrades since this rezoning.	3

<b>EFFECTS ON SEGMENT OF POPULATION</b>	
Potential to reinvest and protect property owner investments benefit a cross-section of those in the three targeted areas.	3
<b>TECHNICAL</b>	
<b>TECHNICAL FEASIBILITY</b>	
Re-zoning has been adopted in the three targeted areas.	3
<b>LONG TERM SOLUTION</b>	
The impacts of re-zoning can take years to be implemented, zoning is clearly long-term.	3
<b>SECONDARY IMPACTS</b>	
Property improvements, increased property value, new economic opportunities.	3
<b>ADMINISTRATIVE</b>	
<b>STAFFING</b>	
This is part of the normal staffing operations of the Planning Department	3
<b>FUNDING ALLOCATED</b>	
Accomplished within existing budgetary constraints.	3
<b>MAINTENANCE OPERATIONS</b>	
None	3
<b>POLITICAL</b>	
<b>POLITICAL SUPPORT</b>	
There is strong political support for revitalizing the villages and the waterfront cottage areas.	3
<b>LOCAL SUPPORT</b>	
Overwhelming support at town meeting for rezoning all three targeted areas.	3
<b>PUBLIC SUPPORT</b>	
Strong support through-out town.	3
<b>LEGAL</b>	

STATE AUTHORITY	
State zoning act	3
EXISTING LOCAL AUTHORITY	
Yes	3
POTENTIAL LEGAL CHALLENGE	
Any zoning decision is open to challenge	2
<b>ECONOMIC</b>	
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
<b>ENVIRONMENTAL</b>	
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	

<b>Shoreline erosion (from shoreline change)</b>	
PREVENTION	
ACTION/TIMEFRAME	SCORE
Regulatory – Coastal Bank Setbacks Ongoing	63
<b>SOCIAL</b>	
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
<b>TECHNICAL</b>	
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, however has also promoted strategic retreat of structures within these setback areas	2
<b>ADMINISTRATIVE</b>	
STAFFING	
Handled through existing zoning channels (Building Department and Board of Appeals Office)	3
FUNDING ALLOCATED	
Existing	3
MAINTENANCE OPERATIONS	
None	3
<b>POLITICAL</b>	

POLITICAL SUPPORT	
Strong	3
LOCAL SUPPORT	
Everyone knows what to expect	3
PUBLIC SUPPORT	
Adopted unanimously a Town Meeting	3
<b>LEGAL</b>	
STATE AUTHORITY	
State Zoning Act	3
EXISTING LOCAL AUTHORITY	
Zoning By-law	3
POTENTIAL LEGAL CHALLENGE	
Typical of any zoning decision	2
<b>ECONOMIC</b>	
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
<b>ENVIRONMENTAL</b>	
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	
<b><i>Shoreline erosion (from shoreline change)</i></b>	
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. Ongoing	59
<b>SOCIAL</b>	
COMMUNITY ACCEPTANCE	
Mixed, some object to the idea of houses on stilts	2
EFFECTS ON SEGMENT OF POPULATION	
In 2013 Zoning was amended to promote elevating structures within flood resource areas. In the most critical coastal resource areas this has removed penalties otherwise associated with meeting environmental standards, especially those associated with elevating structures above shifting sands.	3
<b>TECHNICAL</b>	
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
<b>ADMINISTRATIVE</b>	
STAFFING	

Overseen by Natural Resources Staff and Conservation Commission, no new commitments of staff	3
<b>FUNDING ALLOCATED</b>	
Conservation Commission is funded	3
<b>MAINTENANCE OPERATIONS</b>	
Enforcement follow-up	2
<b>POLITICAL</b>	
<b>POLITICAL SUPPORT</b>	
The town was one of the first to adopt a Local Wetlands By-law	3
<b>LOCAL SUPPORT</b>	
Yes	3
<b>PUBLIC SUPPORT</b>	
Yes	3
<b>LEGAL</b>	
<b>STATE AUTHORITY</b>	
State authorizes the adoption of local wetland protection measures	3
<b>EXISTING LOCAL AUTHORITY</b>	
Yes	3
<b>POTENTIAL LEGAL CHALLENGE</b>	
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
<b>ECONOMIC</b>	
<b>BENEFIT OF ACTION</b>	
Reinvestment in property, reduced risk of hazards, improved beach re-nourishment	3
<b>COST OF ACTION</b>	
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
<b>ENVIRONMENTAL</b>	
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	
<b><i>Shoreline erosion (from shoreline change)</i></b>	
PUBLIC EDUCATION AND AWARENESS	
ACTION/TIMEFRAME	SCORE
Flyers, blog discussions and signage and other information on erosion and the importance of our dunes. Ongoing	57
<b>SOCIAL</b>	
COMMUNITY ACCEPTANCE	
Town public information campaigns are well received.	3
EFFECTS ON SEGMENT OF POPULATION	
Limited	2
<b>TECHNICAL</b>	
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
<b>ADMINISTRATIVE</b>	
STAFFING	
Planning Staff maintains the Planning Webblog and regularly publishes items related to flooding, sea level rise and erosion	2
FUNDING ALLOCATED	
None	1
MAINTENANCE OPERATIONS	
Needs on-going information distribution	2
<b>POLITICAL</b>	
POLITICAL SUPPORT	
The Planning Department efforts are well supported	3
LOCAL SUPPORT	
Yes	3
PUBLIC SUPPORT	
Yes	3
<b>LEGAL</b>	
STATE AUTHORITY	
None needed	3
EXISTING LOCAL AUTHORITY	
None needed	3
POTENTIAL LEGAL CHALLENGE	
None	3

<b>ECONOMIC</b>	
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
<b>ENVIRONMENTAL</b>	
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	
<b><i>Shoreline erosion (from shoreline change)</i></b>	
STRUCTURAL PROJECTS	
ACTION/TIMEFRAME	SCORE
Beach and Dune Replenishment Committee formed 2009, strategy developed 2010, implementation since 2010.	58
SOCIAL	
COMMUNITY ACCEPTANCE	
Dennis has three barrier beaches. These beaches are also major players	3

in town recreational efforts. As such, residents are infinitely aware of the need to protect and replenish these areas.	
<b>EFFECTS ON SEGMENT OF POPULATION</b>	
Beach and dune replenishment improve access for beach goers as well as provides protection for properties near these areas from flooding.	3
<b>TECHNICAL</b>	
<b>TECHNICAL FEASIBILITY</b>	
The town has updated its ten year dredge permit for town waters. The sand that is dredged is used for beach nourishment. The use of the dredge spoils are reviewed as part of this ten year permit.	3
<b>LONG TERM SOLUTION</b>	
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.	3
<b>SECONDARY IMPACTS</b>	
Can reduce erosion issues (discussed elsewhere)	3
<b>ADMINISTRATIVE</b>	
<b>STAFFING</b>	
Town collects funds through the beach, harbor and off-road vehicle accounts to fund necessary engineering efforts. The town contracts with the County Dredge to undertake the work.	3
<b>FUNDING ALLOCATED</b>	
The town dedicates a portion of their beach, harbor and off-road vehicle funds for dredge and beach nourishment.	3
<b>MAINTENANCE OPERATIONS</b>	
Annual dredging and beach nourishment	3
<b>POLITICAL</b>	
<b>POLITICAL SUPPORT</b>	
There is political support. The town relies heavily on visitors to our beaches and harbor during the summer months to support the local economy. Maintaining the harbor and the beaches is a must to protecting this economic interest.	3

<b>LOCAL SUPPORT</b>	
There is support for maintaining the beaches and dunes. Public education has helped to reduce opposition to this allocation of funds.	3
<b>PUBLIC SUPPORT</b>	
Support comes from users when they are adversely impacted by reduced beach area for swimmers and four-wheel drive.	3
<b>LEGAL</b>	
<b>STATE AUTHORITY</b>	
State regulates beach and dune restoration through environmental permitting process. The town has successfully completed a ten-year dredge permit renewal. Some hurdles raised by environmental and regional regulatory agencies slowed this process, but the issues raised were not insurmountable.	2
<b>EXISTING LOCAL AUTHORITY</b>	
Town oversees replenishment efforts through Conservation and Beach staff.	3
<b>POTENTIAL LEGAL CHALLENGE</b>	
Incorrect permitting submittals, endangered species, etc. can all lead to legal challenges.	1
<b>ECONOMIC</b>	
<b>BENEFIT OF ACTION</b>	
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
<b>COST OF ACTION</b>	
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
<b>CONTRIBUTES TO ECONOMIC GOALS</b>	
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
<b>OUTSIDE FUNDING REQUIRED</b>	

Outside funding comes from Barnstable County. Other resources are needed as well.	2
<b>ENVIRONMENTAL</b>	
<b>EFFECTS ON LAND/WATER</b>	
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
<b>EFFECTS OF HAZMAT WASTE SITES</b>	
Dredge materials need to be tested to ensure it is not contaminated.	1
<b>CONSISTENT WITH COMMUNITY ENVIRONMENTAL GOALS</b>	
Protecting the dunes and beaches are consistent with the environmental goals of Dennis.	3
<b>CONSISTENT WITH FEDERAL LAWS</b>	
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

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## **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 \_\_\_\_\_. 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 Emergency 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 Annual and long term capital improvement programming, which provides the local mechanism for turning the goals of the MHM into actual projects.
- 4 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 with the complete draft being available in web and pdf format on January 15, 2016. The Cape Cod Times and Dennis Broadsider both ran feature stories on the availability of the draft plan. Cape Cod Broadcasting also ran a report of its availability as part of its regular newscast across all their sister stations for two days January 19 and 20 2016. 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 January 15, 2016. The

Availability of the document was announced on January 18, 2016 with a public comment period running through March 30, 2016. The Dennis Planning Board held a public comment meeting on March 21, 2016 as part of the public review.

In the future, to review and update the plan, the town will utilize public forums, such as regularly scheduled Planning Board and Selectmen' Meetings; local access cable; press releases and other evolving technologies to promote public participation.



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

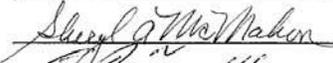
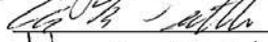
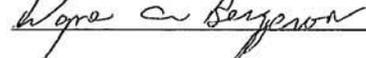
WHEREAS, the Town of Dennis Hazard Mitigation Plan contains several potential future projects to mitigate potential impacts from natural hazards in the Town of Dennis, and

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

Original on Recycled Paper

To be updated