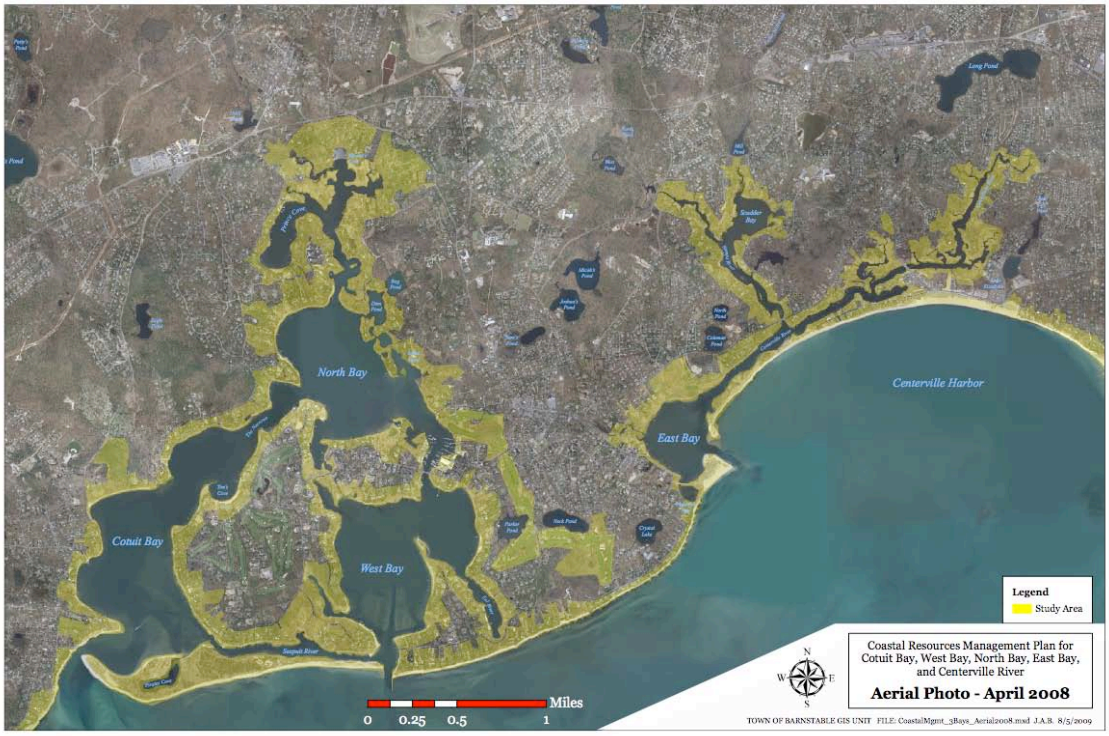
Town of Barnstable

Coastal Resource Management Plan: Three Bays and Centerville River Systems



Final Draft

November 2009

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Coastal Resource Management Committee
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This plan was prepared by Carole Ridley under the direction of the CRMC and with support from the Town of Barnstable Growth Management Department. The authors wish to thank Three Bays Preservation, Inc. for the use of bathymetric data, and the following individuals for their significant contributions to this plan:

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List of Terms and Abbreviations

Bathymetry – the measurement of water depth.

Docks and Piers – According to Ch. 703 wetlands regulations, the terms "dock" and "pier" are used interchangeably to mean the entire structure of any pier, wharf walkway, bulkhead, or float, and any part thereof, including pilings, ramps, walkways, float, tie-off pilings, dolphins and/or outhaul posts, that is located on a bank (inland) (310 CMR 10.54), land under water bodies and waterways (310 CMR 10.56), land under the ocean (310 CMR 10.25), land under a salt pond (310 CMR 10.33), rocky intertidal shore (310 CMR 10.31), or that portion of a coastal beach (310 CMR 10.27) seaward of the mean high water line. Notwithstanding the above, either a swimming float or work float, kept at a mooring, that receives a permit from the Harbormaster and is not connected with the shore, is not a float subject to the regulations.

HAB – Harmful Algal Blooms

Hydrodynamics – the measurement of the flow of water affected by tides and currents.

Marine Fisheries – Massachusetts Division of Marine Fisheries

MassDEP – Massachusetts Department of Environmental Protection

MEP – Massachusetts Estuaries Project

NDA – No Discharge Area

NHESP – Massachusetts Natural Heritage and Endangered Species Program

NWZ – No Wake Zone

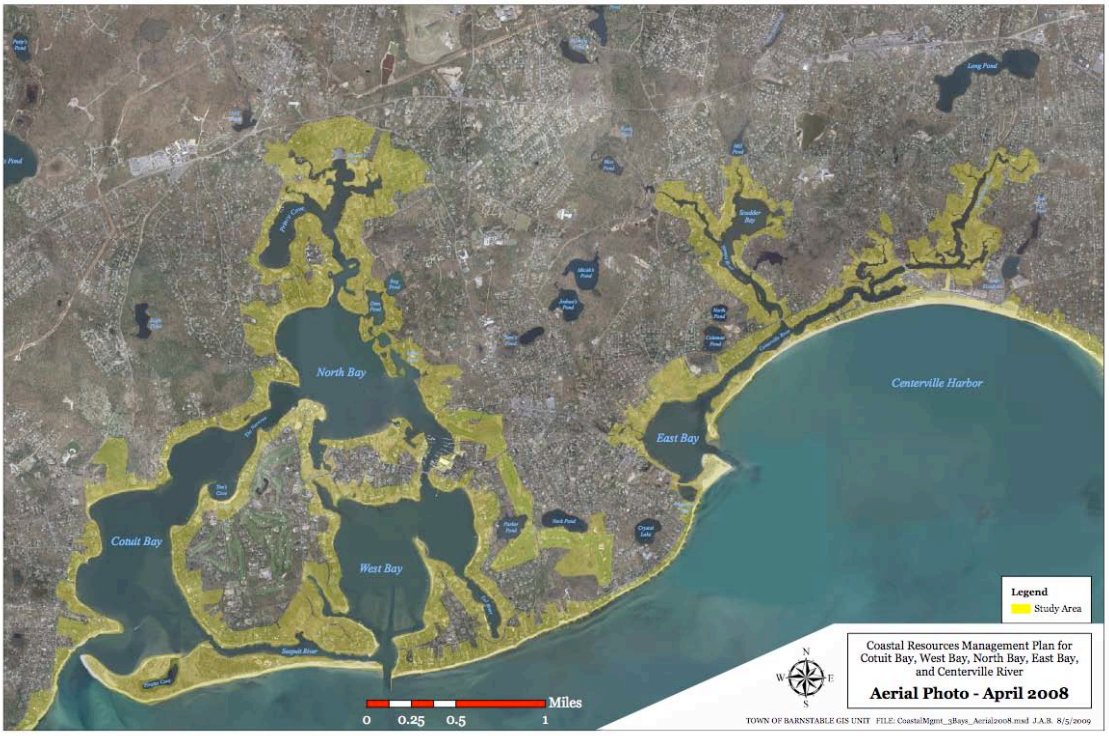
Residence Time (System) - The average time it takes for water to migrate from its location within a subembayment out to ocean waters.

Residence Time (Local) - The average time it takes for water in a subembayment to travel from a specified point in the subembayment to a specified point outside the subembayment.

SMAST - School of Marine Science and Technology, University of Massachusetts-Dartmouth

TMDL – Total Maximum Daily Load

Executive Summary



Executive Summary

Section I. Framework for the Plan

The Three Bays and Centerville River systems are among the Town's south-facing coastal resource areas. These areas are important for their scenic beauty and the important ecological functions supported by abundant natural resources. The areas also provide a wide range of public waterways access opportunities for commercial and recreational purposes.

In 1990, the *Barnstable Coastal Resources Management Plan* (1990 plan) was developed for these areas, which encompass Cotuit Bay, North Bay, West Bay, East Bay and Centerville River.

In 2008, the Town Council voted to establish the Coastal Resource Management Committee (CRMC), with staff assistance from the Growth Management Department, to review the 1990 plan and prepare an updated plan. The *Coastal Resources Management Plan: Three Bays and Centerville River Systems* (CRMP-09) is the result of that effort.

Planning Process

CRMC members include representatives of commercial and recreational shellfishing, aquaculture, private property owners, marine permitting and construction, marina operators, the Conservation Commission, the Waterways Committee, the Shellfish Committee, wastewater management and community planning. The CRMC saw as its purpose to develop a balanced plan that considered the sustainability of natural systems and the interests of a wide variety of community stakeholders. Over a period of more than eighteen months the CRMC reviewed the goals, analysis and recommended actions of the 1990 plan, collected and interpreted new data, and reached out to stakeholders.

Goals

The CRMC adopted the following goals to guide the CRMP-09:

- Protect and Enhance Natural Resources;
- Enhance Public Access;
- Protect Traditional On-the-Water Activities and Uses; and
- Enhance the Aesthetic Quality of the Coastal Area.

The CRMC found that, although planning goals today are largely the same as in 1990, some refinement of the study area was called for in light of complementary municipal planning efforts.

Study Area

The study area for the CRMP-09 includes the Three Bays and the Centerville River estuarine systems and adjacent waterfront parcels. The estuaries in the study area include nearly 2,000 acres of water surface area, 2,000 acres of land area and 59 miles of shoreline. The study area in the 1990 plan encompassed more land area within the watersheds of the two estuarine systems. However, since planning and management activities for land use and wastewater are occurring under the auspices of other municipal efforts, the CRMC determined that the study area should be more focused on near shore areas and waterways.

The Three Bays System has a total surface area of 1,251 acres. This includes Cotuit Bay (469 acres), West Bay and Eel River (343 acres), North Bay (309 acres) and Prince's/Warren's Cove and the Marstons Mills River (93 acres) which flows into North Bay and is the largest surface source of freshwater in the system.[1]

The Centerville River system has a total surface area of 622 acres. The area contains more than 230 acres of salt marsh. Prominent water features of the system include the Centerville River, East Bay, Bumps River, Scudder Bay, and Halls Creek Marsh.[2]

Section II Management Issues

The CRMP-09 addresses the following management topics:

Chapter 3. Marine Services and Facilities,
Chapter 4. Fishing and Aquaculture,
Chapter 5. Natural Resources,
Chapter 6. Coastal Landforms and Processes,
Chapter 7. Coastal Structures, and
Chapter 8. Coastal Land Use and Access.

Each chapter contains a summary of resource conditions and how they have changed since 1990, a discussion of current resource management issues and a listing of recommended actions.

[1] Howes, et al. Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for Three Bays. 2006, p.65.
[2] Howes, et al. Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for Centerville River System. 2006, p.68.

Chapter 3. Marine Services and Facilities

The Three Bays and Centerville River systems provide an ideal setting for all types of boating activity. Approximately 1,667 vessels reside in the Three Bays and Centerville River systems.[3]

Municipal Boating Access Facilities

Town landings and ways to water are vital part of Barnstable's marine infrastructure and support a variety of commercial and recreational activities for homeowners and visitors of the Town. The number and capacity of town landings and ways to water have not changed appreciably since 1990. However, growth in year-round and seasonal population in the Town has placed more pressure on town landings and ways to water. Town landings and other ways to water continue to be heavily used resource areas for several months of the year and some show the stress of heavy use. The Coastal Access Plan (CAP) established in 2007 has helped to maintain boating access facilities and other ways to water, but funding for the CAP is set to expire.

Recommended actions:

3.2.3.1 Provide Ongoing Funding of the Coastal Access Program;
3.2.3.2 Conduct and Record Surveys of all Town Ways to Water;
3.2.3.3 Enforce Parking and other Use Regulations at Town Ways to Water;
3.2.3.4 Evaluate Vessel Removal Needs at Town Landings;
3.2.3.5 Evaluate Vessel Storage Options at Town Landings;
3.2.3.6 Enhance or Create New Public Ways to Water.

Moorings

There are 1,332 mooring permits issued by the Town to private individuals in the study area, which accounts for 54% of the total moorings in Town and is 118 fewer than the 1,450 mooring permits listed in the 1990 plan. As of 2008, transient, commercial or seasonal rental mooring permits accounted for 137 mooring permits or roughly 10% of the total mooring permits issued in the study area. This is down from a total of 270[4] or 19% of total mooring permits in 1990. Currently there are 444 names on waiting lists for mooring fields in the study area. All but two of the lists are closed, otherwise the number of wait-listed individuals would likely be higher, indicating strong demand for moorings.

Since 1990, the Town has developed and implemented a detailed mooring program and revised mooring regulations. These actions, along with the GPS

[3] Application for a Federal No Discharge Area Designation for the Three Bays/Centerville River Area in the Town of Barnstable, MA. 2000.

[4] The 1990 plan recorded 254 commercial, seasonal and transient rental moorings but current Harbormasters records show 270 such permits in 1990.

delineation of mooring areas, the management of mooring waiting lists for all fields, and the reduction in the overall number of moorings due to attrition have significantly addressed concerns associated with mooring density. On-going management issues include increasing the full utilization of existing mooring permits to increase access to waterways, and managing the environmental impacts of moorings and the boating activity they support.

Recommended actions:

3.3.3.1 Maintain Existing Geographic Boundaries of Mooring Fields;
3.3.3.2 Evaluate Changes to Mooring Policies, Regulations and Enforcement Practices to Enhance Utilization;
3.3.3.3 Continue to Review, Refine and Update GPS Data for Mooring Fields and Moorings;
3.3.3.4 Evaluate Alternative Mooring Technologies.

Marinas and Boat Yards

There are four marinas and five marine services businesses in the study area and all are located in the Three Bays system. Prince Cove Marina, formerly Marine Services and Electronics, was purchased by the Town in 2002 and continues to operate as a marina. These operations provide important support services for commercial and recreational boaters, and are a part of the character and heritage of the study area.

Recommended actions:

3.4.3.1 Encourage Use of Environmentally Protective Best Management Practices;
3.4.3.2 Ensure that Any Proposed Alteration to Facilities Protects Resources and Community Character.

Environmental Impacts and No Discharge Area

The highly successful No Discharge Area (NDA) designation obtained in 2001 has helped to curtail the threat to water quality from the discharge of treated boat sewage. Other environmental impacts from boating include emissions from use of internal combustion engines; accidental spillage of petrochemicals; prop dredging; erosion impacts to banks and marsh caused by vessel waking; and noise impacts from motorized vessels.

Recommended actions:

3.5.3.1 Launch a Clean Boating Public Education Campaign;
3.5.3.2 Encourage Use of Environmentally Protective Best Management Practices.

Navigable Channels and Speed Zones

The Three Bays and Centerville River systems provide an ideal setting for all types of boating activity. Channels in the system are well marked and speed controls are posted throughout. However, the potential for conflicts among boaters exists given the intensity and diversity of water-related uses.

Recommended action:

3.6.3.1 Provide Adequate Funds for Aids to Navigation and Enforcement of Waterways Regulations and Policies.

Dredging and Material Disposal

The relatively shallow depths of water throughout much of the Three Bays and Centerville River systems poses challenges to navigation. Navigable depths appear to be maintained in marked channels throughout the Three Bays system. However, shoaling is occurring in some areas including the North Bay channel, west end of Sepuit River in Cotuit Bay, the tip of Sampson's Island, and the channel at Dead Neck. The Centerville River/East Bay system is part of a multi-part town-sponsored dredging project that is now in its third phase. Material from dredging has provided an important sediment source for barrier beaches in the study area.

Recommended actions:

3.7.3.1 Continue Maintenance Dredging in Previously Licensed Dredge Sites to Historically Navigable Depths;
3.7.3.2 Carefully Evaluate Any Proposed Improvement Dredging for Clear Public Benefit.

Chapter 4. Fishing and Aquaculture

The study area includes significant shellfish resources that are valued for their ecological, environmental and cultural importance to the community. Beyond the commodity value of these resources, shellfish and finfish are important links in the estuarine ecology, and their vitality is an indicator of overall ecosystem health.

Shellfish Resource Sustainability

A variety of commercially and ecologically valuable shellfish are found throughout the study area. Quahogs and soft-shell clams are the most consistently abundant and commercially important species found within the study area. Oysters in the study area are propagated by the Town or grown in designated grant areas. Since 1990 the geographic distribution and densities of quahog and softshell clam resources have remained stable. However, nutrient loading, bacterial contamination, and impacts to habitat from piers and boating activity continue to pose management challenges.

Recommended actions:

4.2.3.1 Complete the Significant Shellfish Resource and Habitat Mapping Project;
4.2.3.2 Promote Town-wide Initiatives to Mitigate Pollution Sources.

Public Shellfish Propagation

Public shellfish propagation programs, including the in-town and out-of-town shellfish relay programs, quahog upwelling facility and the oyster propagation program, are credited with helping to replenish shellfish resources throughout the study area. The in-town relays take contaminated quahogs from the Centerville River and East Bay, and relay them to West Bay, and most recently to Bay Street, Osterville. For the out-of-town relay, mildly contaminated quahog stock from off Cape locations is purchased by the Town and transplanted into the designated shellfish relay areas.

Recommended actions:

4.3.3.1 In light of the expiration of the Temporary Recreational Shellfish Area and Shellfish Relay Area Overlay District (§240-37.1), create a zoning ordinance to establish a permanent prohibition on piers for motorized vessels in designated shellfish relay areas and designated recreational shellfishing areas shown on figure 13. Applications for seasonal piers for non-motorized vessels could be submitted for these areas subject to review under Chapter 703 performance standards (See 7.2.3.2, Amend Existing Regulatory Framework);
4.3.3.2 Develop Guidelines for Selecting and Managing Shellfish Relay Areas;
4.3.3.3 Ensure Adequate Funding to Enable Propagation Programs to Meet Demand.

Commercial and Recreational Shellfish Permitting and Management

The study area is quite popular for recreational shellfishing, and also constitutes approximately 85% of the commercial quahog harvests in the Town. Maintaining a balance between commercial and recreational shellfishing activity in the study area is a significant management objective. In response to intense fishing pressure, a cap was placed on the number of new commercial permits issued by the Town. Other management issues include impacts from docks, aboriginal fishing rights, use of hydraulic fishing methods, and the closure of a number of shellfishing areas due to poor water quality.

Recommended actions:

4.4.3.1 Maintain Cap on Commercial Shellfish Licenses;
4.4.3.2 Address the Need for Water Quality Monitoring in Closure Areas;
4.4.3.3 Monitor the Extent of Hydraulic Shellfish Harvesting;
4.4.3.4 Continue the Dialogue on Aboriginal Fishing Rights.

Disease Threats

The potential for shellfish diseases, including Quahog Parasite Unknown (QPX) in Quahogs and Dermo and Juvenile Oyster Disease (JOD) in oysters, as well as Harmful Algal Blooms (HABs) such as Red Tide pose a significant threat to shellfish resources. Yet the occurrence of diseases and HABs is somewhat beyond the Town's ability to control. However, there is concern that degradation of local water quality could create a climate more conducive to the proliferation of certain diseases and HABs.

Recommended actions:

4.5.3.1 Increase Public Education on Disease Threats;
4.5.3.2 Continue Working with Regional Institutions and State Agencies to Understand and Address Disease Threats.

Private Shellfish Aquaculture Grants

Nine private aquaculture grants cover approximately sixty-one acres in the Three Bays system. For the most part the grants are compatible with surrounding landowners and other water uses. However, conflicts occasionally do arise concerning use of certain types of aquaculture gear, proximity of grants to areas heavily used for boating, and the potential for disease outbreaks.

Recommended actions:

4.6.3.1 Thoroughly Evaluate Any Proposals to Alter or Expand Grants;
4.6.3.2 Encourage Grant Holders to Use Latest Best Management Practices.

Finfish Resource Sustainability

Common fish species throughout the study area include bluefish, white perch, striped bass, tautog, scup, and winter flounder. There is no complete inventory of species or population counts available. Fishing in the area is primarily for recreational pursuit, with limited commercial fishing activity, the same as reported in the 1990 plan.

Recommended actions:

4.7.3.1 Support Recommended Actions to Protect or Restore Water Quality, Eelgrass and Salt Marsh (5.2.3.1, 5.2.3.2, 5.3.3.2, Wastewater Management Initiatives; and 5.4.3.1, 5.4.3.2, Stormwater Management Initiatives; and 5.4.3.3, Eelgrass Restoration);
4.7.3.2 Support Recommended Actions to Protect and Enhance Public Access for Boating (3.2.3.1, Provide Ongoing Funding for Coastal Access Program; and 3.2.3.6, Enhance/Create New Ways to Water.)

Chapter 5. Natural Resources

Three Bays and the Centerville River are estuarine systems containing extensive and varied natural resources of ecological, aesthetic and economic significance. Healthy water quality, shellfish resources, and wetlands support marine activities essential to our seasonal economy, and maintain the area as a desirable place to live, which enhances the municipal tax base. As important as estuaries are, they are vulnerable to impaired water quality, and loss of eelgrass, infauna and other natural resources critical to their full functioning.

Water Quality

Three Bays and Centerville River systems are listed under the Massachusetts Surface Water Quality Standards as Class SA waters, the highest state classification for marine waters. Class SA waters should be able to support excellent habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and be used for primary and secondary contact recreation. Detailed analyses have documented water quality impairment from excessive nutrients in both systems and from bacterial contamination in the northern regions of Three Bays. Despite progress in understanding and responding to water quality threats from nitrogen loading and from bacteria, on-going efforts will be required to ensure that regulatory standards are met and water quality remains or is restored to a level consistent with healthy eelgrass and shellfish resources.

Recommended actions:

5.2.3.1.1 Dedicate Funds to Provide On-going Water Quality Monitoring to Address TMDL Compliance, Shellfish Area Closures, and Stormwater Improvement Projects;
5.2.3.1.2 Implement the Wastewater Facility Plan;
5.2.3.1.3 Support Swift Development and Implementation of the Nutrient Management Plan;
5.2.3.1.4 Promote Compliance with *Interim Regulations for the Protection of Saltwater Estuaries* (§360-45);
5.2.3.1.5 Evaluate Sewer Neutral-Growth Neutral Policies;
5.2.3.2.1 Complete any Outstanding Implementation Steps from Three Bays/Centerville River Bacterial TMDL.

Stormwater Management

Stormwater runoff can carry a wide range of pollutants (bacteria, petroleum based contaminants and heavy metals) that are harmful to marine and freshwater bodies. Since 1990 the Town has instituted a number of stormwater management projects through the Coastal Discharge Mitigation Program. Completion of multi-phased projects, implementation of additional projects, as well as ongoing maintenance of existing projects, are needed to control this pollution source.

Recommended actions:

5.3.3.1 Make Stormwater Management a High Priority;
5.3.3.2 Fully Fund the Coastal Discharge Mitigation Program;
5.3.3.3 Monitor Water Quality Pre- and Post- Management Project; and
5.3.3.4 Promote Low Impact Development Practices.

Wetland Resources

Wetland resources account for one-third of the land in the study area. These resources, which include coastal banks, beaches, dunes and salt marshes, absorb pollution before it reaches coastal waters, act as a natural buffer against storm surges, and serve as habitat to a wide variety of animals. These resources also face threats from shoreline development, which displaces opportunities for salt marshes to migrate landward, and from nutrient enrichment which is credited with a sharp loss of eelgrass in both systems.

Recommended actions:

5.4.3.1 Protect Wetlands Resources through Regulatory Reviews;
5.4.3.2 Protect Coastal Land Forms and Salt Marshes;
5.4.3.3 Address the Lack of Eelgrass.

Wildlife, Rare and Endangered Species

The study area is home to a wide variety of plants and animals, including seven state-listed rare species. These species and their habitat can be threatened by encroachment from surrounding land uses. Site clearing that removes large areas of brush or large stands of trees can significantly alter habitat for a number of species and, if not properly managed, can lead to soil erosion and sedimentation of nearby streams or wetlands. Growth in the number of invasive species, particularly plants and some marine organisms, poses additional challenges to maintaining the biodiversity of the study area.

Recommended actions:

5.5.3.1 Promote Compliance with Requirements of the Natural Heritage and Endangered Species Program;
5.5.3.2 Promote Open Space and Habitat Protection;
5.5.3.3 Implement Land Stewardship and Best Management Practices for Site Clearance or Alteration;
5.5.3.4 Develop Best Management Practices to Control or Eradicate Marine or Freshwater Invasive Species.

Fish Runs

Two of the four fish runs in the study area, the Centerville and the Marstons Mill Rivers, are maintained by the Town and are used annually by anadromous fish, primarily Alewife (herring). The Little River and the Bumps River fish runs are not maintained by the Town and therefore are often unused

by spawning fish, especially when the river flow is low. An anadromous fish run is a passageway for these fish to travel from the ocean or bay to their spawning grounds. If anadromous fish are unable to spawn, significant declines in their populations may occur.[5]

Recommended action:

5.6.3.1 Continue the Town's Stewardship of Fish Runs, and Explore Expanding Stewardship to the Other Fish Runs.

Chapter 6. Coastal Landforms & Processes

Coastal landforms and processes are largely the result of natural forces. Often the natural cycles of change at work in a coastal system are perceived as interfering with human uses of the resource area. This can occur when sediment movement blocks a channel, or when erosion and sediment transport threaten a property. Resource managers must take a long-term view in assessing the cycles of change within a coastal system to ensure that short-term measures or projects to enhance access or protect properties do not result in longer-term harm to resources areas or public access.

Coastal Landforms

The study area contains barrier beach, barrier beach-coastal beach, and barrier beach-coastal dune coastal landforms. The landforms help to protect inland areas from storm and flood damage. Coastal landforms are naturally altered by erosive forces of tides and wind, and provide a ready sediment source for beaches and shoreline areas. However, these landforms are also subject to alteration from development activity such as coastal structures (piers, revetments, etc.), storage of vessels, and public access.

Recommended actions:

6.2.3.1 Ensure Application of No Disturb Provision;
6.2.3.2 Control Erosion of Coastal Landforms to the Extent Possible;
6.2.3.3 Develop a Sediment Management Plan.

Bathymetry and Hydrodynamics

Hydrodynamics measure how water flows within an estuarine system and bathymetry measures depth of water. The flow of water is affected by many factors, including the tidal dynamics of ocean waters, coastal land features that may restrict flow, and the presence of marshes or shoals that may create friction and slow water flow. Due in part to the work undertaken for the Massachusetts Estuaries Project (MEP) and additional research conducted by Three Bays

[5] Camp, Dresser & McKee, Inc. Coastal Resources Management Plan (Draft Final) (1990.) Town of Barnstable, Massachusetts. Section 5.2.5.

Preservation, Inc., there is a solid baseline of information regarding bathymetrics and hydrodynamics in the Three Bays and Centerville River system. These conditions are influenced by the geomorphology of the two systems as well as larger tidal forces.

Recommended actions:

6.3.3.1 Continue Periodic Monitoring of Bathymetry and Hydrodynamics.

Relative Sea Level Rise

Recent publications suggest potential of approximately three feet of relative sea level rise by 2100. Possible effects include shoreline erosion, loss of wetlands and beach areas, damage to sensitive infrastructure, saltwater intrusion into wells, and elevated storm surge levels. Relative sea level rise is an impending threat to natural resources, public infrastructure and private property. Although the acceleration of sea level rise is beyond the scope of local control, the Town can adopt management practices to prepare and potentially mitigate its damaging effects.

Recommended actions:

6.4.3.1 Protect the Integrity of Coastal Features that Provide Storm Damage Protection;
6.4.3.2 Assess Potential Threats posed by Accelerated Sea Level Rise;
6.4.3.3 Develop a Local Management Plan for Sea Level Rise.

Chapter 7. Coastal Structures

Coastal structures are a dominant feature of the shoreline in both portions of the study area. Coastal structures include piers and docks, bulkheads and outhauls, among other structures that are designed to provide access to the water. Coastal structures also encompass erosion protection structures, such as revetments, groins, and jetties. In addition to their uses and benefits, coastal structures are also a man-made intrusion in a natural system, and can cause undesirable impacts to natural resources.

Piers and Docks

There are currently 410 piers in the study area compared with 223 piers in the study area reported in the 1990 plan. The vast majority of piers are for private use. According to a recent build out analysis, 260 new piers could potentially be built in the study area under existing regulations, for a total of 670 piers. Piers provide important access to the waterways and property owners should have the ability to seek a permit for a pier. However, there are concerns that growth in the number of piers could displace shellfish habitat as well as access to waterways for traditional activities.

Recommended actions:

7.2.3.1 Complete *Significant Shellfish Resource and Habitat Mapping Project*;
7.2.3.2 In light of the expiration of the Temporary Recreational Shellfish Area and Shellfish Relay Area Overlay District (§240-37.1 found in Appendix B), create a zoning ordinance to establish a permanent prohibition on piers for motorized vessels in designated shellfish relay areas and designated recreational shellfishing areas shown of Figure 13. Applications for seasonal piers for non-motorized vessels could be submitted for these areas subject to review under Chapter 703 performance standards. (See 4.3.3.1, Expiration of Temporary Overlay §240-37.1.) Regulatory or policy changes needed to enforce the recommended ordinance should be implemented.
7.2.3.3 Monitor Pier Development and Effectiveness of Chapter 703 Performance Standards;
7.2.3.4 Develop Permitting Guidelines for Outhauls and Other Private Structures.

Erosion Control Structures

Natural erosion of bluffs, beaches and dunes can result in management challenges and prompt property owners to seek measures to protect their property. Measures are needed to protect, replicate or restore natural sediment transport processes through policies and best management practices for beach nourishment, marsh restoration and by promoting alternatives to hard coastal armoring.

Recommended actions:

7.3.3.1 Support Recommendations to Develop a Sediment Management Plan;
7.3.3.2 Develop performance standards and design criteria for permitting and maintenance of erosion control structures.

Chapter 8. Coastal Land Use and Access

The Three Bays and Centerville River systems are large geographic areas that each contains numerous locales that have their own unique sense of place. The charm and character of these special places reflects many factors: dominant natural features, density of coastal land uses, historical or cultural significant buildings or structures, and well as how people access and use these areas for commercial and recreational activity.

Coastal Land Use

Single-family residential development is the dominant land use in the study area. Currently there are 647 developed lots in the study area that includes

30 lots that are vacant and could be developed as single-family residences. It also includes 53 lots that could be further subdivided into anywhere from 76 to 131 new single-family house lots, depending on whether some of the larger parcels are included.

Recommended actions:

8.2.3.1 Protect and Strengthen Waterfront Character;
8.2.3.2 Swiftly Implement Nutrient Management Initiatives (same as 5.2.3.1.1); and the Nutrient Management Plan (same as 5.2.3.1.2);
8.2.3.3 Evaluate Sewer Neutral-Growth Neutral Policies (Same as 5.2.3.1.5).

Public Access Via Ways to Water

There are twenty-four Town-owned Ways to Water in the study area, including thirteen in the Three Bays System and eleven in the Centerville River System. One-quarter of the access points are simply the width of the roadway leading to the water. The amount of land area accounted for by these town-owned access points accounts for slightly more than forty-two acres, or two percent of land in the study area. Parking and access at the boat ramps, launch areas and mooring access points is extremely limited and in heavy demand during the boating season from late spring through early fall.

Recommended actions:

8.3.3.1 Enhance or Create New Public Ways to Water;
8.3.3.2 Fund Coastal Access Program (same as 3.2.3.1);
8.3.3.3 Survey Town Ways to Water (same as 3.2.3.2).

Waterfront Character

The Town is endowed with many typical maritime features such as small villages, marinas, and mooring areas set in a diverse natural landscape of coves, marshes and beaches. It is the inherent visual quality of these features that attracts so many people to the waterfront; draws so many boats to the harbors and moorings; and brings increasing development along the land bordering the water. Protecting the visual charm of the study area is a significant planning objective.

Recommended action:

8.4.3.1 Protect and Strengthen Waterfront Character.

Section III. Implementation

The CRMP-09 is a comprehensive plan that addresses a wide range of coastal resource management issues and activities within a broad geographic area. The CRMP-09 sets forth sixty-five recommended actions that encompass research, regulation, public education and resource management. A dedicated effort will be needed to coordinate actions, monitor results, and adapt programs as necessary in light of changing needs or conditions.

Coordination

The CRMP-09 assumes that overall responsibility for implementation of the recommended actions will fall to the Town Manager, or the Town department or entity he designates to coordinate implementation efforts. The CRMC recommends that the Town Manager consider appointing a standing committee comprised of representatives of key Town departments to coordinate implementation activities.

Timeframe

Implementation of the recommended actions will necessarily be a multi-year effort. It is recommended that progress on implementation be reviewed annually and summarized in a report and presentation to the Town Council. The CRMP-09 should be updated in five to seven years, depending on the pace of implementation activities, changing conditions or new information that may become available.

Priority Actions

The following is a list of recommended actions of importance to natural resource health, and public access to and safe enjoyment of the waterways:

Protect or Restore Marine Water Quality:
- Implement the Wastewater Facility Plan (See 5.2.3.1.1);
- Support Swift Development and Implementation of the Nutrient Management Plan (See 5.2.3.1.2);
- Complete Implementation Steps from Three Bays/Centerville River Bacterial TMDL (See 5.2.3.2.1); and
- Dedicate Funds for on-going Water Quality Monitoring (See 5.2.3.1.1).

Replace the Temporary Recreational Shellfish Area and Shellfish Relay Area Overlay District (§240-37.1) Set to Expire in 2009:
- Create an ordinance to establish a permanent prohibition on piers for motorized vessels in designated shellfish relay areas and designated recreational shellfishing areas. Applications for seasonal piers for non-

motorized vessels could be submitted for these areas subject to review under Chapter 703 performance standards. (See 4.3.3.1 and 7.2.3.2)
- Develop Guidelines for Selecting and Managing Shellfish Relay Areas (See 4.3.3.2.)

Enhance Stormwater Management:
- Fully Fund the Coastal Discharge Remediation Program (See 5.3.3.2) for stormwater improvement projects and on-going maintenance; and
- Fund and undertake water quality monitoring before and after stormwater management projects are implemented (See 5.3.3.3).

Enhance Public Access to the Water:
- Fund Coastal Access Program (See 8.3.3.2 and 3.2.3.1);
- Enhance or Create New Public Way to Water (See 8.3.3.1, and 3.2.3.6).

Promote Healthy Shellfisheries:
- Complete the *Significant Shellfish Resource and Habitat Mapping Project* (See 7.2.3.1);
- Maintain Cap on Commercial Shellfish Licenses (See 4.4.3.1);
- Ensure Adequate Funding for Propagation Programs (See 4.3.3.3);
- Address Water Quality Monitoring in Closure Areas (See 4.4.3.2);
- Continue the dialogue on aboriginal fishing rights (see 4.4.3.4).

Manage Coastal Structures:
- Develop Permitting Guidelines for Outhauls and Other Private Structures (See 7.2.3.4);
- Develop performance standards and design criteria for permitting and maintenance of erosion control structures (See 7.3.3.2).

Protect Coastal Landforms:
- Assess Potential Threats posed by Relative Sea Level Rise (See 6.4.3.2) and Develop a Local Management Plan for Sea Level Rise 6.4.3.3;
- Enforce the No Disturb Buffer Zone Provision (See 6.2.3.1) and Control Erosion of Coastal Landforms to the Extent Possible (See 6.2.3.2); and
- Develop a Sediment Management Plan (See 6.2.3.3).

Section I: Framework of the Plan

Chapter 1.0 Framework for the Plan

1.1 Overview and Background

With Cape Cod Bay to the north and Nantucket Sound to the south, the Town of Barnstable is home to abundant and varied coastal resources, including harbors, bays, estuaries, salt marshes and shoreline. The extensive coastal resources are a source of local pride and scenic beauty, and they provide important ecological functions such as aquatic and terrestrial habitat, storm damage prevention, pollution attenuation, and sediment replenishment. They also support recreational and commercial activities ranging from shellfishing, fin fishing, and aquaculture to birdwatching, boating and beach-going. These activities provide important opportunities for residents and visitors of the Town to enjoy the refreshing beauty of the coastline, which in turn nurtures environmental stewardship. The activities also help to anchor the local tourism industry and support numerous marine-related businesses. In sum, the coastal resources of the Town are part of the cultural and economic fabric of the community.

The Town of Barnstable has a tradition of placing high value on the health and vitality of its coastal resources, and the public's safe use and enjoyment of those resources for commercial and recreational purposes. To that end, the Town has invested considerable resources and management expertise in developing and implementing policies and management strategies that balance the competing uses of the coastal resource areas with the delicate and significant ecological functions they serve.

The Three Bays and Centerville River systems are among the Town's south facing coastal resource areas. In 1990, the *Barnstable Coastal Resources Management Plan* (1990 plan) was developed for these areas, which encompass Cotuit Bay, North Bay, West Bay, East Bay and Centerville River. The purposes of the 1990 plan were to define current and future uses in these areas, examine the effects of the uses, and to develop policy guidelines and specific actions to help the Town manage and protect valuable coastal resources in these areas.

The process of developing the 1990 plan was a cooperative effort involving the Barnstable Coastal Resource Task Force, Barnstable Department of Planning and Development and concerned citizens of the Town. Camp Dresser McKee, Inc. was hired to coordinate development of the 1990 plan. The planning process, which is outlined in the 1990 plan, included input from a number of area residents, businesses and waterways users in identifying issues of concern and management approaches.

The 1990 plan was adopted by Town Council in 1991 and provided policy guidance to various town departments involved in the management of coastal resources in the study area. Table 1 located at the end of this chapter lists the many actions taken to implement the recommendations in the 1990 plan. Some implementation measures were modified to reflect changing conditions while maintaining the intent of the recommendations. As with any long-range effort, it became necessary to revisit the plan in light of implementation activities, changing conditions and on-going local planning activities, in order to assess progress and identify new issues and strategies.

In 2008, the Town Council voted to establish the Coastal Resource Management Committee (CRMC), with staff assistance from the Growth Management Department, to review and update the 1990 plan. The purposes of the update are to:

- Provide an update on the recommendations of the 1990 plan;
- Identify any new management issues or challenges;
- Compile all relevant community planning information ongoing in the Town with respect to the study area; and
- Provide a template for approaching the management of other coastal resources in the Town.

The *Coastal Resource Management Plan: Three Bays and Centerville River Systems* (CRMP-09) is the product of the review and update planning process undertaken by the CRMC, which is described below.

1.2 Planning Process

The CRMC saw as its purpose to develop a balanced plan that considered the sustainability of natural systems and the interests of a wide variety of stakeholders. The CRMC was constituted to include the broad range of perspectives and interests of stakeholders in the management of the area. CRMC members include representatives of commercial and recreational shellfishing, aquaculture, private property owners, marina operators, the

Conservation Commission, the Waterways Committee, wastewater management and community planning.

The CRMC met twice monthly over a period of eighteen months. The CRMC's approach to developing the CRMP-09 had the following parts:

Detailed review of the 1990 plan; The CRMC reviewed the 1990 plan to determine what had been accomplished, and identify areas and issues that required updating.

Outreach to Town Officials, Regional Experts and Stakeholders. The CRMC invited Town staff, board and commission members, and other regional experts to brief the CRMC on management activities and discuss management issues of concern. Those with whom the CRMC met included:

Department of Public Works: Dale Saad;
Marine & Environmental Affairs: Dan Horn, Joe Gibbs, Tom Marcotti;
Growth Management Department: Patty Daley, Alisha Stanley;
Health Division and Board of Health: Wayne Miller, Tom McKean;
Conservation Division and Conservation Commission: Rob Gatewood, John Abodeely;
Past Chair of CRMC: Richard Nelson;
Division of Marine Fisheries (Neil Churchill and Ross Kessler);
Three Bays Preservation, Inc.: Lindsay Council;
Massachusetts Coastal Zone Management (Stephen McKenna);
Arlene Wilson (Arlene M Wilson Associates, Inc.);
Dr. George Seaver (physical oceanographer);
Jean Crocker (resident).

The CRMC also hosted two public workshops to provide interested citizens and stakeholders the opportunity to raise issues and ideas. On August 26, 2008 the CRMC met with waterfront property owners and water dependent businesses. On September 23, 2008 the workshop focused on commercial and recreational shellfishing.

Data Collection and Analysis. With assistance from the Growth Management Department and GIS Division, the CRMC compiled data on resource conditions, use activities and infrastructure, and assessed how conditions had changed since the 1990 plan was developed. This included an updated dock and pier build-out assessment discussed in chapter 7.0.

Management Issues Assessment. Information generated from the review of the 1990 plan, outreach to experts and stakeholders, and data collection and analysis provided the basis for identifying management issues and recommended actions.

The draft CRMP-09 was developed utilizing the input and analysis generated during these stages of the planning process. The CRMC voted on August 25, 2009 to release the draft CRMP-09 for public review and initiate a public comment period. A public meeting was held on August 31, 2009 at which the plan was presented and public comments were invited. The public comment period closed on September 21, 2009. A list of individuals and organizations who commented on the draft plan is found in Appendix A. Based on comments received during the public comment period, the CRMC modified the draft plan and submitted a final CRMP-09 to the Town Council in November 2009.

Evaluation of State-approved Harbor Planning Process. As part of the Town Council's charge the CRMC was asked to evaluate whether the updated plan should be developed in accordance with regulations for state-approved Harbor Management Plans (301 CMR 23.00). To evaluate this option, the CRMC met with the Massachusetts Coastal Zone Management Cape and Islands Coordinator to review the requirements and implications of following the state harbor management planning process. They learned that the prime benefit of the state process is that it provides a degree of local flexibility and authority with regard to licensing under MGL Chapter 91 regulations, through development of amplifications to the regulations and the requirement to issue consistency findings for Chapter 91 applications. However, where the main focus of Chapter 91 licensing in the study area is on private piers rather than large-scale projects, it was felt that the Town could have ample management flexibility through local zoning and wetland regulations. Furthermore, the state-mandated process has set timeframes and procedural requirements that could make the plan more costly and time consuming to develop. For instance, state approval of the plan expires at a date set by the state, and must be renewed. In consideration of this information, the CRMC concluded that a comprehensive local coastal planning process would accomplish the objectives established by Town Council more effectively and efficiently than would proceeding in accordance with 301 CMR 23.00.

1.3 Planning Goals

The CRMC reviewed the goals articulated in the 1990 plan to assess their applicability going forward. The CRMC acknowledged that over the past decade a number of related community planning efforts have been undertaken in the Town to help address management issues and achieve the goals stated in the 1990 plan. In particular:

Residential build-out and visual impacts from development were a major focus of the 1990 plan, and the plan sought to exert greater control over land uses in the study area. Since that time a number of growth management actions have been undertaken, including ordinance changes, which address land use and aesthetic issues outlined in the 1990 plan. These include:

- Adoption and updating of the Town's Local Comprehensive Plan,
- Adoption of the Town-wide District of Critical Planning Concern and subsequent Growth Management bylaw;
- Adoption of the Resource Protection Overlay District bylaw;
- Creation of the Craigville/Centerville District of Critical Planning Concern (DCPC); and
- Amendments to the Groundwater Protection Overlay District bylaw.

Management of watershed nitrogen sources was identified as another key concern outlined in the 1990 plan. This issue of Cape-wide concern is being addressed through the Town's Comprehensive Wastewater Management Planning Process, and improvements to stormwater management. Steps include:

- Massachusetts Estuaries Project (MEP) technical reports have been completed for the Three Bays and Centerville River systems;
- Total Maximum Daily Loads (TMDLs) have been established for total nitrogen for both systems and for bacteria in Prince's Cove. These regulatory thresholds provide the basis for local wastewater management planning;
- A prioritized list of stormwater managements improvements is being implemented to address nutrient and bacterial impacts from stormwater runoff.

The CRMC recognized that these planning efforts address many of the planning goals identified in the 1990 plan, and provide a depth of focus to the issues of land use, zoning, and nutrient loading that could not be afforded in the updated CRMP-09. The updated plan does not seek to replicate these planning efforts but rather to highlight their importance in a comprehensive strategy for managing the Town's cherished coastal resources. The CRMC found that,

although the goals remain largely the same as in the 1990 plan, some refocusing of the scope and emphasis of the plan update was called for in light of complementary planning efforts.

The CRMC adopted the following goals to guide coastal resource planning and management in the study area going forward:

- **Protect and Enhance Natural Resources**: To protect and where possible regenerate the health and productivity of the natural resources of the coastal waters and adjacent land, including protection of water quality, wetlands, shellfish areas and habitat, and wildlife habitat;

- **Enhance Public Access**: To allow for adequate public access while minimizing adverse impacts to the environment and the aesthetic quality of the coastal area;

- **Protect Traditional On-the-Water Activities and Uses**: To protect historic water-related uses, including fishing, shellfishing, sailing and recreational boating, and passive recreation; minimize conflicts between water-related uses; and enhance safe navigation of the coastal area; and

- **Enhance Aesthetic Quality**: To maintain and, where possible, enhance the aesthetic, historical, and cultural quality of the coastal area.

1.4 Accomplishments

The 1990 plan contained fourteen recommendations for addressing coastal resource management issues identified at the time. As noted above, the Town has taken many steps to implement the recommendations or otherwise address the management issues. Table 1 provides a summary of the 1990 recommendations and subsequent implementation actions. Many of the implementation actions are discussed in more detail later in the CRMP-09.

1.5 Organization of the CRMP-09

The CRMP-09 is organized in four sections.

Section I: Framework, includes this introductory chapter and Chapter 2, which describes the study area.

Section II: Management Issues and Recommendations, contains Chapters 3 through 8. Each of these chapters addresses a major management topic and provides the following information:

- A description of the natural and use-related resources in the study area, how they have changed, and new information generated since the 1990 plan was developed;
- Identification of management issues associated with the management topic; and
- Proposed actions to address the management issues.

Section III: Implementation, Chapter 9, contains a summary of management recommendations and the support structure necessary to implement the recommendations.

Section IV: Maps, is a compendium of figures referenced throughout the document.

An ***Executive Summary*** precedes this chapter.

Table 1. Summary of 1990 Recommendations and Implementation Actions

Recommended Actions	Actions Taken
Establish a structure to implement the Coastal Resources Management Plan	• Implementation activities have occurred through various Town departments. • Coastal Resources Management Committee (CRMC) formed by Town Council (2008) to update 1990 plan.
Designate Coastal Resource Management Areas	• Although management areas where not formally enacted, several area designations reinforced the intent: - The Significant Shellfish Resource and Habitat Mapping Project (2001) rated shellfish habitat on a scale of 1(low) to 10(high); - Dock and Pier Overlay District (§240-37; 2001) prohibits new private docks along Cotuit Bay from Loop Beach to Handy Point; -Three Bays/Centerville Harbor No Discharge Area (2001); - GIS survey to delineate historic mooring fields (2007); - Temporary Recreational Shellfish Area and Shellfish Relay Area Overlay District (§240-37.1, 2008); - Craigville/Centerville District of Critical Planning Concern (2008).
Develop a detailed mooring plan	• Developed detailed mooring plan and revised mooring regulations (1990's): -created licensing requirements for mooring designees, -established equitable fee structure, -standardized tackle requirements, -permits issued to individual boaters, -established additional waiting lists at mooring fields, -refined regulations for commercial and rental moorings -hired fulltime mooring officer. • GIS survey to delineate historic mooring fields (2007 and on-going); • Mooring Capacity Analysis completed (2008).
Conduct a Coastal Resource Monitoring Program	• Water column nitrogen monitoring (1999 to present); • Eelgrass surveys undertaken by MassDEP (1995, 2001); • The Significant Shellfish Resource and Habitat Mapping Project (2001) rated shellfish habitat on a scale of 1(low) to 10 (high); • Benthic infauna (animals in sediments) surveyed for MEP (2005); • Bacterial testing undertaken as part of shellfish sanitary surveys and Beaches Act monitoring of public swimming areas and Princes Cove Bacterial TMDL.

Table 1. Summary of 1990 Recommendations and Implementation Actions, Continued

Recommended Actions	Actions Taken
Eliminate Sanitary Waste Discharges from Boats in the Study Area	• Three Bays/Centerville Harbor No Discharge Area (2001): -Town acquired and staffed two pump-out boats free of charge to boaters, -Established public education program (flyers, waterways presentations, etc.), -Posted no discharge signs at town landings.
Revise the Zoning Ordinance to Create a Coastal Resource Protection District	• Dock and Pier Overlay District (§240-37; 2001) prohibits new private docks along Cotuit Bay from Loop Beach to Handy Point; • Temporary Recreational Shellfish Area and Shellfish Relay Area Overlay District (§240-37.1, 2008); • Craigville/Centerville District of Critical Planning Concern (2008) aims to protect community character and guard against overloading infrastructure; • §360-45 Interim Regulations for the Protection of Saltwater Estuaries.
Revise Conservation Commission regulations to increase jurisdiction and require buffer zones to protect natural resources within the Coastal Resources Protection District	• Chapter 704 was amended to establish a fifty-foot no distrurb zone within the 100-foot jurisdictional buffer area.
Initiate Capital Improvements Program for Town-owned Ways to Water	• In 2007 the Town established the Coastal Access Program and provided $1,985,000 in funding to undertake numerous improvements to public ways to water.
Revise Pier and Dock regulations to restrict private piers and docks in critical resources areas, multi use /low intensity areas and water use support areas	• Dock and Pier Overlay District (§240-37; 2001) prohibits new private docks along Cotuit Bay from Loop Beach to Handy Point. • Chapter (703§1-6; 2004) Private Docks and Piers adopted by the Conservation Commission establishes standards for docks and piers based on the Significant Shellfish Resource and Habitat Mapping Project. • Temporary Recreational Shellfish and Shellfish Relay Area Overlay District (§240-37.1; 2008) prohibits installation of new docks and piers in designated areas used for shellfish relay and recreational shellfishing.
Increase regulation of water safety related regulations	• Navigational aids and No Wake Areas are posted throughout the study area.

Table 1. Summary of 1990 Recommendations and Implementation Actions, Continued

Recommended Actions	Actions Taken
Conduct periodic bathymetric mapping of study area	• Bathymetric analysis and hydrodynamic modeling conducted for MEP (2005)
Conduct immediate dredging of navigation hazard areas and maintenance dredging as needed	• Several dredging projects have been undertaken to maintain navigation • Material has been used to nourish barrier beaches at Dead Neck, Dowses Beach, Long Beach and Craigville Beach.
Establish a “protect the environment” public education program	• The Nutrient Management Plan being developed will include public education component, such as fertilizer best management practices; • Public outreach is mandated by the No Discharge Area designation.
Revise the zoning regulation and subdivision rules and regulations to minimize the amount of impermeable paved surfaces allowed on new lots.	• Groundwater Protection Overlay District (amended 2000) reduces impervious lot coverage to lesser of 15% or 2500 square feet and requires 30% natural vegetation; • Resource Protection Overlay District (§240-36; 2000) increased minimum lot size to 87,120 square feet.
Develop and implement a comprehensive stormwater remediation program	• The Town has launched the Coastal Discharge Mitigation Program and implemented numerous multi-phased improvements throughout the study area; • Additional priority projects have been identified.

Chapter 2.0 Study Area

2.1 Overview

The study area in the 1990 plan encompassed the watersheds of the Three Harbors and Centerville River systems. Watershed issues, namely nitrogen loading and growth management, are now being addressed by other Town planning initiatives. In light of the revised goals and the understanding that major land use and wastewater planning is occurring under other efforts within the Town, the CRMC determined that the study area should be revised for the CRMP-09. Therefore the study area was amended to include the Three Bays system and the Centerville River estuarine systems and adjacent waterfront parcels.

According to the Massachusetts Estuaries Project (MEP), the combined systems have a total water surface area of close to two thousand acres, which is considerably larger than the 1,432 acres accounted for in the 1990 plan.[1] The study area encompasses the water bodies within these systems, adjacent coastal wetlands and the landward parcels adjacent or with deeded access to the water bodies. The seaward boundary of the study area is the three-mile limit of local jurisdiction in Nantucket Sound. The study area is depicted on Figure 1. Selected features within each of the two systems are described below.

2.2 Three Bays System

The Three Bays System is a large and complex estuary with multiple ocean inlets and subembayments. The system has a total surface area of 1,251 acres. This includes Cotuit Bay (469 acres), West Bay and Eel River (343 acres), North Bay (309 acres), and Prince's/Warren's Cove and the Marstons Mills River (93 acres) which flows into North Bay and is the largest surface source of freshwater in the system.[2]

Like many coastal areas on Cape Cod, the Three Bays system has undergone profound transformations resulting from natural and man-made causes. Tidal and littoral (wind-driven) forces over time have shaped the barrier beach and inlet configuration, which in turn influences tidal flushing in the system. The dredging of the inlet into West Bay in 1890 was the first of on-going efforts to maintain a two-inlet configuration for navigation, with implications also

[1] The CDM plan only counted areas with greater than 2 feet of water, however all surface waters are considered for the purposes of the CRMP-09.

[2] Howes, et al. Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for Three Bays. 2006, p.65.

for tidal exchange. Ocean waters from Nantucket Sound exchange with the system through the two maintained inlets on the east and west ends of Dead Neck/Sampson's Island.

Land uses also have evolved over time, with implications for ecological conditions as well as access and use of the waterways. The first settlement of the area likely began in the 17th century with Native Americans who lived off of the heavily forested upland and plentiful estuarine resources. Conditions began to change after the first European settlement arrived in 1653, with the expansion of agriculture and introduction of commercial activities. By the 1800's, commercial activities began to alter the coastal landscape. Land was cleared for agriculture, salt works were set up on the shore, and shipbuilding and trading outposts were erected. Major changes occurred in the 1900's, when residential development surrounding the system intensified and the region's economy shifted away from maritime commerce. The placement of a military base in North Bay during World War II provided a sharp contrast with historical uses of the area, and resulted in the paving of the beach from Baxter's Neck to Point Isabella in North Bay. The fuel, ordinance and heavy equipment employed at the base left an ecological footprint still discernable today. But it was the continual influx of seasonal and year-round homes during the latter half of the twentieth century, which has had the most profound impact on the area and resource conditions. The residential development and accompanying increase in population altered the coastal landscape, and increased demand for access to the water while limiting public access opportunities. Perhaps most significantly, the influx of homes introduced the greatest ecological threat to the system: the flow of nutrients from onsite septic systems. As discussed more fully later in this plan, excessive nutrients threaten water quality in the Three Bays and the ecological species dependent on high water quality.[3]

The Three Bays System today is visually, economically and ecologically a valued asset to the Town. Though facing threats, the distinct areas of the system have identifiable environmental and use-related characteristics:

> ***Cotuit Bay and Seapuit River***– the largest of the Three Bays, is bounded on the east by Grand Island and on the west by Cotuit Village. The open waters of the bay support a wide variety of water dependent uses. A heavily used navigable channel—sometimes used as a sailboat racing course—runs the length of the bay. *Recreational Shellfishing and Shellfish Relay Areas* are designated in three places along the shore, the largest of which extends from Little River Road landing to the Narrows into North Bay. Aquaculture grants are located principally in the southern portion of the bay. Popular public access points include Loop Beach and

[3]Howes, et al. Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for Three Bays. 2006.

Cordwood Lane landing. Private organizations located on the bay include the Cotuit Mosquito Yacht Club and Oyster Harbors Property Owners Association. The Seapuit River connects Cotuit Bay and West Bay, and separates Grand Island and Dead Neck/Sampson's Island.

North Bay and Prince's/Warrens Cove – the smallest of the Three Bays, North Bay and the adjacent coves display a more varied estuarine environment with a more extensive presence of salt marsh. The principle public access to North Bay is from Bay Street landing. *Recreational Shellfishing and Shellfish Relay Areas* are designated in two locations. The open waters of the bay provide the only area available for waterskiing and tubing in the Three Bays system. By contrast, Prince's Cove is connected to North Bay by a meandering channel and has a pond-like character. Located at the entrance to the channel is Prince Cove Marina, purchased by the Town in 2002 and now a Town-owned way to water.

West Bay and Eel River - West Bay is formed largely by the enclosure of Little Island and Oyster Harbors to the north and west. The bay is home to the Wianno Yacht Club and Barnstable Rowing Club, which utilize the west half of the bay for sailboat training. *Recreational Shellfishing* and *Shellfish Relay Areas* are designated along the northern shoreline from, and on a small area of the western shore. Private aquaculture grants are located in the southeastern shore near Eel River.

2.3 Centerville River System

Though somewhat smaller than Three Bays, the 622-acre Centerville River system is a similarly complex estuarine system. The system consists of a tidal lagoon formed behind a barrier beach. The area contains more than 230 acres of salt marsh. Prominent water features of the system include the Centerville River, East Bay, Bumps River, Scudder Bay, and Halls Creek Marsh.[4]

Tidal exchange between the system and the Nantucket Sound occurs through an inlet into East Bay. The inlet is believed to have migrated along the barrier beach over time but is now stabilized and periodically dredged by the Town. A 400-foot stone jetty fortifies the western edge of the inlet. The entrance channel was dredged in 1971, when 20,000 cubic yards of material was placed on the barrier beach known as Dowse's Beach to the west of the inlet, and 30,000 cubic yards was placed on the portion of the barrier beach known as Long Beach to the east. Subsequent dredging of the entrance channel occurred in 2002, as Phase 1 of the Centerville River dredge and Craigville Beach nourishment project. Continuing eastward from the East Bay entrance channel,

[4] Howes, et al. Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for Centerville River System. 2006, p.68.

Long Beach becomes Craigville Beach, and then Coville Beach, which connects with the Halls Creek Marsh system.[5]

Most of East Bay and Centerville River exhibit embayment characteristics of open water, fringe marsh and stable water column salinity. Bumps River and Scudder Bay exhibit more estuarine characteristics, with much shallower depths, more extensive salt marsh and fluctuations in water column salinity due to fresh groundwater inflows.[6]

East Bay - the open waters of East Bay are popular for sail and power boating and windsurfing. Dowse's Beach on East Bay is a heavily used resident-only access point in the study area. Long Beach is privately owned.

Centerville River - provides a passage from the upper reaches of the River to East Bay and the Harbor and Sound. Haywood landing, a popular town-owned access point, is located in the River.

2.4 Resource Management Areas

A primary recommendation of the 1990 plan was to establish Resource Management Areas. The 1990 plan identified four categories of management areas, and assigned a category to regions within the study area. The four categories were:

Critical Resource Areas, which are environmentally critical and sensitive recreation areas in which uses and activities should be restricted to protect valuable natural resources, water quality and historic recreation activities;

Multi-use/Low Intensity Areas, which are environmentally sensitive areas with recreational and low-intensity commercial use in which water and resource quality recreational opportunities and low intensity commercial uses should be maintained or improved;

Commercial/Town Support Areas, which are higher intensity use areas that provide support for recreational and commercial users in which water quality and resource quality should be maintained or improved; and

[5] Howes, et al. Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for Centerville River System. 2006.
[6] Howes, et al. Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for Centerville River System. 2006.

Navigation Protection Areas which are areas critical to navigation in which structures and moorings should be restricted to ensure safe access and adequate to the water.

The 1990 plan further recommended that the Town enact the areas through zoning that would set boundaries and specify allowed and restricted uses in the areas. In implementing the recommendations of the 1990 plan the Town did not designate the areas through zoning. Instead, the Town adopted discrete policy and regulatory changes, some of which were zoning changes, to reinforce the intent of the management area categories. The CRMC believes this approach to implementation has been successful, and should be carried forward in the CRMP-09. The CRMC concurs with the intent of protecting the areas for the uses and activities identified in the 1990 plan. However, the CRMC believes the areas should not be implemented through zoning of districts and uses as originally proposed, but should be viewed as a policy framework for ongoing management and regulation within the study area. This approach provides the flexibility to select the appropriate management tools—which could include wetlands regulations, zoning, waterways regulations or other—to most effectively implement management objectives.

Section II: Management Issues and Recommendations

Chapter 3.0 Marine Services and Facilities

3.1 Overview

The Three Bays and Centerville River systems provide an ideal setting for all types of boating activity. The quiescent and relatively protected estuarine waters are ideal for kayaking and sailing, and ready access to Nantucket Sound is appealing for motorized boating and day-trip ocean fishing. Consequently, boating for recreational and commercial purposes is a primary use of the waterways in the study area. The study area supports a variety of marine facilities and services including mooring fields, public and private marinas and marine support businesses, as well as boating and sailing programs and associations.

Approximately 1,667 vessels reside in the Three Bays and Centerville River systems, including all vessels associated with moorings, slips and piers.[1] The majority of these vessels are small (under 25 feet) and an estimated 95% are used for recreational purposes. Boating in the study area is seasonal, with the most intense activity occurring between Memorial Day and early September.

Table 2. Vessel Population in Three Bays and Centerville River Systems[2]

	<=16'	>16-25'	>25-40'	>40'	Total
Three Bays System					
Cotuit Bay	196	350	195	12	753
North Bay	36	101	66	13	216
West Bay	95	111	56	9	271
Squaw Island	8	1	0	0	9
Prince Cove, Marstons Mills River	26	91	32	7	156
Centerville River System					
East Bay, Centerville River	62	172	28	0	262
Total	423	826	377	41	1,667

[1] Source: Application for a Federal No Discharge Area Designation for the Three Bays/Centerville River Area in the Town of Barnstable, MA. 2000.
[2] Ibid.

Recreational and commercial boating in the study area is supported by a variety of public and private facilities and services. This chapter provides an inventory of the essential marine services and facilities within the study area and examines current conditions and how conditions may have changed since 1990. The chapter also discusses management issues associated with marine facilities and the boating activity they support. **The topics addressed in this chapter include:**

3.2 Municipal Boating Access Facilities
3.3 Moorings
3.4 Marinas and Boat Yards
3.5 Environmental Impacts and No Discharge Area
3.6 Navigable Channels and Speed Zones
3.7 Dredging and Material Disposal

3.2 Municipal Boating Access Facilities

3.2.1 Current Conditions and Change Analysis

Municipal boating access facilities are those facilities that support or enable access to the water by resident and transient boaters, and include landings, ramps, marinas and other ways to water. These access facilities have not changed appreciably since the 1990 plan. The eleven facilities total just under four acres of land area with parking for 121 vehicles. Nine of the public facilities provide docking, launching or mooring access in the Three Bays system, and three facilities provide those amenities in the Centerville River system. The facilities provide access for mooring permit holders as well as transient boaters. The facilities are in heavy demand during the boating season, which generally runs from Memorial Day through Columbus Day.

In 2007 the Town launched the Coastal Access Plan (CAP), a collaborative effort between the Town Manager and various Town Departments to enhance public access to coastal waters town-wide. A total of $1,985,000 was appropriated to the CAP in 2007, and this funding expires in 2010. Projects undertaken through the CAP include improvements to several of the boating access facilities in the study area. These include:

- Repairs to the West Bay bulkhead;
- Repairs to the Bay Street boat ramp;
- Improvements to the Bridge Street parking area and addition of a dinghy tie-up rail;
- Site survey of the Short Beach Road landing.

Table 3. Municipal Boating Access Facilities

Location	Access Type*	Land Area (Acres)	Parking*
Three Bays System			
Cotuit Town Dock	Dock	0.32	40
Hooper's Landing	Boat Ramp	1.04	2
Little River Landing	Landing	0.05	8
Cordwood Landing	Landing	0.07	4
Prince Cove Ramp	Boat Ramp/Dock	0.25	9
Prince Cove Marina	Marina	0.93	9 (Fee Charged)
Bay Street	Boat Ramp	0.12	8
West Bay Road	Bulkhead	N/A	0
Bridge Street	Boat Ramp	.5	25
Centerville River System			
East Bay Road	Boat Ramp	0.25	2 –Additional Permit Required
Hayward Landing Road	Boat Ramp/Dock	0.4	12
Short Beach Road	Landing	0.05	2
Total	11 Ramps - 6 Dock - 3 Landing - 3 Marina - 1	3.98	121

Source: Growth Management Department
*Ramps can be used by anyone but parking requires a resident parking sticker at all locations

3.2.2 Summary of Management Issues: Municipal Boating Access Facilities

Town landings and ways to water are vital part of Barnstable's marine infrastructure and support a variety of commercial and recreational activities for the Town's homeowners and visitors. The number and capacity of town landings and ways to water have not changed appreciably since 1990. However, year-round population in the Town has increased approximately 15% since 1990.[3] The number of seasonal

[3] According to the Town of Barnstable Draft Local Comprehensive Plan, population in July 1990 was: 40,949; and 47,380 in July 2006.

residents (approximately 30,000) nearly doubles the year-round population (approximately 48,000) for a total seasonal population of 78,000.[4] This growth has placed more pressure on town landings and ways to water. Town landings and other ways to water continue to be heavily used town resource areas for several months of the year, and some show the stress of heavy use.

The finite amount of parking area and launching space at town landings and ways to water will continue to provide an upward limit on access to waterways and moorings throughout the study area. Managing the heavy demand for parking at town landings is an on-going management challenge. Resident parking stickers are now required at all ways to water that provide parking, and regulatory signs are posted. However, unauthorized parking in these locations is a frequent complaint, particularly at Long Beach and Short Beach Road.

Storage of dinghies and dry sailed vessels (hobie cats, sunfish, etc.) at selected town landings and other ways to water poses another management challenge. Storage or dragging of vessels can cause damage to salt marsh, dunes and grasses. Abandoned vessels can be unsightly or even hazardous. At narrow town landings placement of dinghies can encroach on private property, resulting in conflicts with abutting property owners.

3.2.3 Recommended Actions: Municipal Boating Access Facilities

3.2.3.1 Fund Coastal Access Program (CAP)

Identify a mechanism for on-going funding of the CAP, for which funding expires in 2010. The CAP maintains a prioritized list of maintenance and improvement projects at town landings and ways to water across town. These projects go a long way toward maintaining and enhancing public access to the water and in some instances ameliorate negative environmental conditions.
Parties involved: Town Manager, Marine and Environmental Affairs Division, Growth Management Department, Department of Public Works, Community Services, Community Preservation Committee.

3.2.3.2 Survey Town Ways to Water

Continue the process of conducting and recording surveys of all town landings and ways to water, to avoid potential future disputes over boundaries and land ownership.
Parties involved: Town Manager, Marine and Environmental Affairs Division, Growth Management Department, Department of Public Works, Community Services, Community Preservation Committee and Town Attorney.

[4] Town of Barnstable Draft Local Comprehensive Plan.

3.2.3.3 Enforce Parking and other Use Regulations

Evaluate the level of resources available for enforcement of the resident parking requirement and other regulatory requirements (no pets, no fires, etc.) at town-owned ways to water to determine whether additional enforcement coverage is warranted.

Parties involved: Town Manager, Marine and Environmental Affairs Division, Growth Management Department, Department of Public Works, Community Services, Community Preservation Committee, Regulatory Services Department, Fire Department, Police Department.

3.2.3.4 Evaluate Vessel Removal Needs

Evaluate whether the vessel removal program authorized under *Barnstable General Ordinance Article II, Chapter 32, Section 7, Chapter 430-Vessels on Town Property* and piloted at Ropes Beach would be effective at other town landings and ways to water in the study area.

Parties involved: Waterways Committee, Marine and Environment Affairs Division.

3.2.3.5 Evaluate Vessel Storage Options

Evaluate the use of dinghy tie-up rails, kayak racks and other vessel storage methods to ameliorate crowding, damage to sensitive resources, visual effects and potential hazards resulting from vessel storage on town land. Monitor the effectiveness of methods used to determine whether further measures such as a permit system or other strategy are necessary to manage vessel storage on town-owned properties.

Parties involved: Waterways Committee, Marine and Environmental Affairs Division, Conservation Division.

3.2.3.6 Enhance or Create New Public Ways to Water

Identify, prioritize and pursue opportunities to enhance or create new public ways to water. Any expansion of public access should be undertaken in a manner that is consistent with a high degree of environmental protection and respect for community character. The range of opportunities to enhance or expand public access could include:

- Town purchase of properties abutting existing ways to water or non-contiguous parcels with coastal frontage or access;

- Securing access through acquisition of easements over private property; and
- Conditioning local subdivision and Conservation Commission approvals, and by seeking enforcement of Chapter 91 public access requirements.

Parties involved: Town Open Space Committee, Town Manager, Marine and Environmental Affairs Division, Growth Management Department, Department of Public Works, Community Services, Community Preservation Committee, Conservation Commission and Division, Shellfish Committee, Waterways Committee, Town Attorney.

3.3 Moorings

3.3.1 Current Conditions and Change Analysis

Moorings are an important component of the Town's overall efforts to promote public access to the Town's waterways. The Town's mooring regulations and policies seek to equitably manage heavy demand for a limited number of mooring permits, and to minimize the negative impacts of moorings on sensitive resources. Many of the issues of concern raised by the 1990 plan concerning moorings, as discussed below, have been addressed through changes in policies and practices adopted since that time, although some management challenges remain.

There are 1,332 moorings in the study area, which accounts for 54% of the total moorings in Town and is 118 fewer than the 1,450 moorings listed in the 1990 plan. The distribution of moorings by location within the study area is shown on Table 5 and on Figure 2. Table 5 also shows the distribution of mooring permits by vessel size. The number of moorings declined for all vessel sizes except for vessels under fourteen feet. However, it is reasonable to assume that the reductions in permits between 2009 and 1990 are fairly evenly distributed across vessel sizes. This is because the 1990 totals included 175 mooring permits for vessels of unknown size, and many of these may have been in the under fourteen foot category. 2009 numbers count vessels of unknown size as being in the under fourteen-foot category.

As of 2008, transient, commercial or seasonal rental mooring permits accounted for 137 mooring permits or roughly 10% of the total mooring permits

issued in the study area. This is down from a total of 270[5] or 19% of total mooring permits in 1990. Of this total, commercial moorings are down by forty-seven or 46%, Seasonal rental moorings are down by eighty-four or 58% and transient moorings are up by only one. The distribution of commercial, seasonal and transient moorings by private entity is shown on Table 4.

Table 4. Commercial, Transient and Seasonal Rental Moorings, 1990 & 2008

Boat Yard	Commercial		Transient		Seasonal		Totals	
	1990	2008	1990	2008	1990	2008	1990	2008
Crosby Yacht Yard	46	20		10	34	49	80	79
Oyster Harbor Marine	25	10	17	8	75	15	117	33
Pecks Boats	8	8	--	--	--	--	8	8
Marine Service & Electronics	15	5	--	--	42		57	5
West Bay Marine	4	4	--	--	--	--	4	4
Gilmore Marine	4	2	--	--	--	--	4	2
Cape Cod Trawlers	--	1	--	--	--	--	--	1
Cotuit Launch	--	1	--	--	--	--	--	1
Murray Marine	--	1	--	--	--	--	--	1
Mass Audubon	--	1	--	--	--	--	--	1
Three Bays Preservation	--	1	--	--	--	--	--	1
Tow Boat Nantucket Sound	--	1	--	--	--	--	--	1
Totals	102	55	17	18	151	64	270	137

Source: Town of Barnstable Harbormaster

[5] The 1990 plan recorded 254 commercial, seasonal and transient rental moorings but current Harbormasters records show 270 such permits were held in 1990. The 270 is used since there is no way to verify the 1990 plan number.

Table 5. Mooring Permits By Location and Vessel Size

Harbor	Area	Total Permits	<14 ft	15 – 20 ft	21 – 35 ft	>35 ft
Prince Cove		**106**	**27**	**30**	**46**	**3**
	Prince Cove	95				
	Warren's Cove	7				
	Mill River	4				
North Bay		**244**	**59**	**64**	**98**	**23**
	Cotuit Bay Shores	64				
	North Bay	87				
	North Bay Channel	74				
	Dam Pond	19				
Cotuit		**628**	**143**	**205**	**253**	**27**
	Cordwood	23				
	Cowyard	13				
	Haydens	22				
	Hoopers	35				
	Left Cotuit Town Dock	126				
	Loop	30				
	Narrows	3				
	Oyster Co.	63				
	Right Cotuit Town Dock	87				
	Ropes	164				
	Outside	18				
	Tim's Cove	28				
	West Side Grand	16				
West Bay		**195**	**48**	**62**	**76**	**9**
	West Bay	138				
	Eel River	28				
	Seapuit River	4				
	Dupont/Mellons/Win	11				
	Grand Island	5				
	South Bay	9				
East Bay		**159**	**19**	**57**	**83**	**0**
	East Bay	120				
	Centerville River	38				
	Bumps River	1				
2009 Total		**1332**	**296**	**418**	**556**	**62**
1990 Total		**1450***	**178**	**433**	**584**	**80**

Source: Barnstable Harbormaster and 1990 CDM Plan *1990 total included 175 vessels of unknown size

3.3.2 Summary of Management Issues: Moorings

The 1990 plan cited a number of management concerns regarding moorings:

- The large amount of water surface area devoted to mooring fields in both the Three Bays and Centerville River systems restricted access for other activities;
- Mooring placement was inefficient, leading to oversized areas and encroaching on areas used for other historical recreational areas;
- Storm moorings occupy a large area of water surface while being used only temporarily;
- Rental moorings could have long-term effects on the study area's future users;
- There is a lack of parking at the Town's shore facilities, which could increase demand for moorings.

A high number of seasonal rental moorings also was cited as a concern in the 1990 plan. Seasonal rental moorings are mooring permits issued by the Town to private marinas that in turn rent them to customers. The number of seasonal rental moorings dropped dramatically, from 151 in 1990 to 64 in 2008.

The Town undertook a number of actions in response to the 1990 plan and the on-going demand for moorings in the study area. In the early 1990's the Town developed a detailed mooring plan for the study area, hired a full-time mooring officer and enacted several changes in regulations. These regulatory changes included standardized tackle requirements, a more equitable fee structure, new requirements for commercial and rental moorings, creating licensing requirements for mooring designees, issuing permits to individual boat owners, and creating additional of waiting lists. More recently the Town was able to use Global Positioning System (GPS) coordinates to demarcate mooring fields and moorings.

Currently there are 444 names on waiting lists for mooring fields in the study area. Table 6 shows the size of existing waiting lists. The longest waiting list is for Cotuit Bay (127), while most other areas have between twenty to fifty names[6]. All but two of the lists are closed, which means no new names can be added to the list. Otherwise the number of wait-listed individuals would likely be higher. The lists demonstrate continued strong demand for moorings throughout the study area.

In response to on-going heavy demand for moorings, in November 2007 Town Council enacted an order (2008-059) to the Barnstable Waterways

[6] Note: some names appear on multiple lists or twice on one list.

Committee to "determine the current usage of moorings in the Town and the appropriateness of increasing the number of moorings." To comply with the order, the Waterways Committee and Harbormaster's staff undertook an in-depth assessment of current mooring permits in light of recommendations set forth in the 1990 plan and the Local Comprehensive Plan. GPS surveys conducted in 2007, and subsequently updated, for all mooring fields in the Town have been used to establish the demarcation of mooring fields.

Table 6. Mooring Waiting Lists as of March 2009

Three Bays System	Wait List Size	Status
Cotuit	127	Established prior to 1990, closed 1995
Cotuit Bay Shores	19	Established 1999, closed 2002
Dam Pond	21	Established 2007, currently open
Eel River	59	Established 2007, currently open
North Bay	35	Established 1998, closed 2002
North Bay Channel	30	Established 1998, closed 2002
Prince Cove	42	Established 1996, closed 2002
Tim's Cove	11	Established prior to 1990, closed 1995
West Bay	54	Established prior to 1993, closed 2002
Centerville River System		
Centerville River	19	Established prior to 1990, closed 2002
East Bay	27	Established 2001, closed 2002
Study Area Total	**444**	

Source: Report of Barnstable Waterways Committee Mooring Analysis Workshops and Harbormaster's website

The town-wide mooring assessment was conducted by the Marine and Environment Affairs Division in conjunction with the Waterways Committee. Based on the assessment the Waterways Committee concluded that "a significant increase in overall number of mooring permits that can be issued is unlikely in the immediate future." The general conclusion of the mooring assessment was that, with few exceptions, existing mooring fields were at full capacity. However, many of the larger fields were found to be at less than optimal capacity, defined as full use from Memorial Day to Labor Day.

Several areas within the study area were identified in the mooring assessment as having potential for the addition of new moorings within the mooring field. These areas included: East Bay, Eel River, West Bay, North Bay Channel, Cotuit Bay Shores and Prince Cove. However, the assessment stopped short of recommending an increase in mooring permits in any area. This was largely due to the fact that up to twenty percent of moorings associated with permits were not in the water, which gives a visual impression that there is room for additional moorings in that given field. The assessment called for further

exploration of the "missing" moorings before a possible recommendation could be made on issuing new moorings in any of these areas.

To address the issue of missing moorings, the Waterways Committee amended mooring regulations to require that the mooring and mooring buoy be placed in its permitted location on or before July 1st and remain in the water until September 1st. Failure to meet this requirement could result in revocation or non-renewal of the permit. The Marine and Environment Affairs Division is still evaluating the extent of missing moorings for the purposes of determining whether it is appropriate to recommend adding to the number of moorings at selected locations indicated by the mooring analysis.

In general, the delineation of mooring areas using the GPS surveys, the management of mooring waiting lists for all fields, and the reduction in the overall number of moorings due to attrition as permit holders relinquish their permits, have significantly addressed the issues associated with mooring density outlined in the 1990 plan. Environmental impacts resulting from the placement of moorings and the boating activity they support continue to pose management challenges. Impacts include disruption of the seabed from the mooring anchor itself, as well as chain scour.

3.3.3 Recommended Actions: Moorings

3.3.3.1 Maintain Boundaries of Mooring Fields

Maintain the current policy of not expanding the established boundaries of all mooring fields in the study area. This policy recognizes that density of moorings within a field depends on many factors including vessel size, and there may be circumstances or locations where incremental increases in permits may be allowed at the Harbormaster's discretion. Any such increase should be undertaken in a manner that is consistent with a high degree of environmental protection and respect for community character.
Parties involved: Waterways Committee, Marine and Environmental Affairs Division.

3.3.3.2 Evaluate Changes to Mooring Policies, Regulations and Enforcement Practices

Evaluate the need for changes in mooring policies, regulations or enforcement practices to facilitate public access to coastal waters, improve the efficient use of moorings, reduce environmental impacts resulting from moorings or their use, and minimize the potential for user conflicts. Possible measures should seek to:

- Review the policy for rental moorings to evaluate whether policy changes would enhance opportunities for access to the water;
- Include water depth at Mean Low Water as a condition of granting a permit within or outside of a mooring field;

- Create a procedure for wait-listed individuals to be alerted to the availability of a seasonal rental mooring, recognizing that utilizing a seasonal rental mooring would not jeopardize their wait list standing;
- Continue to Prohibit use of concrete block moorings unless authorized by the Marine and Environmental Affairs Division;
- Ensure that all vessels registered to a mooring are on the mooring for a minimum amount of time each boating season;
- Ensure that each mooring permit has a GPS coordinate associated with it and is placed at its permitted location;
- Require marina operators holding mooring permits for transient rental moorings to submit a written record of rental activity to the Harbormaster each year or upon request, similar to information requirements associated with seasonal rental moorings.

Parties involved: Waterways Committee, Marine and Environmental Affairs Division, Shellfish Committee.

3.3.3.3 Continue to Review, Refine and Update GPS Delineation of Mooring Fields and Moorings

GPS data has been collected for all mooring fields in the study area. Continued review, refinement and updating of this data will be important to avoid conflicts with dredging projects, shellfishing, and other historic activities within the study area.

Parties involved: Marine and Environmental Affairs Division.

3.3.3.4 Evaluate Alternative Mooring Technologies

Continue experimentation with alternative technology moorings that could reduce negative environmental impacts. If a technology appears promising in that it minimizes disturbance to the seabed from anchors and chain scour, then evaluate how expanded use of this technology could be encouraged or required. The evaluation should take into consideration the cost to each permit holder to purchase, install and maintain the new technology mooring. Some technologies could allow a higher density of moorings to locate in a given area. Any increase in density facilitated by alternative technologies should only be allowed if it does not create additional stress on parking and landside impacts, and is consistent with a high degree of environmental protection and respect for community character.

Parties involved: Marine and Environmental Affairs Division, Waterways Committee.

3.4 Marinas and Boat Yards

3.4.1 Current Conditions and Change Analysis

There are four marinas and five marine services businesses in the study area and all are located in the Three Bays system. Prince Cove Marina, formerly Marine Services and Electronics, was purchased by the Town in 2002 and continues to operate as a marina. These operations provide important support services for commercial and recreational boaters, and are a part of the character and heritage of the study area.

Marinas and boat yards and other marine service businesses located in the study area provide a wide variety of services that include maintenance and repair of vessels and motors, launching, fueling, renting of moorings and slips, seasonal and winter storage, and customer amenities. These businesses encompass retail and marine industrial activities. Three of the marinas are located in Marine Business Districts, and one is located within residential zoning districts. These facilities are shown on Figure 3.

Table 7. Marinas and Boat Yards

Facility	Slips		Moorings		Fuel	Features[7]	
	1990	2008	1990	2008		1990	2008
Prince Cove* (Town-owned)	44	47	15	0	No	60 parking spaces; Services vessels 16-36'	40 parking spaces for fee or resident sticker; Public restrooms; ice; trash removal for slip holders
Nauticus (private)	10	35	1	0	No	7 spaces for dry-sailed vessels	No Change
Oyster Harbor Marine (private)	110	140	195	33	Yes	250 parking spaces; 125 winter storage spaces; 20 dry rack spaces; 50-ton lift	Serve 200 private moorings; Restrooms available for customers; Same storage; 75 ton lift; 200 parking spaces
Crosby Yacht Yard (private)	120	110-120		79	Yes	100 parking spaces; 250 winter storage spaces; 35-ton lift	Restrooms for customers; Public restaurant; same storage and parking; 70 ton lift.

*Formerly Marine Services & Electronics Source: Growth Management Department Harbormaster

[7] Differences in parking numbers probably due to a more accurate count in recent records

3.4.2 Summary of Management Issues: Marinas and Boat Yards

The location of any operation that handles fuel and marine industrial activity in sensitive resource areas requires careful attention to environmental safety. The record of environmental compliance by current marina and boat yard operators is strong and this standard should continue to be upheld whether or not changes in ownership take place.

One of the primary issues relating to marinas highlighted in the 1990 plan was the concern that a proliferation of seasonal rental moorings would reduce access to moorings for residents. As noted above, since 1990 the number of seasonal and transient rental moorings has been significantly reduced through attrition resulting from Town mooring policies, and reporting practices have been instituted to monitor use of remaining seasonal rental moorings. Given the effectiveness of these regulatory changes in addressing the primary concerns raised in the 1990 plan, the issue of seasonal rental moorings is no longer considered a management concern within the study area.

Like all businesses, from time to time marinas seek to expand or augment their facilities in order to upgrade, remain competitive or grow. Expansion of landside facilities such as parking or buildings, as well as on the water facilities such as docks, piers, moorings or other support structures, may be necessary for the viability of the business, and should be undertaken in a manner that is consistent with a high degree of environmental protection and respect for community character.

3.4.3 Recommended Actions: Marinas, Boat Yards and Marine Services Businesses

3.4.3.1 Encourage Use of Environmentally Protective Best Management Practices

Marinas and boatyards should comply with all existing federal, state and local water quality protection measures and regulations. Operators should be encouraged to voluntarily adopt the most environmentally protective best management practices for their operations, such as those found in the Massachusetts Coastal Zone Management *Clean Marina Guide* and the supplement, *A Guide to Selecting Pressure Washing Management Practices and Technologies*.

Involved Parties: Waterways Committee, Marine and Environment Affairs Division, Marina and Boat Yard Operators.

3.4.3.2 Ensure Any Proposed Expansion Protects Resources and Community Character

Local regulatory reviews associated with any proposed expansion plans at marinas or boat yards should seek to ensure that expansion proposals:

- Meet stringent environmental regulations;
- Demonstrate the need or demand for expanded services;
- Adequately address land use impacts, particularly parking; and
- Demonstrate that the use of alternative upland locations is infeasible.

The Planning Board and Growth Management Department should review the provisions of MB-A1, MB-A2 and RF zoning districts in which boat yards and marinas currently operate, as well as the provisions of site plan review, to ensure that the following issues noted above can be fully evaluated in the review of expansion proposals.

Involved Parties: Planning Board, Growth Management Department, Conservation Commission, Marina and Boat Yard Operators.

3.5 Environmental Impacts and No Discharge Area

One of the fourteen major recommendations of the 1990 plan was to eliminate the discharge of boat sewage into the study area. In response to this recommendation, as well as growing awareness of the threat to water quality posed by the discharge of treated boat waste, the Town sought a designation of the study area as a federal No Discharge Area (NDA.) The US EPA granted the designation in 2001. The NDA designation makes it illegal to discharge treated boat sewage from a vessel with a Marine Sanitation Devise (MSD). Prior to the NDA designation, it was illegal to dump boat untreated sewage into Commonwealth waters within three miles from shore, but it was legal to dump sewage treated by an MSD.

The NDA carries two requirements. One is to provide outreach and education to area and transient boaters to ensure that they understand the requirements of the designation, and where they can get access to a pump-out for their MSD. The second requirement is to ensure that there is adequate pump-out capacity provided by municipal or private sources. The Town meets its pump-out requirements through the use of two town-owned pump-out boats. The boats are available seven days a week to provide pump-out service to vessels on request.

The boats are efficient within the large and dispersed system because they are able to reach vessels anywhere in the study area. Vessel waste is transported by the pump-out boats to Hyannis where it is directly offloaded to the treatment plant via the sewer system. The NDA application also lists a pump-out trailer at Oyster Harbor Marine, which is equipped to services boats of up to 50 feet in length and can also remove waste from porta-potties.

The NDA is enforced by the Massachusetts Environmental Police as well as the Harbormaster. A state law signed in 2009 gives the Massachusetts Environmental Police and Harbormasters the ability to fine violators up to $2,000 per violation of the NDA, which should help to enhance local enforcement capability.

3.5.2 Summary of Management Issues: Environmental Impacts and No Discharge Area

In addition to the issue of boat sewage, another environmental impact raised by the 1990 plan was runoff from marinas and boatyards that may include toxic pollutants from solvents, paints and other materials and supplies used in boat maintenance and repair.

Environmental impacts from boating not described in the 1990 plan include:

- Air and water emissions from use of internal combustion engines, or from accidental spillage of petrochemicals;
- Prop dredging from operation of motorized vessels with an insufficient depth of water under the draft of the boat;
- Erosion impacts to banks and marsh from waking caused by travel at excessive speeds; and
- Noise impacts from motorized vessels.

In 1996 the US EPA established emission standards for marine engines. The EPA recently finalized more stringent emissions controls to reduce hydrocarbon, nitrogen oxide and carbon monoxide emissions from marine spark ignition engines. The new emission standards will take effect in the 2010 model year.[8] There is now available a wide variety of marine engines that range from low emissions to ultra low emissions.

[8] US Environmental Protection Agency. www.epa.gov

3.5.3 Recommended Actions: Environmental Impacts and No Discharge Area

3.5.3.1 Launch a Clean Boating Education Campaign

Launch a *Clean Boating* public education campaign, in concert with public education for the NDA. The campaign should promote information on the NDA and other environmentally protective boat operation and maintenance practices. The public education campaign should feature such items as:

- Environmentally preferred products and technologies for cleaning and maintenance;
- Engine and bilge maintenance;
- Selection of equipment and technology, particularly the purchase of a marine engine that meets the latest US EPA emissions standards.

Parties involved: Waterways Committee, Marine and Environmental Affairs Division, Marina and Boat Yard Operators.

3.5.3.2 Encourage Use of Environmentally Protective Best Management Practices

Encourage marinas and boat yard operators to voluntarily adopt the most environmentally protective best management practices for their operations including the *Massachusetts Clean Marina Guide* and the supplemental *Guide to Selecting Pressure Washing Management Practices and Technologies*. Marinas and boat yards also should be encouraged to relocate to an inland facility any activities that pose an environmental hazard or threaten water quality. All vessel scraping, painting and power washing, if done within the study area, should be completely contained to avoid run-off into the estuaries.

Parties involved: Waterways Committee, Marine and Environment Affairs Division, Marina and Boat Yard Operators.

3.6 Navigation Aids and Regulations

3.6.1 Current Conditions and Change Analysis

Navigational channels marked by the Town Harbormaster are essentially the same as shown in the 1990 plan. Marked channels and buoys are shown in Figure 4.

Massachusetts law (323 CMR 2.07) and Town of Barnstable Code (Chapter 40, §40-1) prohibit operating a boat at greater than headway speed (6 mph or less) when within 150 feet of a swimmer, waterskier, mooring area, marina, or boat launch. Vessels are also required to operate at no wake speed when operating in a marked channel. In addition to state law, towns may adopt additional no wake zones to address areas where speeds above headway speed

may pose a safety or environmental risk. With the exception of the marked area in the east side of North Bay, all of the marked channels within the study area are posted by the Harbormaster as no wake areas (Figure 4.) The area in North Bay lying westerly of a line running from a pier on St. Mary's Island to the northern most tip of Little Island is an area in which water skiing is allowed. Currently the policy is that waterskiing is allowed on weekdays only.

The study area is home to a number of private sailing clubs and associations, many of which have boating classes and events on-going during the summer season. These are shown on Figure 5. These activities can result in heavy boating traffic in certain areas at certain times, and often involved non-motorized vessels such as small sailboats.

3.6.2 Summary of Management Issues: Navigation Aids and Regulations

The Three Bays system is perhaps more heavily used for navigation than the Centerville River. Channels in the system are well marked and speed controls are posted throughout. The potential for conflicts among boaters exists given the intensity and diversity of water related uses. Challenges to boating safety in the system include:

- Existence of sailing clubs and youth sailing programs in heavily used waterways;
- Operation at high speeds even in marked slow or no wake zones;
- Practice of water skiing in North Bay, the only area where the activity is allowed; and
- The practice by some boat yards and marinas of test running boats at high speed in North Bay.

3.6.3 Recommended Actions: Navigation Aids and Regulations

3.6.3.1 Provide Adequate Funds for Aids to Navigation and Enforcement Activity

Ensure that adequate resources are provided to Town Departments charged with providing aids to navigation and enforcement of waterways and other safety and environmental regulations. Resources should be adequate to:

- Continue demarcation of channels and posting of speed zones at current levels;
- Support a presence of law enforcement and Harbormaster patrol at the 1990 level at a minimum;
- Enforce existing speed controls for public safety and to reduce erosion from vessel waking, and to keep noise levels down;

- Sustain the level of pump-out service currently provided, and to seek state or federal grant funds to expand pump-out capacity if demand for the services outpaces the boats' capacity;
- Re-instate the position of seasonal mooring assistant to monitor compliance with mooring placement and other regulatory requirements; and
- Evaluate the need for additional monitoring of speed controls in North Bay to address concerns about water skiing/tubing and high speed test-running of boats by nearby marinas and boat yards.

Parties involved: Waterways Committee, Marine and Environmental Affairs Division, Police Department.

3.7 Dredging and Material Disposal

3.7.1 Current Conditions and Change Analysis

Bathymetry or water depth is shown in Figures 6 (Three Bays) and 7 (Centerville River System). Navigable depths appear to be maintained in all marked channels in the Three Bays system at all levels of the tide. However, significant shoaling is perceptible outside the channels. Areas where shoaling is of concern include the North Bay channel, west end of Sepuit River in Cotuit Bay, the tip of Sampson's Island, and the channel at Dead Neck.

Maximum draft required for boats is six feet according to the 1990 plan. The 1990 plan also cites maintenance dredging as having occurred in the in West Bay entrance, Cotuit Bay and North Bay channels. These channels were permitted for a dredge to a depth of six feet and a width of 100 feet.

The channel into East Bay and the Centerville River was also listed as being subject to periodic maintenance dredging at a depth of six feet and width of fifty feet. The 1990 plan finds that depths diminish to four feet moving from East Bay into the Centerville River, and further to two feet further into the River.

A summary of dredging projects within the study area since 1990 is found in Table 8. The areas of these projects are shown on Figure 8.

3.7.2 Summary of Management Issues: Dredging and Material Disposal

The relatively shallow water depths throughout much of the Three Bays and Centerville River systems poses challenges to navigation. Navigable depths appear to be maintained at all tide levels in marked channels throughout the Three Bays system. However shoaling is occurring in some areas, notably the North Bay channel, west end of Sepuit River in Cotuit Bay, the tip of Sampson's Island, and the channel at Dead Neck.

The Centerville River dredging and Craigville Beach nourishment is a multi-phase dredge project now in its third phase. Phase I, completed in 2002, consisted of maintenance dredging to improve navigability. Phase II, which concluded in 2006, included maintenance and improvement dredging to improve navigability. Phase III consists of dredging in areas of East Bay. Areas of dredging are shown on Figure 8.

Material from the phase II dredge was used to nourish the Craigville barrier beach, which was experiencing a loss of sediment. Significant measures were undertaken before, during and after the dredge project to ensure minimal disruption of habitat, particularly for shellfish. Areas within the proposed dredge footprint were identified as having no shellfish, low-density or moderate- to high-density shellfish. The project included the pre-dredge relocation of shellfish in moderate- to high-density areas to other suitable habitat. Also, shellfish were recovered from material pumped for de-watering onto Craigville Beach and also were relocated. Pre- and post-dredging bathymetric surveys and surveys of shellfish densities were among the many requirements imposed by the project through environmental reviews by state and local agencies and the Cape Cod Commission. The Development of Regional Impact (DRI) decision by the Cape Cod Commission establishes six certificates that must be obtained at various stages of the project. According to Cape Cod Commission records, the first of the six certificates has been issued.

Table 8. Dredging Locations, Volume and Material Disposal from 1990

Location	Volume (cu. yds.)	Last Dredged	Disposal Site
Three Bays System			
Cotuit Bay Entrance-Seapuit River Channel-West Bay Channel; Eastern Running Channel off West Bay Entrance	150,000	1999	Dead Neck Barrier Island
Eel River/West Bay Channel	4,500	2001	Dead Neck Barrier Island
Centerville River System			
East Bay/Centerville River	40,700	2002	Dowses Beach Parking Lot
East Bay/Centerville River	16,280	2006	Craigville Beach
Borrow Site SE East Bay Channel	90,265	1990	Long Beach
Borrow Site SE East Bay Channel	80,000	1999	Long Beach

Source: Growth Management and Conservation Departments

3.7.3 Recommended Actions: Dredging and Material Disposal

3.7.3.1 Continue Maintenance Dredging

Continue maintenance dredging in previously licensed dredge sites to historically navigable depths, provided that all local, state and federal licensing requirements are met and proposed dredging projects are not inconsistent with other facets of this CRMP-09:

- Traditional navigable channels;
- Town landings, town marina and other town-owned access points suitable for boat access; and
- Private facilities such as boat yards, marinas and associations.

Parties involved: Waterways Committee, Shellfish Committee, Marine and Environmental Affairs Division, Conservation Commission.

3.7.3.2 Carefully Evaluate Any Proposed Improvement Dredging for Clear Public Benefit

Evaluate the need for or extent of proposed improvement dredging projects based on a demonstrated potential to promote one or more public benefits such as habitat restoration, public safety, all-tide navigation or improved flushing and water quality. Evaluation should encompass a review of impacts to shellfish habitat and resources. The shellfish survey conducted for the Centerville River dredging project provides a useful model for thoroughly assessing the impacts from dredging, and the potential to protect, restore or relocate shellfish.
Parties involved: Waterways Committee, Shellfish Committee, Marine and Environmental Affairs Division, Conservation Commission.

Chapter 4.0 Fisheries and Aquaculture

4.1 Overview

The study area includes significant shellfish resources that are valued for their ecological, environmental and cultural importance to the community. Figure 9 shows the extent of suitable shellfish habitat in the study area as designated by MarineFisheries. The 1990 plan placed an estimated market value on the resource of just under two million dollars.[1] While a similar estimate was not conducted for the purposes of this plan update, given current market values for shellfish and recent years' propagation efforts, the current market value is likely to be comparable—if not higher—than was estimated in the 1990 plan. That market value is significant given the fact that a large proportion of commercially harvested shellfish comes from the Three Bays, providing livelihoods for resident shellfishermen and spending for area businesses.

Finfishing is a less intensive but also important historic activity within the study area. Fishing activity is primarily recreational, but also includes commercial rod and reel and pot fishing.

Beyond the commodity value of these resources, shellfish and finfish are important links in the estuarine ecology, and their vitality is an indicator of overall ecosystem health. Having healthy and abundant fisheries is important to a large number of Town residents who enjoy shellfishing and finfishing and view ready access to these activities as an important benefit of coastal living.

This chapter addresses resources conditions, management issues and recommended actions for the following topics:

4.2 Shellfish Resource Sustainability;
4.3 Public Shellfish Propagation;
4.4 Commercial and Recreational Shellfish Permitting and Management;

[1] Camp, Dresser & McKee, Inc. Coastal Resources Management Plan (Draft Final.) Town of Barnstable, Massachusetts, 1990. Page 4-12.

4.5 Disease Threats;
4.6 Private Shellfish Aquaculture Grants;
4.7 Finfish Resource Sustainability.

4.2 Shellfish Resource Sustainability

4.2.1 Current Condition and Change Analysis

As noted in the 1990 plan, a variety of commercially and ecologically valuable shellfish are found throughout the study area. Quahogs and soft-shell clams are the most consistently abundant and commercially important species found within the study area. Oysters in the study area are propagated by the Town or grown in designated grant areas.

Scallops are another commercially important shellfish species, but the location and acreage of scallop beds is difficult to pinpoint because the adult population is mobile and areas of concentration can vary significantly from year to year. Other commercially viable species are razor clams (Stout tagelus and Ensis directus). Other shellfish species found within the area, but which are either not commonly harvested or have limited populations, include ribbed mussels, whelks, angel wings, blood arcs, spider crabs and a variety of crabs.

Quahogs

Quahogs (Mercenaria mercenaria) live in coastal sediments from the low tide mark to depths of up to fifty feet. In the study area, quahogs can be found to depths of sixteen feet (the deepest water in the area). Although quahogs can survive in a wide range of sediment types, they prefer fine sediments interspersed with crushed shells and small rocks. Quahogs spawn in the summer, and the planktonic larvae settle after a few weeks and develop to harvestable size within two to three years.

Quahogs are by far the most abundant and consistently harvested shellfish in the study area (see Figure 10.) The distribution of quahog resources has not changed appreciably since 1990. The 1990 plan found that quahog beds covered approximately 668 acres, compared with current coverage measured at 639 acres. Quahogs can be found along the shoreline at varying densities throughout the study area, but they are most plentiful in the northern portion of Cotuit Bay where the beds extend across the Bay. In addition, several large quahog beds are located in North Bay, the shoreline of West Bay, the northern and southern portions of East Bay, and the Centerville and Bumps Rivers. Approximately 85% of the commercial quahog harvest in Town comes from

areas within the Three Bays system, 15% in Cotuit Bay, 15% in West Bay and 55% from North Bay.[2]

The average density of quahogs in the study area is equal to or greater than the Massachusetts Division of Marine Fisheries (MarineFisheries) definition of a significant shellfish resource, which is one quahog per square foot (nine per square yard.) [3] As reported in the 1990 plan, densities in some area are much higher.

Soft-shell Clams

Soft-shell clams (Mya arenaria) are most commonly found in sand and sandy-mud sediments, especially throughout the intertidal zone, but at times in water up to twenty feet deep. Soft-shell clams spawn in the spring and sometimes again in the late summer. After a two to three week-long planktonic stage, the young clams settle and attach to sand grains. The clams grow to harvestable size in about two years. Clams typically burrow two to three times their length into the sediments, thus a four-inch clam may be found as deep as one foot.

The distribution of soft-shell clam resources is roughly the same today (242 acres) as was documented in the 1990 plan (224 acres.) Within the study area, soft-shell clams are located primarily in the shallow waters along the shoreline. The distribution of soft-shell clams is shown on Figure 11. Soft-shell clams are most plentiful in Cotuit Bay, North Bay, West Bay and the Seapuit River, although small beds can be found in Prince Cove, East Bay and the Centerville River. The largest soft-shell clam beds are located along the shorelines of Cotuit Bay and North Bay.

Average soft-shell clam densities within the study area are consistent with the state MarineFisheries definition of a significant shellfish resource, in the range of three per square foot (twenty-seven per square yard.) [4]

Scallops

Bay scallops (Argopectin irradians) are found primarily in eelgrass beds because the larval stages of scallops attach to eelgrass blades for protection. Bay scallops spawn in the early summer and can be harvested within one year. Harvesting usually occurs in the late fall until the adult stock is depleted. Scallops only live on average two years, and can only be harvested legally after the first full year of growth, when a one-year growth ring is visible.

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[2] Tom Marcotti, Marine & Environmental Affairs Division, 2009.

[3] Tom Marcotti, Marine & Environmental Affairs Division, 2009.

[4] Tom Marcotti, Marine & Environmental Affairs Division, 2009.

Scallop populations in the study area are cyclic, varying widely from year to year. According to the 1990 plan, the last "good" harvest was approximately 1985, and at that time the population was expected to rise significantly over the next few years. It was noted also that the time between good harvests was getting longer, and that in good years harvesting extended through the state bay scallop harvest season (October/November through April 1st annually) or until most of the stock was depleted. According to the Town's shellfish biologist, the next good crop is still awaited. Pollution, lack of eelgrass, water quality and predation may be contributing factors as to why scallops have not had a bountiful crop in many years.

Oysters

Oysters (Crassostrea virginica) typically grow attached to hard objects, such as rocks, shells or pilings. The life cycle of the American oyster is similar to that of most other bivalve mollusks - mature oysters produce larvae, which feed on microscopic plankton for a few weeks before settling out and attaching to the substrate. Once they attach, oysters reach market size in one to three years depending on the water quality, water temperature, and food supply.

Most oysters found in the study area are grown commercially and harvested in designated oyster grant areas since there are no significant naturally occurring oyster populations in the area. There are currently seven oyster grant areas in the study area - two in Cotuit Bay, four in West Bay, and one in North Bay (see Table 11.) This is one less oyster-growing grant than noted in the 1990 plan. These grant areas are licensed by the Town to individual shellfishermen. In addition, the Town cultivates oysters for recreational shellfishing only.

4.2.2 Summary of Management Issues: Shellfish Resource Sustainability

The location and densities of quahog and soft-shell clam resources were estimated for the 1990 plan and again for the CRMC-09 (see Figures 10 and 11.) These estimates suggest that the geographic distribution and densities of the resources have remained stable. Current healthy resource conditions are attributed to a number of initiatives addressed later in this chapter, including steps to address water quality threats from stormwater run-off, controls on commercial permits, and the success of public propagation efforts. However, nutrient loading, bacterial contamination, and impacts to habitat from piers and boating activity continue to pose management challenges.

As with all estuaries that are heavily used and are surrounded by heavily populated watersheds, the habitats that support shellfish are under constant

stress. The Massachusetts Estuaries Project (MEP) documented habitat degradation in areas throughout the study area that is believed to be the result of excessive nutrient enrichment. Perhaps the most notable habitat indicator is the trend in eelgrass. The 1990 plan reported substantial eelgrass beds throughout Three Bays system, yet today eelgrass is virtually missing in the system. The restoration and sustainability of shellfish habitat is a significant objective of the CRMP-09.

Recognition that bacterial contamination in some areas poses a significant threat to shellfish and other resources led to the development of a bacterial TMDL for Prince and Warren's Cove. Much of the bacteria causing contamination emanates from wildlife and is draining from the marshes surrounding the Marstons Mills River. Concerns raised in the 1990 plan and subsequently about the long-term sustainability of shellfish resources in the study area prompted the Town to adopt a number of protective measures aimed at minimizing impacts on shellfish resources resulting from the installation and use of piers in the study area.

In 2000 the Town Marine and Environmental Affairs Division launched a Significant Shellfish Resource and Habitat Mapping Project. The project was initially focused in the Three Bays system, and later expanded to include other southside embayments. A committee of individuals with a broad range of shellfish expertise was assembled. Participants included Town Natural Resources and Conservation officials, representatives from MarineFisheries, and commercial shellfishermen and aquaculturists. Each committee member individually assessed shoreline areas based on the historical significance as a recreational or commercial shellfishing area, notwithstanding current shellfish population densities in the areas. The committee then compiled the individual maps into a composite map, and assigned a numeric value based on the number of participants who viewed an area as significant. The project assigned a numeric rating of 0-5 for areas considered low shellfish habitat value, and 6-10 for areas considered to be high-value shellfish habitat. The habitat valuations were used as the basis for amendments to the Town's wetlands regulations governing docks and piers (Chapter 703) adopted in 2004. In such high-value habitat (rated 6-10), the minimum depth under the draft of the boat berthed at the pier must be 30 inches at Mean Low Water. In areas determined not to be high-value shellfish habitat (rated 0-5), the minimum depth under the draft of the boat must be 12 inches at MLW. The rating of shellfish habitat areas is depicted on Figure 12.[5]

In 2008, Town Council took the further step of enacting the *Temporary Recreational Shellfish Area and Shellfish Relay Area Overlay District*. The purposes of the overlay district were to protect public access along the shore for

[5] Memo from Natural Resources Department to Doug Kalweit et al, November 22, 2000.

shellfishing, prohibit activities which may be harmful to shellfish including installation of piers and harvesting by hydraulic dredging, and to allow time to assess whether further regulatory steps were needed to control shoreline uses and protect shellfish resources. The relay areas and recreational areas covered under the overlay were selected based on the input of the committee formed for the Significant Shellfish Resource and Habitat Mapping Project. The extent of the overlay district is shown on Figure 13. A purpose of the CRMP-09 is to recommend whether the prohibitions in relay areas should be continued, altered or eliminated. This recommendation is addressed in section 4.3.3.1.

4.2.3 Recommended Actions: Shellfish Resource Sustainability

4.2.3.1 Complete Significant Shellfish Resource and Habitat Mapping Project

Complete the *Significant Shellfish Resource and Habitat Mapping Project* begun in 2001 to include all shoreline and intertidal areas in the study area, including those that are as yet unrated. The assessments should be reviewed every ten years and updated as necessary.
Parties involved: Shellfish Committee, Marine and Environmental Affairs Division, Conservation Division and Commission.

4.2.3.2 Promote Town-wide Initiatives to Mitigate Pollution Sources

Promote other local initiatives to reduce or mitigate pollution sources that pose a threat to shellfish habitat. These initiatives include, but are not limited to:

- Implementation of stormwater improvement projects to reduce the inflow of bacteria, metals, petroleum-based pollutants and nutrients;
- Swift implementation of other measures identified in the Bacterial TMDL to control inflow of bacteria;
- Swift implementation of the Wastewater Facilities Plan, which will extend sewer service to portions of the Centerville River watershed;
- Swift completion and implementation of the Nutrient Management Plan, which will provide strategies for reducing nutrient loading in the Three Bays watershed; and
- Enforcement of the No Discharge Area.

Parties involved: Shellfish Committee, Board of Health, Department of Public Works, Waterways Committee, Marine and Environmental Affairs Division, Conservation Commission, Growth Management Department

4.3 Public Shellfish Propagation

4.3.1 Current Condition and Change Analysis

Since the 1990 plan was developed, the Town has significantly augmented its efforts to enhance shellfish propagation throughout the system. These propagation efforts included seeding as well as participating in the state-regulated shellfish relay program.

Quahog Upwelling Facility

The Town has a quahog upwelling facility in Prince Cove. Nearly one million seed quahogs are grown annually in the upwelling facility. When it has reached the proper size, the seed is taken and broadcast in different areas in Town, including West Bay in the study area.

Oysters are also propagated by the Town in the Three Bays, and are available for harvesting by recreational permit holders only.

Shellfish Relay Program

Since the 1930's the Town periodically has participated in a Contaminated Shellfish Relay Program, which is a propagation program regulated by the Massachusetts MarineFisheries. Through this program MarineFisheries permits municipalities to relocate contaminated shellfish to clean waters for natural purification and propagation. Relays are conducted under stringent National Shellfish Sanitation Program (NSSP) guidelines and are heavily supervised by state and local enforcement authorities. Contaminated shellfish must remain at the relay site for a minimum of three months and also for the duration of one spawning season. Shellfish are tested prior to relaying and again before harvesting for human consumption to insure that they meet NSSP requirements for safety. [6]

[6] MarineFisheries website, http://www.mass.gov/dfwele/dmf/

Barnstable has both an in-town and an out-of-town relay program. The in-town relays take contaminated quahogs from the Centerville River and East Bay, and relay them West Bay, and most recently to Bay Street, Osterville. The relay began in 1999 at which time 640 bushels of quahogs were relayed from the River to West Bay. The amount relayed increased annually through 2002, when 1,662 bushels were relayed. In 2002 the Town undertook dredging of the Phase 1 channel as part of the Centerville River dredging project. Approximately 70,000 quahogs were extracted from the dredge material placed on Long Beach and relayed to West Bay. A post-dredge shellfish survey conducted in 2004 found that stocks were able to replenish following dredging.[7] An additional shellfish survey conducted in 2007 concluded that the dredging "has not had a serious effect on the repopulation of juvenile shellfish in the channel."[8] In 2007, 286 bushel-bags of quahogs were transplanted through this program. To date, nearly 4,500 bushel-bags of quahogs have been transplanted from the Centerville River and East Bay into the Three Bays.[9]

For the out-of-town relay, mildly contaminated quahog stock from off Cape locations (Mount Hope Bay) is purchased by the Town and transplanted into the designated shellfish relay areas. If purchased stock is placed prior to June 15th, the area is required to remain closed for at least three months. If the stock is placed after June 15th, the relay area must remain closed until the first day of fall of the following year. In Spring 2007, 506 bags of quahogs from Mount Hope Bay were placed in the Cotuit Town Dock Relay area. In the fall of that year, 753 bags were taken to the Cordwood Lane relay area and 547 bags of quahogs were placed in the Bluff Point relay area. [10]

4.3.2 Summary of Management Issues: Public Shellfish Propagation

Public shellfish propagation programs, including the in-town and out-of-town shellfish relay programs and the oyster propagation program, have operated successfully for a number of seasons. Recreational and commercial shellfish permit fees have contributed to a revolving fund which sustains these programs. Fees are used primarily to purchase stock and supplies. Manpower assistance to the propagation program from regional community service

[7] Woods Hole Group. Centerville River Shellfish Survey: Post Dredging Operations-Phase 1 Dredging. April 2004.
[8] Woods Hole Group. Centerville River Shellfish Survey: 3rd Year Post Dredging Operations – Phase 1 Dredging. October 2007.
[9] Tom Marcotti, Marine and Environmental Affairs Division, 2009.
[10] Marine and Environmental Affairs Division. Barnstable Shellfish Newsletters. Summer, Fall 2008.

programs has been discontinued. Personnel hours available to implement propagation programs have been cut back.

Shellfish propagation through seeding of propagation areas, and in the successful in-town and out-of town relay areas have by all accounts been very successful and have been credited with helping to restore shellfish stocks. The Town Shellfish Committee is considering whether additional relay locations are advisable, and if so, what criteria should be used to select and manage these areas.

4.3.3 Recommended Actions: Public Shellfish Propagation

4.3.3.1 In Light of the Expiration of the Temporary Recreational Shellfish Area and Shellfish Relay Area Overlay District (§240-37.1):

Create a zoning ordinance to establish a permanent prohibition on piers for motorized vessels in designated shellfish relay areas and recreational shellfishing areas shown on Figure 13 of this CRMP-09. Applications for seasonal piers for non-motorized vessels could be submitted for these areas subject to review under Chapter 703 performance standards. (See 7.2.3.2, *Amend Existing Regulatory Framework for Private Piers*.)
Parties involved: Shellfish Committee, Marine and Environmental Affairs Division, Conservation Commission and Division, Planning Board, Growth Management Department, Town Council

4.3.3.2 Develop Guidelines for Selecting and Managing Shellfish Relay Areas

- Maintain existing designated shellfish relay and shellfish recreation areas;
- Develop guidelines and procedures for proposals to amend or establish designated shellfish relay areas to allow public vetting of pertinent issues such as access, suitability of habitat conducive to health and long-term survival of shellfish, and compatibility with other historic uses.

Parties involved: Shellfish Committee, Waterways Committee, Marine and Environment Affairs Division, Conservation Commission and Division

4.3.3.3 Ensure Adequate Funding for Propagation Programs

Continuation of the Town's highly successful public propagation programs is essential to the sustainability of the shellfish resources and the public's access and ability to harvest shellfish. These programs include:

- Oyster propagation for recreational fishing;

- Quahog seed propagation program;
- In-town quahog relay program;
- Out-of-town quahog relay program; and

In addition, there should be an evaluation of the need to expand or add new relay areas to support recreational and commercial shellfishing. The Town should continue to provide dedicated funds to sustain programs at a level commensurate with public demand.
Parties involved: Shellfish Committee, Marine and Environmental Affairs Department, Town Manager

4.4 Commercial and Recreational Shellfish Permitting and Management

4.4.1 Current Condition and Change Analysis

Harvesting of shellfish for recreational and commercial purposes is a time-honored activity in Barnstable. Area residents take pride in the Town's shellfish resources and demonstrate their support through financial contributions and by donating thousands of volunteer hours in support of propagation efforts. Significant volunteer contributions are made by the Barnstable Association of Recreational Shellfishing (BARS), and Three Bays Preservation, Inc. among other students and individual volunteers. These efforts are a crucial element in the success of the Town's shellfish propagation efforts described above.

Another way to gage interest in shellfishing is through permit activity. Overall there has been a 4% increase in the number of recreational permits issued by the Town as compared with figures reported in the 1990 plan. Within that category, recreational permits issued to residents declined slightly, while non-resident permits more than doubled. Still, recreational permits issued to residents accounted for 64% of all recreational permits issued in 2008, compared to 69% of recreational permits issued in 1990.

Commercial permits increased by 6, or 15%, over the 1990 level. However this tells only part of the story. Commercial permits grew steadily in the early 1990's, reaching a peak of 193 in 1995. The Shellfish Committee instituted a control on commercial permits, as described below. Under the Town's current policy new commercial shellfishing licenses are being issued to individuals who successfully complete the commercial shellfishing apprentice program. Otherwise, any commercial licenses that are relinquished are being re-issued through a lottery system.

Table 9. Shellfish Permits Issued 1990 and 2008

Permit Type	1990	2008	Change 90-08
Recreational - Resident	1574	1518	-56 (-4%)
Recreational - Senior	621	682	61 (10%)
Recreational - Non-resident	79	163	84 (106%)
Recreational - Total	2274	2363	89 (4%)
Commercial	41	47	6 (15%)
Total Permits Sold	2315	2410	95 (4%)

Source: Barnstable Marine and Environmental Affairs Division; and 1990 Town Report

4.4.2 Summary of Management Issues: Commercial and Recreational Shellfish Permitting and Management

Intensity of Commercial Permits

Maintaining a balance between commercial and recreational shellfishing activity in the study area is a significant management objective. The study area is quite popular for recreational shellfishing, and also constitutes approximately 85% of the commercial quahog harvests in the Town.

Data compiled by the Marine and Environment Affairs Division demonstrates a strong correlation between the number of commercial shellfishing permits issued by the Town and the volume in bushels of reported commercial catch of quahogs and soft-shell clams. The number of commercial permits issued in 1990 was only forty-one, but that number spiked rapidly in the mid-1990's, reaching 193 commercial permits in 1995 and staying well above one hundred 1992 through 1996. During this time, commercial harvests for soft-shell-clams went from under 2,000 bushels in 1990 to as high as 12,000 bushels in 1992 and over 11,000 bushels in 1995. Quahog harvests roughly doubled, from around 2,000 bushels a year to 4,000 bushels a year in much of the mid 1990s (see Chart 1.)

Concern that a proliferation of commercial licenses was contributing to a depletion of shellfish resources led the Town to establish a cap on commercial licenses in 1996. In 2001 the cap program required that three commercial licenses would need to be retired in order for one new commercial license to be

issued. In 2005 regulations required that one commercial license be retired for another new commercial license to be issued. Currently (2009) there are forty-seven commercial shellfish permits issued by the Town. The Shellfish Committee is now weighing whether there should be an increase in the number of commercial permits issued.

Aboriginal Fishing Rights

Some harvesting of shellfish (oysters, quahogs, soft-shell clams) is undertaken by individuals claiming aboriginal fishing rights. This issue is under review by the Town.

Docks and Piers

The 1990 plan cited the expansion of docks and piers as posing a threat to shellfish habitat and displacing access to public tidelands for shellfishing and navigation. In response, the Town adopted stricter regulations for piers, and also adopted the *Temporary Recreational Shellfish Area and Shellfish Relay Area Overlay District* (§240-37.1) which is set to expire in November 2009.

The potential impacts of docks and piers on shellfishing and shellfish habitat are addressed in Chapter 7. Briefly these impacts include:

- Potential alteration of water circulation and littoral transport;
- Water shading with impacts to aquatic vegetation;
- Displacement or alteration of habitat;
- Aesthetic impacts.

Area Closures

At the time of the 1990 plan shellfishing was prohibited year-round in Prince Cove, Seapuit River, East Bay, Centerville River and Bumps River due to a variety of reasons including bacterial contamination, lack of testing, and reproduction or replenishment. Some areas were closed seasonally in North Bay (May 1st through October annually.) The plan noted that deteriorating water quality posed a threat to open shellfish areas in West, Cotuit and East Bay.

Current shellfish closures are listed in Table 10. The Centerville River and East Bay are indefinitely closed, yet the shellfish from those areas are harvested and transplanted through the in-town shellfish relay. Only West and Cotuit Bays are fully open. Several areas within the study area are subject to seasonal or indefinite closure for the taking of shellfish by the Massachusetts Division of Marine Fisheries (MarineFisheries). Of these, the Marstons Mills River, which has a prolific soft-shell clam population, is closed nine and a half months. The Centerville River and East Bay are indefinitely closed. Modification of these closures are unlikely given that MarineFisheries does not have adequate

resources for water quality monitoring of these areas, and will not accept monitoring data from other sources.

Table 10. Study Area Shellfish Closures

Location	Closure Dates	Area Status
Prince Cove, Marstons Mills River	May 1 – Feb 14	Seasonal – Water Quality Closure
Warrens Cove	Indefinite	Prohibited – Water Quality Closure
North Bay, Cotuit Bay Narrows, Pirates Cove	May 1 – October 31	Seasonal – Water Quality Closure
Cotuit Bay	Open per regulations	Open Area
West Bay	Open per regulations	Open Area
East Bay, Centerville River, Scudder Bay, Bumps River	Indefinite	Prohibited – Water Quality Closure

Source: Marine and Environmental Affairs Division

Hydraulic Dredging

Hydraulic dredging is used on a limited basis by some commercial shellfishermen. This method works by injecting water into the sediments to extract shellfish. The technique can cause turbidity and disruption of other animals and vegetation. However the method, when judiciously applied, is credited with aerating the bottom and enhancing habitat. Currently, given the low intensity of this activity and widespread adherence to Town regulations aimed at avoiding potential negative effects, hydraulic harvesting is not considered a management concern.

4.4.3 Recommended Actions: Commercial and Recreational Shellfish Permitting and Management

4.4.3.1 Maintain a Cap on Commercial Shellfish Licenses

The Town should continue to cap the number of commercial shellfishing licenses as a way to prevent over-fishing of the resource. In weighing whether to increase the cap to allow a higher number commercial permits, the Shellfish Committee should consider the worst-case impacts in terms of fishing effort associated with new licenses, and assess the cumulative impact of total outstanding licenses. While some people may seek a commercial license as a convenience, others may see shellfishing as a viable livelihood. In determining the cap, the Shellfish Committee should ensure that the overall number of licenses will respect the interests of current and prospective shellfishermen and, most importantly, promote the health and sustainability of shellfish habitat and resources.
Parties involved: Shellfish Committee, Marine and Environmental Affairs Division.

4.4.3.2 Address Water Quality Monitoring in Closure Areas

The Town should approach MarineFisheries to identify an acceptable protocol for water quality monitoring in areas subject to lengthy or permanent closure. The protocol should provide for the collection of data that is monitored and reviewed on a regular basis and could be considered valid for the purposes of assessing and possibly modifying the closure status.
Parties involved: Shellfish Committee, Marine and Environmental Affairs Division, MA Division of Marine Fisheries.

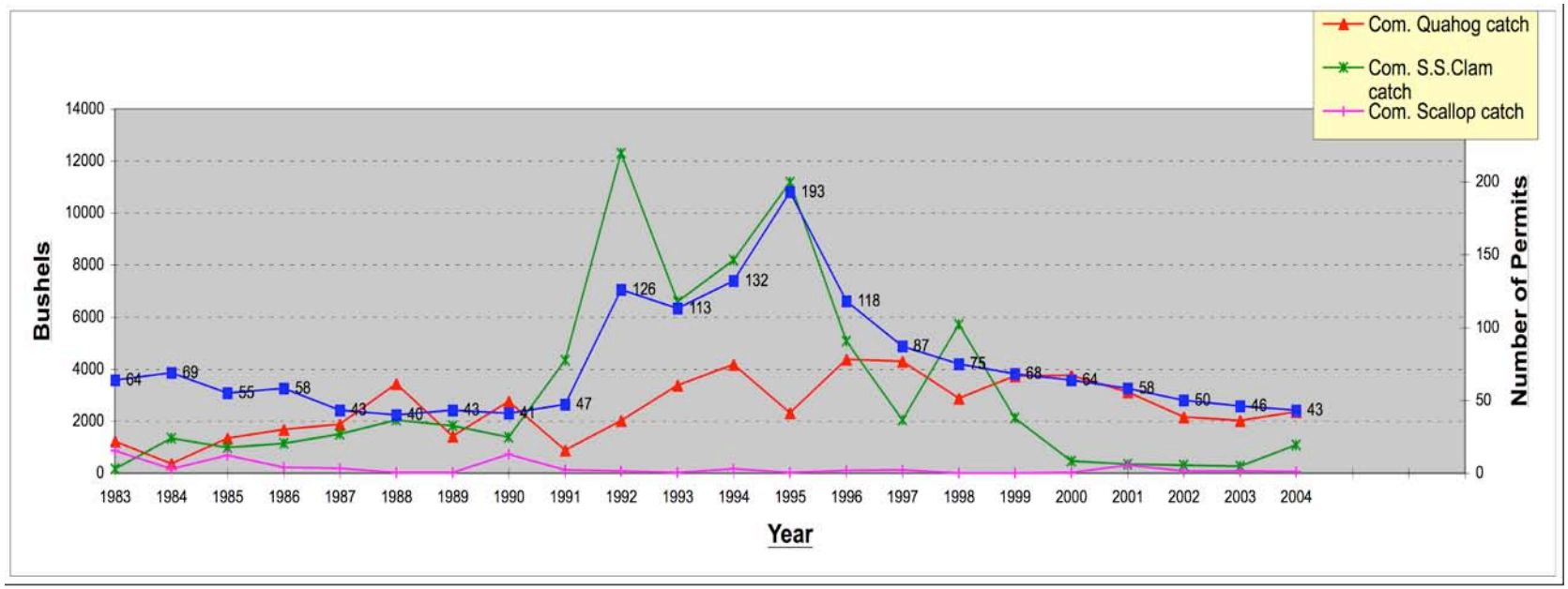
4.4.3.3 Monitor Extent of Hydraulic Shellfish Harvesting

Hydraulic shellfishing is not considered a threat to resource health at this time in part because it is not a prevalent technique. However, the Shellfish Committee and Marine and Environmental Affairs Division should continue to monitor use of this harvesting technique see if there is a change in intensity or impacts.
Parties involved: Shellfish Committee, Marine and Environmental Affairs Division.

4.4.3.4 Continue Dialogue on Aboriginal Fishing Rights

The Town currently is working with representatives of Native American heritage to understand and resolve issues surrounding aboriginal fishing rights. These discussions should continue as needed.
Parties involved: Town Manager, Legal Department, Marine and Environmental Affairs Division, Shellfish Committee.

Chart 1 Commercial Shellfish Harvests and Permits Issued 1983-2005



Source: Marine and Environmental Affairs Division

4.5 Disease Threats

4.5.1 Current Conditions and Change Analysis

Shellfish resources are vulnerable to diseases and harmful algal blooms that can be toxic to the animals and, in some cases, harmful to humans who may consume infected shellfish. In 2001 a strain of red tide was detected in areas of North Bay, Prince Cove and Oyster Harbors. Three Bays Preservation, Inc. collected water quality samples and sent them for analysis at the Woods Hole Oceanographic Institute. The samples were analyzed and it was determined that the strain of Red Tide was cochlodinium polykrikoides, a member of the dinoflagellate family. This organism has caused many large fish kills in Asia and North America, primarily in fish farms, but does not appear to be harmful to humans.[11] This strain differs from the alexandrium strain that swept the near-shore waters off the New England coast in a massive Red Tide Bloom in 2005. The New England bloom resulted in the closure of areas on the north side of Barnstable, but not the Town's south-facing shore.

Red Tide is a on-going threat to all inland coastal waters. Unfortunately, little can be done to contain a Red Tide outbreak, but careful monitoring by state and local shellfish authorities can provide early closures and warnings necessary to ensure that any outbreak is contained with the minimal threat to the resources or human health.

MSX (Minchinia nelsoni), Dermo (Perkinsus marinus) and Juvenile Oyster Disease (JOD) are diseases that pose a threat to oysters in the study area. The 1990 plan noted an outbreak of MSX which infected town-planted oysters in the Centerville and Bumps Rivers. MSX is a microscopic protozoan parasite which can devastate oyster populations and reduce their marketability due to aesthetic problems, but is not harmful to humans. The plan also noted that MSX had effected oyster populations in Cotuit and West Bays, but that grant owners had begun to purchase disease resistant stock. However, no stock is immune from these diseases and MSX and Dermo continue to pose a threat to oyster growers in the study area.[12] Dermo is a parasite that also can devastate oyster populations. Both diseases are particularly troubling because they can settle in animals in the first year of growth and manifest symptoms in the second year of growth when animals are nearing market size.

QPX (Quahog Parasite Unknown) is an organism that can wipe out quahog crops. There was a QPX outbreak reported on the north side of Barnstable, but to date there has not been a QPX outbreak within the study area.

[11] Three Bays website: http://www.3bays.org/

[12] Tom Marcotti, Marine and Environmental Affairs Division, 2009.

County and state officials continue to work with regional researchers to understand the causes and develop possible containment strategies for QPX.

4.5.2 Summary of Management Issues: Disease Threats

The potential for shellfish diseases, including QPX in Quahogs and Dermo and JOD in oysters, as well as Harmful Algal Blooms (HABs) such as Red Tide pose a significant threat to shellfish resources and yet are somewhat beyond the Town's ability to manage. However, there is concern that degradation of local water quality could create a climate more conducive to the proliferation of certain diseases.

4.5.3 Recommended Actions: Disease Threats

4.5.3.1 Public Education on Disease Threats

Develop a public education effort aimed at educating local homeowners, boaters and shellfish harvesters about the signs of water quality degradation or of an outbreak of an HAB or other disease threat, and urging them to report these incidents to the Marine and Environmental Affairs Division quickly.
Parties involved: Shellfish Committee, Marine and Environmental Affairs Division, Barnstable Association of Recreational Shellfishing.

4.5.3.2 Continue Working with Regional Institutions and State Agencies to Understand and Address Disease Threats

Efforts to understand the causes of disease threats and to develop effective prevention or management responses should continue. The Town should continue to work closely with regional governmental and institutional researchers on this management topic.
Parties involved: Marine and Environmental Affairs Division, Barnstable County Cooperative Extension Service, Woods Hole Oceanographic Institution, other Regional Institutions.

4.6 Private Aquaculture Grants

4.6.1 Current Condition and Change Analysis

Currently there are nine active aquaculture grants operating in the Three Bays. The grants are described in Table 11 below and area shown on Figure 14.

Table 11. Aquaculture Grants in Three Bays System

Location	Grantee	Area (Ac)	Species	Active (Y/N)
West Bay	Robert Ashworth	0.81	Oysters	Y
	Douglas Campbell	1.38	Quahogs	Y
	Wayne Hayes	0.92	Quahogs	Y
	Les Hemmila	3.18	Oysters	Y
	John V. Kelley	0.32	Oysters	Y
	Cape Cod Oyster Company	14.81	Oysters	Y
North Bay	Cape Cod Oyster Company	1.24	Oysters	Y
Cotuit Bay	Cotuit Oyster Company	33.82	Oysters, Quahogs	Y
	Conrad Geyser	5.13	Oysters, Quahogs	Y

Source: Barnstable Marine and Environmental Affairs Division

4.6.2 Summary of Management Issues: Private Aquaculture Grants

Nine private aquaculture grants cover approximately sixty-one acres in the Three Bays system (see Table 11.) Some of the grant areas are located in or very near areas of heavy boating traffic, such as the Narrows between North and Cotuit Bays, and the southern end of West Bay near the entrance channel. For the most part the grants operate with little or no conflict with surrounding land owners and other water uses. However, conflicts occasionally do arise. One example is the conflict over gear used in West Bay, which was contested by abutting property owners as unsightly. Additionally, shellfish diseases, primarily Dermo, have occurred in the grants yet this has not posed a serious threat to surrounding shellfish resources or to human health.

Aquaculture is an important historic activity in the Three Bays, covering more 61 acres. The grants are a longstanding part of the visual character of the study area. Many argue they also contribute to the health of the wild shellfisheries by contributing spat into the water column, and that the shellfish themselves as filter feeders have a beneficial impact on water quality. However, the grants are a private use of a public resource, and should enhance and not detract from the health and visual character of the study area.

4.6.3 Recommended Actions: Private Aquaculture Grants

4.6.3.1 Thoroughly Evaluate Any Proposals to Alter or Expand Grants

Any proposals to expand or alter grant coverage or equipment must go through a public review and approval process. Such proposals should be thoroughly evaluated and publicly vetted in terms of: compatibility with other traditional waterways uses and activities, impacts to natural resource conditions, and visual impacts or intrusions.
Parties involved: Town Council, Town Manager, Shellfish Committee, Marine and Environmental Affairs Division

4.6.3.2 Encourage Best Management Practices

Grant operators should be required to abide by the latest best management practices applicable to the species and the region, and should seek to minimize conflicts or visual impacts associated with gear, landside impacts (parking, noise, etc.) and disease potential.
Parties involved: Marine and Environmental Affairs Division, Barnstable County Cooperative Extension Service, Ma Division of Marine Fisheries, Grant Holders

4.7 Finfish Resource Sustainability

4.7.1 Current Condition and Change Analysis

Common fish species throughout the study area include bluefish, white perch, striped bass, tautog, scup, and winter flounder. There is no complete inventory of species or population counts available. Fishing in the area is primarily for recreational pursuit, with some commercial fishing in connection with day charters, pot fishing and rod and reel, which operate out of the Three Bays. This condition is the same as reported in the 1990 plan, which cited limited commercial fin fishing activity.

4.7.2 Summary of Management Issues: Finfish Resource Sustainability

There is limited information in the 1990 plan concerning finfish species and fin fishing activity. The current condition of shellfish resources today and the extent of fishing activity continue to be based on anecdotal information. Nevertheless, protecting or restoring the health of finfisheries and protecting or enhancing access to waterways for recreational and commercial finfishing are important management objectives of the CRMP-09.

4.7.3 Recommended Actions: Finfish Resource Sustainability

4.7.3.1 Support Recommended Actions to Protect or Restore Water Quality, Eelgrass and Salt Marsh

See Recommended Actions 5.2.3.1 (*Address Nutrient Loading*), 5.2.3.2 (*Address Bacterial Contamination*), 5.3.3.2 (*Funding Coastal Discharge Remediation*), 5.4.3.1 (*Protecting Wetlands*), 5.4.3.2 (Protecting Coastal Landforms), and 5.4.3.3 (Addressing the Lack of Eelgrass.)

4.7.3.2 Support Recommended Actions to Protect and Enhance Public Access for Boating

See Recommended Actions 3.2.3.1 (*Fund Coastal Access Program*) and 3.2.3.6 (*Enhance and Create New Ways to Water*.)

Chapter 5.0 Natural Resource Protection

5.1 Overview

Three Bays and the Centerville River are estuarine systems containing extensive and varied natural resources of ecological, aesthetic and economic significance. Estuaries are coastal systems that provide an interface between open ocean waters and inflowing freshwater sources such as streams, groundwater, and ponds with hydrological connection through wetlands. Estuaries are very productive ecosystems, and help to support many species vital to the food chain. Beaches, salt marshes and tidal flats provide spawning, nursery and feeding areas to a wide variety of shellfish, finfish, and birds. Crabs, polychaetes (worms), infauna (animals living in sediments) and other invertebrates provide vital food sources for other species.

In addition to habitat values, the vast salt marshes and wetland grasses naturally absorb pollutants such as nutrients that can degrade marine water quality. They also help to buffer the shoreline from wave energy from tides and storms.

The economic and aesthetic values associated with healthy natural resources are also significant. Healthy water quality, shellfish resources, and wetlands support marine activities essential to our seasonal economy, and maintain the area as a desirable place to live, which enhances the municipal tax base.

As important as estuaries are, it is also important to acknowledge their vulnerabilities. Impairment to water quality in the study area caused by nutrient loading and bacterial contamination is well documented. The MEP helped make the link between impaired water quality and loss of eelgrass, infauna and other natural resources critical to the functioning of estuaries.

This chapter addresses resources conditions, management issues and recommended actions for the following topics:

5.2 Water Quality (nutrient loading and bacterial contamination)
5.3 Stormwater Management
5.4 Wetland Resources
5.5 Wildlife, Rare and Endangered Species
5.6 Fish Runs

5.2 Water Quality

5.2.1 Current Conditions and Change Analysis

Both the Three Bays and Centerville River systems are currently listed under the Massachusetts Surface Water Quality Standards (310 CMR 4.00) as Class SA waters, the highest classification for marine waters. According to the standard, Class SA waters are an excellent habitat for fish, other aquatic life and wildlife, including for their reproduction, migration, growth and other critical functions, and for use for primary and secondary contact recreation. It should be noted that the Classification system represents the water quality that the embayment should support, not the existing level of water quality.[1]

Total Maximum Daily Load ***(TMDL) is the total amount of a pollutant a water body can receive and still remain healthy. TMDLs are mandated for impaired water bodies under the Federal Clean Water Act. TMDLs have been issued for Total Nitrogen in Three Bays and Centerville River systems and for bacteria in Three Bays.***

The 1990 plan cites bacterial contamination and nutrient loading from septic systems and stormwater runoff and major threats to water quality and the health of the Three Bays and Centerville River systems. While these threats remain today, since 1990 the Town has undertaken aggressive measures to address them:

- Water column nitrogen has been monitored throughout the study area since 1999;
- Massachusetts Estuaries Project (MEP) technical reports have been completed for the Three Bays and Centerville River systems. The reports measure the extent and sources of nutrient loading, and identify thresholds for reductions in watershed nutrient sources needed to restore ecosystem health;
- Total Maximum Daily Loads (TMDLs) have been established for total nitrogen for both systems. These regulatory thresholds codify the findings of the MEP Technical Reports, and provide the basis for local wastewater management planning;
- A Total Maximum Daily Loads (TMDLs) have been established for bacteria in the Three Bays system. The bacterial TMDLs are based on the highest standard of protection for taking of shellfish from these waters;
- A prioritized list of stormwater management improvements is being implemented to address nutrient and bacterial impacts from stormwater runoff.

[1] Basis of Development of Total Maximum Daily Load of Bacteria (Final) for Princes Cove/Three Bays Watershed, Town of Barnstable Massachusetts (2005). Massachusetts Estuaries Project, Massachusetts Department of Environmental Protection. Boston, MA.

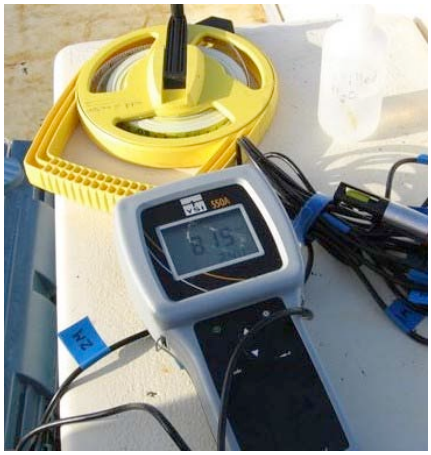
Despite progress in understanding and responding to water quality threats from nitrogen loading and from bacteria, on-going efforts will be required to ensure that regulatory standards are met and water quality remains or is restored to a level consistent with healthy eelgrass and shellfish resources. The data and analyses referred to above, as well as on-going efforts by the Town, are summarized below. Full reference to these reports and how they may be accessed is found in the list of sources at the end of this document.

5.2.2 Management Issues: Water Quality

5.2.2.1 Nutrient Loading

Nutrient loading in estuarine systems is a problem because it can lead to excessive algae growth, which in turn reduces the amount of sunlight that can reach the bottom, where plants and benthic animals are located. The lack of sunlight inhibits photosynthesis needed for plants to survive. The death and decay of plant material consumes and ultimately depletes oxygen needed for animals to survive. This process is referred to as eutrophication. Eutrophication can occur in marine or fresh waters. In marine waters, the nutrient of concern is nitrogen, while in freshwater systems it is phosphorous.

The three primary sources of nitrogen in coastal systems are atmospheric deposition, regeneration of nitrogen from bottom sediments, and nitrogen flowing through groundwater and surface run-off from watershed sources. Of the three, only the load from watershed sources is considered controllable by local actions (infrastructure, regulations, management practices, etc.) The primary watershed sources of nitrogen are on-site septic systems, fertilizers and run-off. Wastewater from on-site septic systems accounts for approximately eighty-five percent of the locally controllable load.



The Massachusetts Estuaries Project (MEP) is state-sponsored program run by MassDEP in conjunction with the School for Marine Science and Technology at UMASS-Dartmouth. The MEP provides towns with a detailed understanding of nitrogen loading and its effects on eelgrass and benthic animals in specific embayments. MEP technical reports were issued for both the Centerville River and the Three Bays systems. These reports provided the basis for Total Maximum Daily Loads (TMDLs) for Total Nitrogen issued for the systems and approved by the US EPA. The TMDLs provide the threshold targets for watershed nutrient loading that underlie the development of local wastewater management plans.

Centerville River System

The MEP Technical Report concluded that nitrogen in the Centerville River system was in excess of what would have occurred naturally, and was having a negative effect on water quality. The system was considered impaired due to "excess nutrients, low dissolved oxygen levels, elevated chlorophyll a levels, and benthic infauna degradation." However the technical report found variations in nutrient enrichment in different subembayments within the system. For example, benthic habitat was generally healthy to moderately impaired throughout the system, yet the lower portions of Centerville River and East Bay were assessed as significantly impaired due to loss of historical eelgrass beds.

Table 12. Sources of Nitrogen

	Overall Nitrogen Load	Locally Controllable Nitrogen Load
Three Bays System		
Wastewater	69%	85%
Fertilizer	8%	10%
Impervious Surfaces	4%	5%
Water Body Surfaces	17%	Not Locally Controllable
Natural Surfaces	2%	Not Locally Controllable
Total	100%	100%
Centerville River System		
Wastewater	80%	87%
Fertilizer	5%	6%
Impervious Surfaces	6%	7%
Water Body Surfaces	8%	Not Locally Controllable
Natural Surfaces	1%	Not Locally Controllable
Total	100%	100%

Source: MEP Technical Reports for Three Bays and Centerville River Systems

According to the MEP technical report, the primary source of nutrients is from septic systems in the watershed. Residential land use accounts for fifty-five percent of the land area and eighty-eight percent of the parcels in the watershed, and virtually all of these have on-site septic systems. Wastewater from septic systems accounts for eighty percent of the overall load and eighty-seven percent of the controllable load in the watershed. Based on the MEP findings, the Total Nitrogen TMDL for the Centerville River system calls for a fifty-two percent reduction in controllable watershed load necessary to achieve threshold concentrations of nitrogen that would support ecosystem restoration.

Table 13 Percent Controllable Nitrogen Load Reductions

Embayment	Present Controllable Watershed Load (kg/day)	Target Threshold Watershed Load (kg/day	%Controllable Watershed Load Reduction to achieve Threshold Target
Centerville River System			
Centerville River	70.95	34.18	52%
East Bay	8.63	8.63	0%
Scudder Bay	52.63	52.63	0%
Three Bays System			
Cotuit Bay	23.77	22.34	6%
West Bay	17.90	15.97	11%
Seapuit River	3.77	3.77	0%
North Bay	27.48	4.47	84%
Prince Cove	31.30	17.89	43%
Warrens Cove	10.80	5.05	50%
Prince Cove Channel	5.02	0.77	85%

Source: TMDL Reports for Three Bays and Centerville River systems

Three Bays System

As with the Centerville River system, the MEP report for Three Bays concluded that the system was experiencing habitat degradation related to excessive nutrients. The report noted that each of the major embayments in the system was experiencing periodic dissolved oxygen stress, which in extreme conditions could result in loss of marine life. In sum, water quality conditions posed an on-going threat to benthic infauna as well as other habitat features such as eelgrass. Wastewater from septic systems was identified as the leading source of controllable nitrogen load entering the system, accounting for sixty-nine percent of the total nitrogen load and eighty-five percent of the controllable load. Residential land uses accounted for nearly half of the watershed land area, and for three quarters of all parcels. The TMDL report called for reductions in controllable load throughout the system, ranging from six percent in Cotuit Bay, eleven percent in West Bay, eighty-four percent in North Bay, fifty percent in Warrens Cove, forty-three percent in Prince Bay and eighty-five percent in Prince Cove Channel.[2]

[2]Howes B., S. W. Kelley, J. S. Ramsey, R. Samimy, D. Schlezinger, E. Eichner (2006). Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for Three Bays, Barnstable, Massachusetts. Massachusetts Estuaries Project, Massachusetts Department of Environmental Protection. Boston, MA.

The Town is undertaking actions to reduce watershed nitrogen loading from septic systems, road run-off and fertilizer use throughout the town, including the Centerville River and Three Bays watersheds. In 2008 the Board of Health adopted *Interim Regulations for the Protection of Saltwater Estuaries* (§360-45), which create stricter limits for nutrient loading from on-site septic systems within watersheds for which a TMDL has been issued. The Town also has developed and is in the process of implementing a final *Wastewater Facilities Plan*, which includes proposals to extend connection to the centralized wastewater treatment facility to the Craigvillle area of the Centerville River watershed. More recently, the Town embarked on development of a nutrient management plan to augment the facilities plan and identify additional strategies for nitrogen removal, including wastewater treatment systems, reductions in fertilizer use, and natural attenuation of nitrogen through wetlands and water bodies. The strategies identified in the nutrient management plan will be targeted to areas such as the watershed of the Three Bays system, which is not currently targeted for connection to the centralized wastewater treatment facility.

5.2.2.2 Bacterial Contamination

Unlike nitrogen, which is of concern because in excess it has the potential to degrade natural resources, bacterial contamination is of concern because of its potential threat to human health. The bacteria of highest concern is fecal coliform, because historic sampling data exceeded state water quality standards for this parameter. Fecal coliform bacteria are indicators of contamination of a water resource with sewage and/or the feces of warm-blooded wildlife (mammals and birds). This type of bacterial contamination may pose risks to human health as well as limit the use of natural resources such as shellfish beds.[3]

At a regulatory level, two bacterial contamination standards must be met in order to safeguard the natural resources (shellfish) of the system and public health. The first regulatory standard (Massachusetts Surface Water Quality Standards 314 CMR 4.05(4)(a)4 is intended to protect the shell fish resources of the coastal system using fecal coliform as the indicator organism. The shellfish standard for class SA waters is 14 colonies per 100 milliliters of water (14 fc/100 mL.)

The second bacterial contamination standard is a minimum standard for bathing beaches (105 CMR 445.00) and is commonly regarded as a swimming standard aimed at protecting public health using *Enterococci* as the indicator organism in marine waters. The regulatory standard is 104 colonies per 100 mL

[3] "Basis for Development of Total Maximum Daily Load of Bacteria – Prince Cove/Three Bays Watershed, Town of Barnstable", August 2005, and authored by University of Massachusetts Dartmouth – School of Marine Science and Technology (SMAST).

and the geometric mean of the most recent five *Enterococci* levels within the same bathing season shall not exceed 35 colonies per 100 milliliters of water. [4]

Centerville River System

Bacterial contamination in the Centerville River system is a long-standing concern of the Town. High levels of bacteria have been a reason for shellfish closures in the system.

Bacterial contamination in the Centerville River system has been attributed to the close proximity to water resources of a large number of onsite septic systems (most of which pre-date Title V regulations) and an insufficient distance between system leaching areas and groundwater, due to high groundwater. The Town took steps to upgrade many of the systems, particularly in the areas of Long Beach and Short Beach Road. However, the upgrades were not sufficient to remove the threat. The extension of the sewer system to Craigville Beach area proposed in the Wastewater Facilities Plan is in part a response to the ongoing need to address bacterial inputs from septic systems. Other sources of bacterial contamination to the system include stormwater effluent and run-off from marshes inhabited by a large number of mammals and waterfowl.[5]

Bacterial data collected by Marine Fisheries for Sanitary Surveys conducted between 1988 and 2008 show that fecal coliform levels periodically exceed shellfishing standards in Cotuit Bay, North Bay and West Bay, and periodically exceed both swimming and shellfishing standards in East Bay, Centerville River, Scudder Bay and Bumps River.

Three Bays System

Historical water quality data collected by the Town and MarineFisheries indicated excessive bacteria levels in the upper portions of the Three Bays system, leading to shellfish closures. The Town and Three Bays Preservation, Inc. provided data and analysis to assess the extent and causes of bacterial contamination in the Three Bays. The data were compiled in a technical report conducted in 2005 to provide the basis for a bacterial TMDL report. The report found:

> *Fecal coliform levels are generally low within the lower estuary, but high (relative to shellfish harvest limits) within the upper estuary. However, examination of the long-term record of fecal coliform levels collected by DMF [MassFisheries] (1985-1998) indicates that levels over the shellfish*

[4] "Basis for Development of Total Maximum Daily Load of Bacteria – Prince Cove/Three Bays Watershed, Town of Barnstable", August 2005, and authored by University of Massachusetts Dartmouth – School of Marine Science and Technology (SMAST).

[5] Interview with Dale Saad, Barnstable Department of Public Works, 2009.

limit occasionally occur in the near shore regions throughout most of the Three Bays System; and

Elevated fecal coliform levels are not always associated with rain events, suggesting potential direct discharges to the upper system from waterfowl, boats, direct wastewater discharges (in violation of health code).

The technical analysis found that the most likely sources of fecal coliform bacteria that needed to be evaluated were: stormwater inflows from paved areas; boat discharges in Prince and Warren's Coves; waterfowl/wildlife within Prince and Warren's Cove with their associated wetlands; and transport of fecal coliform via the Marstons Mills River into the Coves via tidal exchange.[6]

In 2007, a draft bacterial Total Maximum Daily Load Report (TMDL) report concluded that "the data indicates that West and Cotuit Bays contain low concentrations of fecal coliform bacteria while levels of fecal coliform bacteria in excess of the water quality standards frequently occur in Prince Cove, Warren's Cove and the tidal channel to North Bay. Analysis of the bacterial loads in the Marstons Mills River indicates that the river is an important source of bacterial contamination." [7]

The TMDL established 14 colonies per 100 milliliters of water as the standard to be met. This is the state regulatory standard for the taking of shellfish in Class SA waters.

5.2.3 Recommended Actions: Water Quality

5.2.3.1 Nutrient Loading

5.2.3.1.1 Dedicate Funds to Provide on-going Water Quality Monitoring

On-going monitoring of water quality conditions throughout the study area should be a Town priority. The Town should provide dedicated funds to ensure that comprehensive monitoring is continued or augmented to meet the following objectives:

- Measure Total Nitrogen and Bacterial TMDL compliance;
- Assess effectiveness of stormwater management projects (see 5.3.3.3);
- Evaluate shellfishing areas under indefinite closure (see 4.4.3.2).

[6] Basis of Development of Total Maximum Daily Load of Bacteria (Final) for Princes Cove/Three Bays Watershed, Town of Barnstable Massachusetts (2005). Massachusetts Estuaries Project, Massachusetts Department of Environmental Protection. Boston, MA.

[7] Basis of Development of Total Maximum Daily Load of Bacteria (Final) for Princes Cove/Three Bays Watershed, Town of Barnstable Massachusetts (2005). Massachusetts Estuaries Project, Massachusetts Department of Environmental Protection. Boston, MA.

Parties involved: Public Health Division, Department of Public Works, Town Manager, Marine and Environmental Affairs Division

5.2.3.1.2 Support Swift Implementation of the Wastewater Facility Plan

The Town Wastewater Facility Plan provides a comprehensive approach to nutrient management in many areas of Town. The plan proposes to extend sewer service to portions of the Centerville River watershed. This will help to address water quality degradation from nutrients and bacteria from underperforming or failed septic systems.
Parties involved: Department of Public Works, Comprehensive Town-wide Effort

5.2.3.1.3 Support Swift Development and Implementation of the Nutrient Management Plan

Support town efforts to develop a Nutrient Management Plan to address nutrient loading in areas that are not included in the 2007 Town Wastewater Facilities Plan. Steps to address nutrient loading from septic systems in the Three Bays portion of the study area should be fully explored. These alternatives may include: package treatment plants, de-nitrifying septic technology, growth controls to curb further development of single family homes, stormwater management improvements, and fertilizer controls. Regarding fertilizer use, the full range of public education and regulatory options should be fully explored for their feasibility in controlling this source of nutrient loading.
Parties involved: Department of Public Works, Comprehensive Town-wide Effort

5.2.3.1.4 Compliance with *Interim Regulations for the Protection of Saltwater Estuaries* (§360-45)

Pending implementation of the recommended actions for water quality noted above, the Town should continue to enforce the Board of Health Interim Regulation aimed at limiting growth in nutrient flow in watersheds for which TMDLs have been developed.
Parties involved: Board of Health, Public Health Division

5.2.3.1.5 Evaluate Sewer Neutral-Growth Neutral Policies

Sewer neutral controls and growth neutral land use strategies should be evaluated for their potential to control growth facilitated by sewering, in order to protect natural resources and community character and prevent overburdening of infrastructure.
Parties involved: Board of Health, Public Health Division, Department of Public Works, Growth Management Department

5.2.3.2 Bacterial Contamination

5.2.3.2.1 Complete Implementation Steps from Three Bays Bacterial TMDL

The Town should proceed with any unfinished components of the following implementation steps outlined in the Draft Three Bays Bacterial TMDL. The following is a status of actions recommended by the TMDL:

- It was recommended that the Town undertake a sanitary survey to identify the bacterial sources to the Marstons Mills River, a major contributor to bacteria in Princes Cove. This was completed in 2008.

- It was recommended that the Town work with the Massachusetts Highway Department to determine the Route 28 roadway drainage area discharging to the Marstons Mills River and install best management structures and/or operational practices to the maximum extent practicable and at a minimum, be designed to meet the water quality standard for bacteria in SA waters.

- In 2000 the Three Bays Preservation, Inc. conducted a fecal coliform source identity study throughout the Thee Bays System. As a part of this study, DNA testing was done which showed most bacterial contamination comes from wildlife sources, however, human sources to Prince and Warren's Coves are indicated. It was recommended that the Public Health Division continue to focus on finding the sources of bacteria with a "human DNA" signature within these coves, and that the potential for an isolated failing on-site septic system be a part of this investigation. However, the Town encountered problems with the test procedure for human DNA where overflow from septic systems was not being detected. The test procedure is also very costly.

- In Prince Cove higher levels of bacteria are found at the well-flushed entrance and lower levels are present at the more poorly flushed upper station indicating a source near the entrance. The tidal inflows from upper Marstons Mills River and Warren's Cove may be potential sources. The extent to which bacterial contaminants from Warren's Cove contribute to the contamination in Prince Cove should be quantified by the Town of Barnstable. Flow models developed by the Town in 1992 and through the Massachusetts Estuaries Project study address this point.

- The TMDL noted that the Three Bays System received designation as a "No Discharge Area" making direct discharge of wastewater from boats illegal. However, these discharges may still occur periodically during the summer. It was recommended that the Town institute a sampling program that evaluates the bacterial impacts of allowed greywater discharges and illegal blackwater discharges from moored boats particularly in Prince Cove. However, determining the extent of these discharges is difficult to

achieve through monitoring because they tend to be episodic events. Also, funding to support this type of monitoring has not been approved by the Town.

- The TMDL also noted that the land areas surrounding Prince Cove are the most heavily developed in the entire Three Bays watershed. There are numerous roadways circling all of the bays with tangential residential roads connecting to those. Stormwater runoff from roads is a likely source of contamination in some regions. It was recommended that the Town continue to work toward compliance with its Stormwater Management Program established under the NPDES Phase II Stormwater Program to implement the six minimum control measures. NPDES is a non-funded federal mandate. Funding must be authorized annually by the Town Council through the local budget process. In general, $250,000 is requested annually for the Coastal Discharge Mitigation program established in 2001. However the program was not funded in FY2009 and a request for funding for FY2010-2014 is under review by Town Council. When funded, the program has successfully identified and mitigated numerous stormwater projects throughout the study area.

- The TMDL recommended that any bacterial testing that is done to determine sources of contamination should consider analytical testing to differentiate anthropogenic versus non-anthropogenic sources to rule out waterfowl/wildlife as the source. The salt marsh at Station 8 in the southeast quadrant of North Bay was identified in the TMDL for investigation for human sources of fecal coliforms. Starting in the fall 2007, the Public Health Division with help from Americorp has been working on a bacteria source-tracking (BST) project for the Marstons Mill River, Warren's Cove and Prince's Cove. Following the guidance from MassDEP's BST lab in Lakeville, the Town developed BST testing techniques to help identify human sources of bacterial pollution. An IDEXX Quanti-tray Sealer was added to the Town's Pollution Control lab, enabling the Town to perform year-round Enterococci studies in conjunction with the BST methods. Multiple failed septic systems and cesspools have been discovered and upgraded as a result of findings.

A directed outreach initiative to residents is also underway. Last year's Americorp member developed a new Coastal Health Brochure and the Town has a water web button or Coastal Health Toolkit on its web site, with water quality resources for residents. The toolkit includes detailed information about septic maintenance, best management practices for landscaping, boating, animal husbandry and a homeowner survey.

5.3 Stormwater Management

5.3.1 Current Condition and Change Analysis

Stormwater runoff can carry a wide range of pollutants that are harmful to marine and freshwater bodies. The pollutants of primary concern are bacteria and petroleum-based contaminants (oil, grease, etc.) and heavy metals that wash off of roadways. Other contaminants carried by stormwater include road salt, pesticides, herbicides and nutrients from fertilizers and other organic materials. Some of these pollutants are flushed directly into the water bodies during storms (non-point source), while others are collected and discharged through stormdrains into coastal waters (point source). The concentration of pollutants in stormwater runoff varies widely in response to local land use practices, the severity of the storm, and the mount of time elapsed since the previous storm.

A stormwater management study conducted for the Town of Barnstable by Dames & Moore in 1988 identified and developed stormwater treatment methods for nine drainage areas, five of which are in the study area. In some of these drainage areas the stormwater runs off directly into the water, and in other areas the stormwater is collected into a drainage pipe system which discharges the runoff into the water. Data from the Dames and Moore study indicated that stormwater entering the coastal waters represents a significant source of bacteriological pollution to the study area. The data, though inconclusive, seem to indicate that storm drains are not a significant source of nutrients to the coastal waters.

At the time of the report, the Town developed a list of twelve priority stormwater improvement projects, several of which were located in the vicinity of the study area, or could affect stormwater flow into the study area. These include:

- East Bay Road Boat Ramp;
- South Main Street/Catch basins at head of East Bay Road;
- Oyster Place Road-Town Pier;
- Little River Road/Town Boat Ramp;
- Old Shore Road Town Boat Ramp/Beach;
- Old Post Road Stream Area;
- Cross Street Way to Water.

Since that time the Town has made progress in reducing negative impacts from stormwater flow at these and other locations in the study area. Table 14 and Figure 15 show the location of stormwater improvement projects in the vicinity of the study area currently underway, proposed or in planning stages:

Table 14. Stormwater Improvement Projects Planned or Underway

Three Bays System
1. Cross Street - Diversion of pipe run-off and upland infiltration
2. Cotuit Town Dock at Oyster Place Road - Installation of porous pavement to enhance leaching
3. Ropes Beach - Revamping wetlands pockets
4. Public and Private Ways near Little River - Elimination of direct discharges to Little River
5. Little River Road Landing - Enhance infiltration and/or natural swale for nitrogen attenuation
6. Little River Road at Old Post Road - Improvements to leaching and removal of sediments
7. Cordwood Landing - Infiltration and wetlands creation
8. Prince Cove Marina Area and Town Boat Ramp - Improvements to mitigate run-off
9. Route 149/Route 28 at Mill Pond - Maintenance of stormwater treatment unit
10. Bay Street - Infiltration
11. Main Street Osterville Drainage System - Improvements to increase infiltration
12. Bridge Street on Little Island - Improvements to increase infiltration
13 Bridge Street Boat Ramp Area - Parking lot improvements and vegetation to limit run-off
14. Eel River - Pipe removal and infiltration
Centerville River System
15. Phinney's Bay - Culvert enlargement to increase tidal exchange (completed)
16. Main St Osterville near East Bay Rd - Sediment removal and dredging for nitrogen attenuation
17. South Main Street near Bay Road - Improvements to divert flow and increase infiltration.

Source: Department of Public Works

5.3.2 Summary of Management Issues: Stormwater Management

Managing stormwater run-off to limit pollutants poses a massive management challenge. Stormwater run-off problems often stem from public roadway systems, but can also encompass private properties and roadways. Management of this pollution source requires careful prioritization of projects in terms of cost effectiveness and feasibility.

In addition to storm drains and roadways, on-going field investigations continue to uncover direct discharge sources. Additional areas need to be identified, and all areas should be checked for new sources.

Stormwater management projects are funded through the Coastal Discharge Mitigation Program. The program is funded through the general fund, and is subject to the vagaries of the budget process and attendant fiscal stresses. As noted above, $250,000 is requested annually. Funding was not approved in FY2009 and a funding request for FY2010-2014 is under review by Town Council.

Adding to the funding concern is that newer low impact strategies that incorporate green or natural features to manage stormwater often cost more to maintain or require new maintenance techniques that may require personnel training and equipment.

Maintenance of all projects must be maintained to achieve the remediation benefits. However, there is no provision for water quality monitoring before or after project implementation to provide a means of measuring its effectiveness.

5.3.3 Recommended Actions: Stormwater Management

5.3.3.1 Make Stormwater Management a High Priority

Support LCP goal to have all stormwater discharge treated to appropriate levels through adaptive management and use of stormwater best management practices and to provide high quality stormwater recharge to water resources. Support implementation of priority stormwater remediation projects in the study area (listed above) and continue to identify new projects to address areas of concern.
Parties involved: Town Council, Town Manager, Department of Public Works,

5.3.3.2 Fully Fund the Coastal Discharge Mitigation Program

Explore funding alternatives to ensure that adequate resources are available to implement and maintain improvements to stormwater management over time. Maintenance is particularly a need with regard to newer green “low impact” project designs that incorporate natural features. Identify a dedicated funding stream for on-going maintenance of stormwater management improvements. Consideration should be given to the creation of a stormwater utility or other similar approach
Parties involved: Town Council, Department of Public Works

5.3.3.3 Monitor Water Quality Pre and Post Management Project

Water quality data before and after implementation of a stormwater management projects is needed to measure remediation benefits and provide a basis for adapting or altering projects if anticipated improvements are not achieved.
Parties involved: Public Health Division, Department of Public Works, Marine and Environmental Affairs Division

5.3.3.4 Promote Low Impact Development Practices

Ensure that regulations and bylaws require or promote application of low impact development practices and best management practices in private developments and subdivisions. Three Massachusetts towns (Duxbury, Marshfield, Plymouth) have developed a model stormwater management bylaw that may provide a useful starting point for review and discussion of alternatives for Barnstable.
Parties involved: Growth Management Department, Planning Board, Conservation Commission and Division

5.4 Wetlands Resources

5.4.1 Current Condition and Change Analysis

Wetland resources in the study area, consisting of coastal banks, beaches and dunes, and salt marshes, cover 690 acres or approximately one-third of land area. These wetland resources, which are regulated under the Massachusetts Wetland Protection Act (M.G.L. 131, s.40) and town ordinance, provide valuable wildlife habitat and play an important role in flood control and storm damage protection. Figure 16 shows all wetland resources in the study area.

Coastal Beaches

A coastal beach is a gently sloping shore that consists of unconsolidated sediment subject to wave attack, tidal action and coastal storm inundation. Coastal beaches, which are defined to include tidal flats, extend from the mean low water line landward to the seaward edge of the dune, coastal bank, wetland or upland.

Coastal beaches are important to storm damage protection, flood control, and wildlife habitat protection. The gradual slope and unconsolidated sediments allow beaches to shift in response to wave actions, thus dissipating wave energy. The ability of a coastal beach to dissipate wave energy depends on the size of the sediment grains, the slope of the shore, and the force or energy of the wave. Coastal beaches also serve as a sediment source for nearby beaches, dunes, and subtidal areas as wave action moves beach sediment along or over the shore. In. addition, coastal beaches are valuable in terms of the socioeconomic benefits and recreational opportunities they provide. And the tidal flat portion of coastal beaches is valuable to marine fisheries since it provides a habitat for many invertebrates including various shellfish, snails, and polychaete worms.

Significant coastal beaches within the study area include Dowses Beach between East Bay and Nantucket sound, Oyster Harbors Beach along the shore of Dead Neck and Sampsons Island, and Long Beach/Craigville Beach/Coville Beach south of the Centerville River.

Coastal Dunes

A coastal dune is a ridge or mound of sediment, often covered with vegetation, located landward of a coastal beach. The toe of the dune is located at the seaward limit of beach grass growth.

Coastal dunes play an important role in flood control and storm damage prevention. The dunes closest to the beach are especially significant in terms of dissipating wave energy. Coastal dunes are typically created or expanded as sediments are deposited by wave action during storms or trapped by dune grass from prevailing winds. The dune grass also helps to stabilize the unconsolidated dune sediments.

Coastal dunes are also important to wildlife habitat protection. Many birds, especially terns, plovers and gulls, nest on or near the dunes.

The largest and most functional dunes within the study area are located behind the coastal beach on Long Beach; Dead Neck, and Coville Beach. These dunes are particularly valuable for protection from flooding and storm damage because of their location between developed areas and the ocean. Coastal dunes are also located at Dowses Beach, at Bluff Point in Cotuit Bay, and at the sandy point west of the entrance to the Eel River.

Barrier Beach

According to the Massachusetts Wetland Protection Act, a barrier beach is a narrow, low-lying strip of land consisting of beaches and dunes, separated from the mainland by a narrow body of water and/or salt marsh system. A barrier beach may be connected to the mainland at both ends (bay barrier), one end (barrier spit), or neither end (barrier island). A barrier beach is a combination of several coastal features such as dunes, salt marshes, and beaches, and therefore protects the mainland from storm damage and flooding better than any single coastal feature. Barrier beaches within the study area: Dead Neck/ Sampsons Island, Dowses Beach, and Long Beach/Craigville Beach. Dead Neck/Sampsons Island is a barrier island, separated from Osterville Grande Island by the Seapuit River. Smaller barrier beaches throughout the study area including Bluff Point, Handy Point, and Tim Point.

Coastal Bank

A coastal bank, according to Ch. 131 sec. 40, is the seaward face of an elevated landform other than a coastal dune that lies at the landward edge of a coastal beach, land subject to tidal action, or other wetland. Banks extend to the first break in slope above the 100-year flood elevation. Coastal banks typically perform one or both of two functions: they protect inland areas from storm damage and flooding; and, if they consist of unconsolidated and unvegetated material, they may supply sediment to nearby beaches or dunes through erosion.

There are several coastal banks throughout the study area, most of which are vegetated. Coastal banks are located on the northern shore of the Centerville River between East Bay and the Bumps River, on the entire shore around Osterville Grand Island, on the northern shore of North Bay, in Cotuit Bay on either side of the Ropes Beach/Hoopers Landing, along both sides of the Eel River, along the southern shore of Wianno, and along the western side of the Bumps River. These banks were identified by field observation and by examination of USGS topographic maps.

Salt Marsh

A salt marsh is a highly productive, vegetated community that extends from about the middle of the tidal range to the highest high tide line and is characterized by salt-tolerant plants. Salt marshes perform several valuable functions within coastal areas. They provide habitat and food for terrestrial and aquatic wildlife. Many young organisms, such as fish larvae, rely on salt marshes as nursery grounds. Salt marshes also reduce coastal pollution by trapping chemicals such as metals and excess nutrients from surface runoff. Salt marshes dissipate wave energy, often significantly reducing shoreline erosion and buffering storm tides. Also, marshes temporarily store flood water, thereby preventing or minimizing flooding of nearby land.

The 1990 plan reported approximately 240 acres of salt marsh throughout the study area, where relatively protected waters and adequate nutrient supplies encourage their development. The current location and distribution of salt marshes is shown in Figure 16.

Field observations indicate that salt marshes throughout the study area are relatively healthy, as indicated by dense stands of vegetation and limited signs of pollution or disturbance. As one would expect, the larger salt marsh areas, particularly those adjacent to less developed areas, tend to be healthiest and least disturbed. In addition, the largest salt marshes tend to be the most functional, providing the greatest benefits to the adjacent land and water areas. Thus, within the study area, the largest, most extensive salt marshes are considered the highest quality and most valuable. This does not imply, however, that small or disturbed salt marshes are not valuable or should not be protected. All salt marshes, no matter how small, perform the valuable functions described above to some extent. Additionally, all salt marshes are protected under the Massachusetts Wetlands Protection Act.

Eelgrass Coverage

Eelgrass (Zostera marina) typically grows in dense beds on sand or sandy-mud in protected areas extending from just below the mean low tide line to water depths of more than 15 feet, although in the study area it rarely extends beyond depths of 7 to 8 feet. Eelgrass beds are extremely valuable resources due to the wide variety of ecological functions they perform. Most notably they stabilize bottom sediments, provide nursery areas for young aquatic organisms,

provide food for grazing animals, produce oxygen during daylight hours, and produce nutrient-rich organic matter as food for filter-feeding organisms. As a result, eelgrass beds often support diverse communities of fish, shellfish and other invertebrates, and waterfowl. Survival of some coastal species is dependent on the presence of eelgrass beds. For example, larval stages of bay scallops attach to blades of eelgrass and often cannot survive without such a habitat.

Figure 17 shows the distribution of eelgrass in the study area based on MassDEP eelgrass mapping project data from 1995 and 2001. The data show that as of 2001, there was virtually no eelgrass within the Three Bays and East Bay/Centerville River systems. A large bed of eelgrass extends outside the embayments along the Nantucket Sound shoreline running parallel to Seaview Avenue, off Dowses Beach and off of the western end of Long Beach. By comparison, the 1990 plan reported dense eelgrass beds in Prince Cove, North Bay, West Bay, East Bay, and Scudder Bay; and small or sparse patches in Cotuit Bay. This was based on a review of aerial photographs taken during the winter of 1989. Because there were no summer aerial photographs to confirm the extent of beds, the beds were not mapped or delineated. The 1990 plan also reports that a review of random aerial photographs from 1967 through 1988 showed a decline of eelgrass in the protected embayments and an increase along the Nantucket Sound shoreline. Consistent with current findings, the most extensive eelgrass beds were reported outside of the study area in Nantucket Sound off the shore of Wianno and Long Beach. It was also noted in the 1990 plan that eelgrass samples collected and microscopically examined indicated that most of the eelgrass in the bay areas, especially in Prince Cove and North Bay, was covered with epiphytic growth.

5.4.2 Management Issues: Wetlands Resources

Wetlands is a broad term referring to a wide variety of resources. For the purposes of this plan, the key wetland resources of concern are coastal beaches, banks and dunes; salt marshes; and eelgrass. Wetland resources provide a variety of ecological functions that include pollution attenuation, storm damage prevention and habitat for a wide variety of animals. If these resources and their associated functions are lost or seriously degraded, attempting to replace or replicate them would be difficult or infeasible and would be very costly. In this light, the true value of wetland resources has both ecological and economic dimensions.

Wetland resources face many threats. For salt marshes, the increasing amount of development close to shore displaces opportunities for salt marshes to migrate inward in response to coastal erosion. This condition is likely to become more severe over decades as sea level rises.

Wetlands also face pollution threats. Salt marshes are naturally able to take up nitrogen, but other wetland vegetation, notably eelgrass, is degraded by excessive amounts of nitrogen. The MEP Technical Reports for Three Bays and the Centerville River document a shocking loss of eelgrass in both systems, and attribute much of this loss to excessive nutrients from watershed sources. The MEP reports document the presence of significant eelgrass beds throughout both systems in 1951. The 1990 plan also reports healthy eelgrass throughout the system, but notes a steady decline in many areas over the previous decade. By 2001, eelgrass mapping conducted by MassDEP finds virtually no eelgrass in either system. Eelgrass is considered an indicator species reflecting the health of estuarine systems, and it provides habitat that supports shellfish and finfish.

Coastal banks, beaches and dunes are critical resources that provide habitat and storm damage prevention. They are also part of the natural landscape that enhances the visual character of the study area. Coastal beaches also are a major recreational resource available to Town residents and visitors.

Chapter 704, the Town Wetlands Regulations, require a fifty-foot *no disturb* buffer within the 100-foot jurisdictional buffer. Furthermore, any building within the 50-100- foot jurisdictional buffer should be located no closer than twenty feet from the landward edge of the *no disturb* buffer. The *no disturb* does not apply to paths and water dependent structures and applicants can apply for a relaxation of the *no disturb* buffer treatment based on site conditions.

5.4.3 Recommended Actions: Wetlands Resources

5.4.3.1 Protect Wetlands through Regulatory Reviews

Protection of salt marsh and other wetlands resources should be a priority consideration in the review of shoreline projects including residential expansion, private docks, marina and boat yard expansion, erosion control structures and dredging. The Conservation Commission is urged to promote strict adherence to the regulatory no disturb zone.
Parties involved: Conservation Commission and Division.

5.4.3.2 Protect Coastal Landforms and Salt Marshes

The Town should look for ways to protect coastal landforms and salt marshes that provide critical storm damage prevention and are integral to the coastal landscape. The efforts could include:

- Identification of shoreline properties that could be protected or acquired to allow inland migration of salt marshes; and
- Development of re-nourishment guidelines or a sediment management plan to guide the placement of material to sustain coastal landforms on public and private lands.

Parties involved: Conservation Commission and Division

5.4.3.3 Address Lack of Eelgrass

The MEP reports for Three Bays and Centerville River found a profound loss of eelgrass over decades ago. The Town should make efforts to restore this indicator species by:

- Implementing nutrient management programs such as the Wastewater Facilities Plan and Nutrient Management Plan, and increasing public awareness of best management practices for fertilizer use, particularly in coastal areas;
- Exploring the potential for an eelgrass restoration project that would identify areas that have a high likelihood of being able to re-establish eelgrass through planting and management. Researchers have developed an interactive GIS-based site selection model to identify areas with the best chances for restoring eelgrass.[8]

Parties involved: Marine and Environmental Affairs Division, Conservation Commission and Division

5.5 Wildlife and Plant Biodiversity

5.5.1 Current Condition and Change Analysis

Rare or endangered species are protected under various federal and state laws. Rare species, in the Commonwealth of Massachusetts, are designated by status codes of endangered, threatened, or of special concern. These codes are defined by the Massachusetts Natural Heritage Program (MNHP). The MNHP was formed in 1978 for the conservation and protection of Massachusetts' biodiversity, with particular focus on the 178 species of vertebrate and invertebrate animals and 264 species of native plants and their habitats that are officially listed as Endangered, Threatened or of Special Concern under the Massachusetts Endangered Species Act.[9]

Table 15 lists the rare animals and plants identified by MNHP to inhabit the study area. In 2006 the Massachusetts Natural Heritage and Endangered Species Program updated atlas of estimated and priority habitat for species that are rare, endangered or of special concern. Figure 18 shows the Estimated and Priority Habitats within the study area. These areas are taken from the Natural Heritage Atlas, which identifies Priority and Estimated Habitat for state listed species in GIS format. Projects requiring Conservation Commission review are required to submit a request for information with MNHESP to determine which

[8] See Short, Frederick T. and Burdick, David M. Interactive GIS-based, Site Selection Model for Eelgrass Restoration. Department of Natural Resources, Jackson Estuarine Laboratory, NOAA and the University of New Hampshire.

[9] Information on these classifications is available at the NHESP website: http://www.mass.gov/dfwele/dfw/nhesp/nhesp.htm.

species may be located on the site, and how that may affect project design. However projects outside of Conservation Commission jurisdiction are not required to make this filing.

Table 15 State–listed Rare Species in the Study Area

Scientific Name	Common Name	Taxonomic Group	State Status
Sterna dougallii	Roseate Tern	Bird	Endangered
Sterna hirundo	Common Tern	Bird	Special Concern
Sternula antillarum	Least Tern	Bird	Special Concern
Charandrius melodus	Piping Plover	Bird	Threatened
Terrapene carolina	Eastern Box Turtle	Reptile	Special Concern
Papaipema sulphurata	Water-Willow Stem Borer	Butterflies & Moths	Threatened
Carex mitchelliana	Mitchell's Sedge	Plant	Threatened

Source: Natural Heritage and Endangered Species Program

5.5.2 Summary of Management Issues: Wildlife and Plant Biodiversity

There continues to be a wide variety of wildlife, including rare and endangered species that live or visit in or very near to the study area. These species and their habitat can be threatened by encroachment from surrounding land uses. Site clearing that removes large areas of brush or large stands of trees can significantly alter habitat for a number of species and, if not properly managed, can lead to soil erosion and sedimentation of nearby streams or wetlands.

As noted above, NHESP has a procedure for reviewing projects undergoing Conservation Commission review, to ensure they do not harm species that are rare, endangered or of special concern. However, a large number of projects proceed outside of wetlands jurisdiction and are not being required to check in with NHESP.

Throughout the region, invasive marine and freshwater species area of increasing concern. Marine invasive species include green crabs and tunicates. These species tend to grow rapidly and use up limited food supplies. In freshwater the zebra mussel has recently been spotted in Massachusetts waters. Invasive species can be plants as well. Purple loosestrife and phragmites are two well know invasive plants. Invasive species tend to multiply rapidly, crowd out other species and reduce biodiversity of the resource.

5.5.3 Recommended Actions: Wildlife and Plant Biodiversity

5.5.3.1 Promote Compliance with Requirements of NHESP

Town departments involved in regulatory reviews and inspections should develop a protocol to ensure that projects not requiring a Notice of Intent but located within areas of either Priority and Estimated Habitat, as mapped on the 2006 Atlas of the Natural Heritage of Endangered Species Program (NHESP), are required to file a request for information with the Massachusetts Natural Heritage and Endangered Species Program to determine which species may be mapped on the site, and how that might inform project design.
Parties involved: Growth Management Department, Regulatory Services Department, Conservation Commission and Division

5.5.3.2 Promote Open Space and Habitat Protection

Prevent degradation of critical wildlife and plant habitat, maintain existing species diversity, and support wildlife's natural breeding, feeding and migration patterns by:

- Limiting clearance of vegetation in mapped sensitive habitat areas; and
- Establishing policies to limit fragmentation of wildlife habitat.

This is consistent with Draft Local Comprehensive Plan goal 2.5.1.
Parties involved: Growth Management Department, Planning Board, Town Council

5.5.3.3 Land Stewardship and Best Management Practices from Site Clearance or Alteration

Best management practices for clearance or alteration of vegetation on large land areas should be developed, and possibly codified as a site clearance ordinance. The management guidelines will address protection of natural features and native species, protection of wetlands and upland wildlife habitat, filling and earth removal, drainage, stormwater management, and erosion and sedimentation control. This is consistent with recommendation 2.5.1.3 of the Draft Local Comprehensive Plan.
Parties involved: Growth Management Department, Planning Board, Town Council

5.5.3.4 Develop Best Management Practices to Control or Eradicate Marine or Freshwater Invasive Species

A comprehensive and coordinated approach to managing invasive species in the study area is needed. The Town should work with state, regional and local organizations to inventory and prioritize invasive species in the study area, and to develop and disseminate best management practices. This effort should incorporate the latest scientific research and will incorporate regional resources such as the Invasive Plant Atlas of New England and Massachusetts Coastal

Zone Management's Aquatic Invasive Species Program, among others. The best manage management practices should incorporate an understanding of the types of invasive plant and animal species in the study area, identification of new species or small populations that could be addressed through early intervention, as well as recommended management guidelines for established species. Parties involved: Conservation Commission and Division, Marine and Environmental Affairs Division.

5.6 Fish Runs

5.6.1 Current Condition and Change Analysis

Anadromous fish are fish that mature and live in the ocean, yet enter fresh water from the ocean to spawn. An anadromous fish run, therefore, is a passageway for these fish to travel from the ocean or bay to their spawning grounds. Spawning occurs in shallow ponds or lakes, or stream pools. Maintenance of adequate water quality and flow (volume and rate) in fish runs, and especially in spawning areas, is important to the protection of marine fisheries. If anadromous fish are unable to spawn, significant declines in their populations may occur.[10]

The Division of Marine Fisheries documents four anadromous fish runs within the study area that are used by Alewife (Alosa pseudoharengus), also known as river herring, and occasionally brook trout (Salvelinus fontinalis). These runs, shown in Figure 19 include the Marstons Mill River, where fish spawn in Middle Pond and Mystic Lake; the Centerville River, where fish spawn in Bearse Pond, Wequaquet Lake, Lake Elizabeth and Red Lily Pond; the Little River, where fish spawn in Wells Pond; and the Bumps River, where fish spawn in Lovells Pond.

In 2008 the Massachusetts Marine Fisheries Advisory Commission approved the continuation of a moratorium on the harvest, possession and sale of river herring in the Commonwealth through 2011. The moratorium includes the species of river herring found in the study area, (alewife, *Alosa pseudoharengus.*) This species is listed as being *of concern* due to an overall decline coast-wide.

The moratorium was extended because of a lack of recovery of river herring runs in the Commonwealth and surrounding regions. All available information indicated that the number of spawning river herring entering the runs in spring of 2008 remained well below average and mortality remained high.[11]

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[10] Camp, Dresser & McKee, Inc. Coastal Resources Management Plan (Draft Final) (1990.) Town of Barnstable, Massachusetts. Section 5.2.5.

[11] Massachusetts Department of Fish and Game, Division of Marine Fisheries, "River Herring Moratorium." http://www.mass.gov/dfwele/dfw/regulations/abstracts/abstracts.htm

5.6.2 Summary of Management Issues: Fish Runs

The same fishing runs exist in the study area as did in 1990. Two of the four runs in the study area, the Centerville and the Marstons Mill rivers, are maintained by the Town and are used annually by anadromous fish, primarily Alewife (herring). The 1990 plan reported that the Centerville River is also used by the American eel. Little River and the Bumps River are not maintained by the Town and therefore are often unused by spawning fish, especially when the river flow is low.

Fish runs can be impaired by excessive vegetative debris that may fall into the run following storm events and obstruct passage. Loss of riparian vegetation, excessive sedimentation caused by erosion can also degrade fish runs. Storm runoff carrying pollutants can impair water quality. Ongoing maintenance is needed to ensure that the runs are clear and open for fish at the appropriate time.

5.6.3 Recommended Action: Fish Runs

5.6.3.1 Continue Fish Run Stewardship

The Town should continue to maintain the Marstons Mills and Centerville River fish runs, which are the two primary runs in the study area. It should be evaluated whether, through municipal or volunteer efforts, maintenance activity could be extended to the Bumps River and Little River fish runs.
Parties involved: Marine and Environmental Affairs Division, Conservation Division and Commission

Chapter 6.0 Coastal Landforms and Processes

6.1 Overview

Coastal systems are complex and ever-changing. Coastal systems exhibit numerous and often inter-related biological, chemical and physical processes that are constantly changing in ways large and small. Winds and tides influence the physical configuration of coastal landforms, such as beaches, bluffs or dunes. This configuration affects bathymetry, which in turn influences tidal flow in and out of the system. Tidal flow affects the ability of water to disperse pollutants, and affects temperature, salinity and other parameters of water chemistry. All of these events alter habitat for a wide range of animal and plant species.

Coastal landforms and processes are largely the result of natural forces. Often the natural cycles of change at work in a coastal system are perceived as interfering with human uses of the resource area. This can occur when sediment movement blocks a channel, or when erosion and sediment transport threaten a property. Often a system's propensity to change occurs on a timeframe that conflicts with seasonal use of the area. Resource managers must take a long-term view in assessing the cycles of change within a coastal system to ensure that short-term measures or projects to enhance access or protect properties do not result in longer-term harm to resources areas or public access.

This chapter addresses resources conditions, management issues and recommended actions for the following topics:

6.2 Coastal Landforms;
6.3 Bathymetry and Hydrodynamics;
6.4 Relative Sea Level Rise.

6.2 Coastal Landforms

6.2.1 Current Condition and Change Analysis

The seaward edge of the study area consists primarily of barrier beach, barrier beach-coastal beach, and barrier beach-coastal dune coastal landforms. The fragile wetland resources provide a variety of environmental functions that include storm damage prevention and flood control. The erosion of these landforms by wind and tidal action is a natural process that provides a source of sediment for downdraft beaches. However the encroachment on these resource areas by shoreline development has diminished if not precluded opportunities for the landforms to migrate inward. As a result, erosion of coastal landforms is often viewed as a threat to private property, rather than a natural process. Steps

taken by property owners to protect shoreline properties are evident on Figure 20, which shows that most of the Nantucket Sound shoreline of the study area is armored with erosion controls structures and jetties designed to prevent sand from migrating down drift.

The 1990 plan identified three major barrier beaches within the study area. Dead Neck/Sampson's Island is a barrier island separated from Osterville Grande Island by the Seapuit River. Dowses Beach is a barrier spit which extends between East Bay and Nantucket Sound. Long Beach is a barrier beach separated from Centerville by East Bay and the Centerville River. The barrier beaches continue to be prominent features in the study area.

The Sampson's Island/Dead Neck barrier beach is among the primary landforms in the Three Bays system. Although sediment transport is usually west to east along the south facing shore of Cape Cod due to prevailing southwest winds, the orientation of the barrier beach results in an east-to-west drift. As a result of this reversal and the presence of the West Bay channel at the end of the barrier beach, sediment erodes at the east end of the Sampson's Island Dead Neck, and accretes at the western end. In 1990, erosion on the eastern end resulted in tidal over-wash under certain tidal and storm conditions. In an effort to stabilize the barrier beach, the Three Bays Preservation and Grand Island Homeowners supported a number of dredging projects, which generated material for placement on the eastern end of the barrier beach. Between 1985 and 2000, periodic dredging of Cotuit and West Bay entrance channels generated 332,400 cubic yards of material which was used for nourishment on the east end of the barrier beach. Table 8 in Chapter 3 provides a list of dredging projects and disposal locations.

Within the Centerville River System, the dominant coastal landform is the barrier beach system encompassing Craigville Beach, Long Beach and Dowses Beach. According to a description of the geomorphology of the area found in the MEP report, the generally mild wave conditions and west to east littoral drift define conditions along this stretch of beach. In the past, generally stable conditions have been punctuated by periodic hurricanes (1938, 1944, 1954 and 1991). However the MEP cites as the greatest influence on the barrier beach the creation of the jetty on the west edge of the East Bay entrance channel. The jetty trapped sand from moving west to east, resulting in accretion along Dowses Beach and offsetting erosion along Long Beach/Craigville Beach.

In 2001 the Town commissioned a review of the Centerville River Dredging and Long Beach Nourishment Project sponsored by the town. The review, done by the Woods Hole Group, found that the Long Beach barrier beach was eroding and migrating landward and would benefit from placement of compatible sediment material from the dredging of the Centerville River. Figure 8 depicts the dredging and disposal locations for this project.

The inland shoreline of Three Bays and Centerville River Systems are dominated by coastal beach, bluff or dune, and salt marsh. Marsh areas are dominant on either side of Warren's Cove in the Three Bays System, and in the upper reaches of the Centerville River and Bumps River/Scudder Bay.

6.2.2 Management Issues: Coastal Landforms

Coastal landforms are naturally altered by erosive forces of tides and wind, and provide a ready sediment source for beaches and shoreline areas. However, these land forms are also subject to alteration from development activity such as coastal structures (piers, revetments, etc.), storage of vessels, and public access.

The Town and Three Bays Preservation Inc. have collaborated on dredging and nourishment projects, particularly in the area of Dead Neck and Sampsons Island. In 1999 dredging occurred at the Cotuit Bay entrance, Seapuit River channel, West Bay channel and eastern running channel off West Bay entrance, and dredge material was used to nourish Dead Neck barrier island. In 2001, 4,500 cubic yards was dredged from West Bay and Eel River channel and placed on the barrier beach. These projects have succeeded in maintaining navigability through the channel into Cotuit Bay at Dead Neck, and have maintained the profile of the barrier beach. Currently a limited amount of beach profile monitoring is occurring to track the stability of the barrier beach.

The Town has undertaken comparable projects in the Centerville River system. Material from dredging in the East Bay and Centerville River has been used to nourish Dowse's Beach (40,700 cubic yards in 2004) and Craigville Beach (16,280 cubic yards in 2006.) Long Beach has been nourished periodically with dredged material from an offshore borrow site located southeast of the East Bay channel, with 90,265 cubic yards in 1990 and 80,000 cubic yards in 1999.

6.2.3 Recommended Actions: Coastal Landforms

6.2.3.1 Ensure Application of No Disturb Provision

As noted in 5.4.3.1 the protection of salt marsh and other wetlands resources should be a priority consideration in the review of shoreline projects including residential expansion, private docks, erosion control structures and dredging. The Conservation Commission is urged to promote strict adherence to the regulatory 50-foot no disturb zone. Additionally, re-nourishment coastal landforms with the potential to be altered by a project should be required.
Parties involved: Conservation Commission and Division

6.2.3.2 Control Erosion of Coastal Landforms to the Extent Possible

- Control development and redevelopment on coastal landforms; and
- Require that development or redevelopment within 100 feet of coastal landforms be designed to have no adverse impact on the height, stability or use of the landform as a sediment source.

These actions are consistent with recommendation 2.2.2.2 of the Draft Local Comprehensive Plan.
Parties involved: Growth Management Department, Planning Board, Zoning Board of Appeals, Conservation Commission and Division

6.2.3.3 Develop a Sediment Management Plan

The study area encompasses expanses of barrier and coastal beaches, and numerous areas that require maintenance dredging. A sediment management plan that identifies and prioritizes areas in need of dredging and nourishment could help to coordinate management of coastal landforms and navigation channels. It would also lay out a schedule and sense of need that could helpful in securing public and private funding for projects. The plan would:

- Assess the potential needs, benefits and detriments of maintenance and improvement dredging in specific locations and prioritize areas where dredging may be needed or desirable;
- Identify and prioritize areas for placement of dredged material for shoreline stabilization, habitat restoration and protection of public access;
- Identify priority areas for proactive beach nourishment;
- Identify strategies for disposing of fine-grained material not compatible for beach nourishment;
- Establish nourishment guidelines for public and private projects; and
- Identify areas where beach profile monitoring should be undertaken.

Parties involved: Conservation Commission and Division, Marine and Environment Affairs Division, Waterways Committee, Shellfish Committee.

6.3 Bathymetry and Hydrodynamics

6.3.1 Current Conditions and Change Analysis

Hydrodynamics measure how water flows within an estuarine system. The flow of water is affected by many factors, including the tidal dynamics of ocean waters, coastal land features that may restrict flow, and the presence of marshes or shoals that may create friction and slow water flow. A detailed study of hydrodynamics in both the Three Bays and Centerville River systems was conducted as part of the respective MEP Technical Reports. The modeling study incorporated measurements of bathymetry, tidal range, current velocities and into two-dimensional model of water flow during all stages of the tide. A brief summary of hydrodynamic features found in the reports is summarized below. More detail is found in Chapter 5 of each of the respective reports.

Centerville River System

Circulation in the Centerville River system is dominated by tidal exchange with Nantucket Sound. From measurements made in the course of this study, the average tide range at the entrance to Centerville River is approximately 2.66 feet. Flow restrictions caused by narrow channels, bridge abutments, and frictions losses, reduce the tide range in upper Centerville River to approximately 2.52 feet. Freshwater inflow is relatively small in comparison to tidal waters entering through the inlets, and does not have a significant impact on the hydraulic response of the system.

Bathymetric measurements of the Centerville River system were undertaken for the hydrodynamic modeling in the MEP Technical Report. This information can be found in Chapter 5 of that report.

Three Bays System

Circulation in the Three Bays system is dominated by tidal exchange with Nantucket Sound. There is negligible attenuation of the tide range throughout the system, even into its uppermost reaches in Prince's Cove. This indicates that there is little loss of tidal energy through the system, either due to bottom friction in shallow areas or from channel restrictions, e.g., at the system inlets and the Little Island draw bridge. The familiar twice-a-day tide has a total range of 2.4 feet throughout the system.

Table 16 shows system and local residence times for the study area. Residence times reflect the rate of tidal flushing throughout the system. System residence times represents the average time it takes for a drop of water to migrate from its location within a subembayment out to ocean waters (in this case Nantucket Sound.) For example, it takes a drop of water in North Bay 4.8 days to reach Nantucket Sound. Local residence times reflect the average time it takes for a drop of water in a subembayment to travel from a specified point in the subembayment to a specified point outside the subembayment. For example, it takes a drop of water in Prince Cove 1.5 days to reach North Bay (local residence time) and 48.8 days to make it to Nantucket Sound (system residence time.) Residence time is important in that it depicts how quickly a system can disperse pollutants such as nutrients, and is a factor in determining nutrient thresholds used for wastewater planning.

Bathymetric measurements of the Three Bays system were undertaken for the hydrodynamic modeling in the MEP Technical Report. This information can be found in Chapter 5 of that report. An extensive bathymetric survey of the Three Bays was undertaken by Three Bays Preservation, Inc. in 2008, and is depicted in Figures 6 and 7.

Table 16. Residence Times, Three Bays and Centerville River Systems

Embayment	System Residence Time Number of days it takes for a drop of water in the embayment to reach a point in Nantucket Sound	Local Residence Time Number of days it takes for a drop of water in the embayment to reach a point outside the embayment
Three Bays System	1.6	1.6
North Bay	4.8	1.6
Marstons Mills River	20.5	1.2
Prince Cove	48.8	1.5
Warrens Cove	61.4	0.7
Dam Pond	185.1	1.2
Eel River	130.5	1.2
Centerville River System	0.53	0.53
East Bay	1.5	0.59
Centerville River - Lower	1.98	0.69
Scudder Bay & Bumps River	3.66	0.36
Centerville River - Upper	2.68	0.39

Source: MEP Technical Reports for Three Bays and Centerville River Systems, SMAST

6.3.2 Management Issues: Hydrodynamics and Bathymetry

Due in part to the work undertaken as part of the MEP and additional research conducted by Three Bays Preservation, Inc, there is a solid baseline of up-to-date information regarding bathymetrics and hydrodynamics in the Three Bays and Centerville River system. These conditions are influenced by the geomorphology of the two systems as well as larger tidal forces. Other than the periodic dredging that has occurred in the systems, there is little human influence on these conditions.

6.3.3 Recommended Actions: Hydrodynamics and Bathymetry

6.3.3.1 Continue Periodic Monitoring of Bathymetry and Hydrodynamics

Periodic updates to the bathymetry or hydrodynamic modeling of the Three Bays and Centerville River systems should be undertaken. These measurements are increasingly important in light of potential for an increase in relative sea level (see 6.4 below.) Bathymetric measurements would be particularly useful in areas where changes in navigation conditions are observed. The Town should continue to coordinate efforts with Three Bays Preservation, Inc.

Parties involved: Marine and Environmental Affairs Division, Three Bays Preservation, Inc.

6.4 Relative Sea Level Rise

6.4.1 Current Condition and Change Analysis[1]

Recent publications suggest potential of approximately three feet of relative sea level rise by 2100. Relative sea level reflects changes in water level in relation to land, and incorporates global sea level rise due to thermal effects as well as land subsidence.

Possible effects of relative sea level rise include:

- Coastal erosion is the most likely impact, and its extent will depend on coastal elevation;
- Loss of wetlands by inundation is also likely, but again the extent will depend on local factors, such as ability to migrate landward;
- Habitat loss and alteration, which could result in loss of or change in species;
- Loss of recreational beaches;
- Salt water intrusion into wells and septic systems;
- Elevated storm surge flood levels; and
- Risk to infrastructure, such as storm drains, roads, utilities.

A report conducted by the Coastal Resources Work Group in Falmouth indicates that development over the past century and a half has impaired ability of coastline to adapt to natural changes. For example, armoring reduces ability of shoreline to erode and nourish beaches, and shoreline development reduces opportunities for inland migration of salt marsh.

6.4.2 Management Issues: Relative Sea Level Rise

Relative sea level rise is an impending threat to natural resources, public infrastructure and private property. Although the dynamic of sea level rise is beyond the scope of local control, the Town can adopt management practices to prepare and potentially mitigate its damaging effects.

[1] Climate Change Science Program 2009: Coastal Sensitivity to Sea-Level Rise: A Focus on the Mid-Atlantic Region. A report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. [James G. Titus(Coordinating Lead Author), Eric K. Anderson, Donald R. Cahoon, Stephen Gill, Robert E.Thieler, Jeffress S.Williams (Lead Authors]. U.S. Environmental Protection Agency, Washington D.C., USA.

The Town Draft Local Comprehensive Plan (LCP) (Action 2.2.2.1) includes a number of recommended actions to address flood hazards and potential impacts of sea level rise. These include:

- Purchasing land in FEMA A and V zones and barrier beach areas;
- Preparing a pre-disaster mitigation plan to meet FEMA standards;
- Directing development outside of FEMA A and V zones
- Developing regulations to prevent movement of earth, development of erosion control structures or mounding of septic systems from altering the flood preventing functions of coastal landforms;
- Adopting a flood plain bylaw based on the Cape Cod Commission Model.

The draft LCP also calls for a study to determine the potential threat of sea level rise based on local conditions, and for the design of stormwater infrastructure and septic systems within FEMA and V zones to accommodate sea level rise. Figure 21 shows that a significant number of shoreline properties in the study area are within the FEMA VE zone, which means they are subject to inundation with a velocity hazard under 100-year flooding conditions. Expanses of inland area are within the AE zone, subject to inundation under 100-year flooding conditions. Figure 22 shows the vulnerability of properties within the study area to inundation from hurricane storm surge for different categories of hurricanes. Storm threats to public and private properties and infrastructure can only be expected to increase with an increase in sea level rise.

6.4.3 Recommended Actions: Relative Sea Level Rise

6.4.3.1 Protect the Integrity of Coastal Features that Provide Storm Damage Protection

Based upon further evaluation, actions to protect coastal features that provide storm damage could include:

- Town land acquisitions in FEMA A and V zones,
- Limiting development in FEMA V zones,
- Ensuring regulations allow for reasonable use of property,
- Adoption of a sewer neutral regulation,
- Adoption of a Flood Plain ordinance.

This recommendation is consistent with Draft Local Comprehensive Plan recommendation 2.2.2.1

Parties involved: Growth Management Department, Planning Board, Board of Health and Public Health Division, Conservation Commission and Division, Department of Public Works

6.4.3.2 Assess Potential Threats posed by Accelerated Sea Level Rise

Determine the extent of threats posed by the general outcomes anticipated with Relative Sea Level Rise. This may include collection of data on shoreline elevations, coastal land uses, and detailed elevations and conditions of wetlands resources. A methodology to accomplish this for the study area could be applied to other coastal areas in Town.
Parties involved: Growth Management Department, Information Technology (GIS) Department, Conservation Commission and Division, Marine and Environmental Affairs Division, Department of Public Works.

6.4.3.3 Develop a Local Management Plan for Sea Level Rise

Based on the assessment in 6.4.3.2 above, develop a local management plan for addressing effects of sea level rise. Some of the recommendations of the Falmouth Coastal Resources Work Group[2] that should be evaluated by the Town of Barnstable include:

- Acquiring coastal lands to protect natural processes and minimize property damage;
- Relocating sensitive public infrastructure;
- Removing hazardous or damaging coastal armoring structures;
- Developing a sand management plan to prevent sand caught in jetties from moving offshore;
- Obtaining voluntary conservation easements to protect coastal landforms;
- Conducting beach profile monitoring at key locations; and
- Enhancing local regulations to protect sensitive shoreline resources.

Parties Involved: Growth Management Department, Information Technology (GIS) Department, Conservation Commission and Division, Marine and Environment Affairs, Department of Public Works.

[2]Thieler, Robert. "Planning for Shoreline Change and Sea Level Rise." Presentation to Plan to Protect: How Communities Can Prepared for Climate Change. Waquoit Bay Estuarine Research Reserve Coastal Training Program. April, 2009.

Chapter 7.0 Coastal Structures

7.1 Overview

Coastal structures are a dominant feature of the shoreline in both portions of the study area. Coastal structures include piers and docks, bulkheads and outhauls, among other structures that are designed to provide access to the water. These coastal structures are a component of the marine infrastructure so important to commercial and recreational boaters.

Other coastal structures, such as revetments, groins and jetties, provide erosion protection. These structures are designed to protect the shoreline from erosion caused by wave action, or to trap sand to maintain beach areas.

In addition to their uses and benefits, coastal structures are a man-made intrusion in a natural system, and can cause undesirable impacts to natural resources. These impacts may include alteration of water circulation, alteration of habitat, among others. Erosion control structures can disrupt the natural process of sediment transport essential to healthy coastal landforms. Coastal structures are also visible and, in sufficient numbers, can alter the visual character of an area.

Most coastal structures are required to go through a rigorous permitting process. If a project is within the area of wetlands jurisdiction, it must obtain an Order of Conditions from the Conservation Commission. If a project extends below MHW, the structure also must obtain a state license pursuant to 310 CMR 9.00: *The Massachusetts Waterways Regulations* (“Chapter 91.”) When reviewing permit applications for new structures, local and state officials must

seek to balance the rights of property owners with the sustainability of natural resources and the public's right to access and enjoy coastal resources.

This chapter addresses resources conditions, management issues and recommended actions for the following topics:

7.2 Piers and Docks;
7.3 Erosion Control Structures.

7.2 Piers and Docks

7.2.1 Current Condition and Change Analysis

There are currently 410 piers in the study area, of which 277 are in the Three Bays System and 133 are in the Centerville River System. These structures are shown on Figure 23. This number compares with a total of 223 piers in the study area reported in the 1990 plan. This represents a study area-wide increase of 187 piers. The vast majority of piers are for private use, as shown on Table 18.

Table 17. Docks and Piers 1990 and 2009

	1990	2009	Change
Three Bays System	157	277	120
Centerville River System	60	133	73
Unassigned to either area	6	--	
Total	223	410	187

Source: Barnstable Growth Management Department

The 1990 plan describes management issues associated with the then current and potential increase in the number of private piers in the study area. The key management issues related to piers cited in the 1990 plan include:

- Private piers were encroaching on historic recreational areas;
- Potential overdevelopment of piers would alter the character of the study area and obscure shoreline views;
- Piers create environmental impacts which cumulatively could alter the health of resources in the study area by shading and displacing habitat.

In response to these management concerns, the 1990 plan recommended that new construction of piers be restricted in critical resource areas (Policy 3.1), areas used for navigation (Policy 1.4), and residential lots in areas of historic recreational use (Policy 1.3).

Table. 18 Piers by Ownership

Ownership Type	Three Bays System	Centerville River System
Commercial/Marina	32	0
Private	243	132
Town-owned	2	1
Total	277	133

Source: Growth Management Department

Following adoption of the 1990 plan the Town implemented regulatory measures designed to mitigate the impact of piers. These included the Dock and Pier Overlay District (§240-37), adoption of regulatory standards in wetland regulations (Chapter 703) and adoption of the Temporary Recreational Shellfish and Shellfish Relay Overlay District (§240-37.1). As shown in Table 16 the number of piers increased substantially between 1990 and 2009. During the CRMC's deliberation on this topic, it was noted that the new wetlands performance standards were adopted five years ago, in 2004, and so the increase in docks since 1990 could not be interpreted to demonstrate ineffectiveness of the new regulations.

A more recent pier and dock build-out analysis conducted by the Growth Management Department revised the build-out potential for new piers. The analysis found that there is the potential for 326 new docks to be added to the study area, including 28 new piers in areas subject to the temporary prohibition on new piers in designated shellfish relay areas and recreational shellfishing areas. Of these, 265 would be on existing developed parcels, and 61 would be on parcels that could be created under existing zoning. This analysis assumes one pier per parcel. The pier build-out analysis is summarized in Table 19.

This analysis is not intended to exactly predict the number of future piers but to provide a reasonable "order of magnitude" assessment of the potential for piers to be added to the study area under existing regulations. Representatives of the Conservation Department, Growth Management Department and Marine and Environmental Affairs Division reviewed this assessment and methodology. Recognizing that this represents the "worst case" in terms of pier development, it is reasonable to apply a percentage likelihood of achieving this level of development. For example, the total potential build out could be reduced by 20% to reflect a scenario where not all potential piers ultimately would be able to meet performance standards required to be permitted, or where not all owners of shoreline properties would seek a structure. Accordingly, the total addition of new piers could be expressed as a range of between 261 and 326 new piers.

Table 19. Summary of Pier and Dock Build-out Analysis

Existing Docks or Piers (town, residential, commercial)	410
Existing Developed Parcels without Dock or Pier	265
New Potential Parcels eligible for new Dock or Pier	61
Total Potential for New Docks or Piers	326
Adjusted Total Potential for New Docks or Piers (less 20%)	261
Range of Total Existing and Potential Docks or Piers	671 to 767

*Numbers assume dock overlay in Cotuit remains in tact Source: Growth Management Dept.

Barnstable's current regulatory framework for piers in the study area relies on a combination of zoning and conservation regulations. Zoning establishes two geographic areas where new piers are prohibited: the Dock Overlay District and the Temporary Shellfish Recreational Area and Shellfish Relay Area Overlay District. The Dock Overlay is indefinite, while the Recreational and Relay Overlay will expire in May 2010. The Town's zoning code also considers a pier an allowed accessory use, which means a dock may not be built on a parcel that does not have a building or residence on it. A vacant parcel may be allowed by special permit to have a pier if the owner also has an adjoining parcel.

Table 20. Chapter 703 Performance Standards (Abbreviated)

Feature	Performance Standard
Location	Must be built on land contiguous to an existing dwelling
Materials	Creosoted and CCA woods as well as lead piling caps prohibited*
Length	No docks (including pier, ramp, float, dolphin, tie-off piles) extend further than: 1/2 of lot's water frontage, 35 feet from a channel, 100' from MLW, and 20% of a linear waterway at MLW
Water Depth Under Draft of Boat (MLW)	Minimum 30" in shellfish habitat rated 6-10 (high value) Minimum 12" in shellfish habitats rated 0-5 Minimum depths above also required between berth and channel or open water
Float Size	Maximum 200 square feet
Water Depth Under Float	Minimum 12 inches at MLW
Dock Width	Maximum 4 feet
Deck Plank Spacing	Minimum 3/4 inches; 65% light penetration where dock crosses salt marsh
Lateral Shoreline Access	Crossover access stairs, proximate to MHW, for public traverse with signage
Orientation	Base of pier at centerline of lot, perpendicular to shore
Lighting	Downward facing, 25 watts, spaced ≥ 12 feet, height ≤ 2 feet above walking surface
Storage	No floats, ramps, piers and boats stored on marshes, dunes or coastal banks
Posting	MA DEP SE number permanently & conspicuously posted, seaward facing

*CCA piles and structural timbers 3" or more may continue to be used until such time as the Conservation Commission determines that suitable alternatives exist.
Source: D. Houle, Conservation Commission

Outside of areas where piers are specifically prohibited, local wetlands regulations (Chapter 703 of the Town Code) provide performance standards for controlling the location and design of piers. These performance standards are listed in abbreviated form in Table 20.

Many other coastal communities managing piers in heavily used estuaries and have used a combination of zoning and wetlands regulations to regulate piers in order to mitigate anticipated impacts. Zoning is effective in specifying areas of prohibition and in enforcing dimensional standards such as length, water depth and setbacks from property lines or other community resources. Wetlands review ensures that the pier is evaluated specifically in terms of impacts to protected wetlands interests.

7.2.2 Summary of Management Issues: Piers and Docks

Concerns related to a growth in piers were among the issues driving a review and update of the 1990 plan. There are continuing management concerns about potential conflicts between piers, traditional recreational activities and the health of natural resources in the study area. The temporary shellfish recreation and relay areas ordinance calls for the plan update process to include "recommendations with regard to land use enactments, watersheet zoning or other harbor management tools as deemed appropriate" to address the issues of concern.

The direct and cumulative impacts resulting from piers are widely documented.[1] These effects include:

- Potential alteration of water circulation and littoral transport;
- Water shading with impacts to aquatic vegetation;
- Displacement or alteration of habitat; and
- Aesthetic impacts.

Because piers extend below Mean Low Water (MLW) into Commonwealth tidelands, it is also recognized that private piers represent a private use of a public resource and can interfere with or displace public access for historic uses such as navigation or shellfishing. The public trust doctrine which guides coastal laws in Massachusetts and elsewhere establishes the Commonwealth's sovereignty over the tidelands seaward of MLW, and its obligation to protect the public's right to access those lands. The doctrine also seeks to protect the rights of property owners to approach their property from the water. The

[1] Kelty, R.A. and S. Bliven. 2003. Environmental and Aesthetic Impacts of Small Docks and Piers, Workshop Report: Developing a Science-Based Decision Support Tool for Small Dock Management, Phase 1: Status of the Science. NOAA Coastal Ocean Program Decision Analysis Series No. 22. National Centers for Coastal Ocean Science, Silver Spring, MD.

Commonwealth's waterways regulations, MGL Chapter 91, are designed to balance these objectives.

The issue of how to treat structures within designated shellfish recreational and relay areas received a great deal of consideration by the CRMC. The temporary overlay prohibits new docks from being permitted in those areas. The pier build-out analysis revealed that there were 27 existing developed lots without piers in those areas that potentially could have a pier if the temporary restriction were lifted. In addition, one new lot could be created in these areas through subdivision, resulting in a potential for 28 new piers to be built in areas currently designated as shellfish recreational and relay areas if the prohibition were lifted. The CRMC's discussion centered on the potential impacts to the recreational and relay areas if the new structures were built, and whether the prohibition should be continued or, alternately, existing performance standards would be adequate to protect the areas' natural resource and public access values.

It was unanimously agreed by the CRMC that the addition of docks for use by motorized vessels would be detrimental to the areas and therefore the prohibition on such structures should be continued in designated shellfish recreational and relay areas. Of concern was the potential increase in propeller dredging and turbidity resulting from additional motorized boating activity supported by the potential new piers. A majority of CRMC members felt that property owners with frontage within designated shellfish recreational and relay areas should be allowed to apply for a seasonal dock for a non-motorized vessel, believing that the structures alone would not create undue negative impacts if they met the performance standards set forth in Chapter 703.

The pier build-out analysis revealed that the vast majority of new pier growth could occur outside the designated shellfish recreational and relay areas. Chapter 703 performance standards have not been in effect long enough to question or confirm their effectiveness in controlling pier growth. Recognizing this, periodic monitoring of the increase in pier and dock permits is needed to gage whether further modification of performance standards would be appropriate to manage pier and dock growth.

Other types of private shoreline structures designed to enhance access to the water can have impacts on natural resources, lateral shoreline access, access for shellfishing and navigation. These structures, which could include boat ramps, walkways, outhauls, storage racks and boat houses, could be ancillary to a pier and dock or built in lieu of a pier or dock. For example, outhauls are a type of structure that is not clearly regulated by the Town. Outhauls are ropes and pulleys usually attached to posts that allow a vessel to be brought from deep water to the shore. Posted outhauls, which are the type used in the study area, require a Chapter 91 license but do not require action by the Conservation Commission or Harbormaster. Outhauls also could be designed using moorings rather than posts, in which case they would require mooring permits from the Harbormaster.

7.2.3 Recommended Actions: Piers and Docks

7.2.3.1 Complete *Significant Shellfish Resource and Habitat Mapping Project*

Complete the *Significant Shellfish Resource and Habitat Mapping Project* begun in 2001 to include all shoreline and intertidal areas in the study area, including those that are not yet unrated. The assessments should be reviewed every five years and updated as necessary.
Parties involved: Marine and Environmental Affairs Division, Conservation Commission and Division, Shellfish Committee

7.2.3.2 Amend the Existing Regulatory Framework

Continue to regulate piers in the study area through a combination of zoning and wetlands regulations. Modify the current regulatory framework as follows:

> 7.2.3.2.1 In light of the expiration of the Temporary Recreational Shellfish Area and Shellfish Relay Area Overlay District (§240-37.1, see Appendix B), create a zoning ordinance to establish a permanent prohibition on piers for motorized vessels in designated shellfish relay areas and recreational shellfishing areas as shown on Figure 13 of this CRMP-09. Applications for seasonal piers for non-motorized vessels could be submitted for these areas subject to review under Chapter 703 performance standards. (See 4.3.3.1)
>
> 7.2.3.2.2 Implement regulatory or policy changes to ensure enforcement of the prohibition called for in 7.2.3.2.1. Measures could include an ordinance to require color markers on all piers to identify legal use.
>
> 7.2.3.2.3 Continue to enforce the accessory use requirements of zoning and the occupancy permit requirements of wetland regulations (§703-4B) to prevent dock parcels and to prevent docks from being placed on unbuildable lots.

7.2.3.2.4 Convey to the Planning Board the importance of avoiding amendments to the zoning bylaw that would increase the potential for the creation of additional lots—and therefore dock development potential—in the study area.

Parties involved: Planning Board, Growth Management Department, Town Council, Conservation Commission and Division

7.2.3.3 Monitor Pier Development and Effectiveness of Chapter 703 Performance Standards

- Provide an annual and cumulative count of new piers permitted throughout the study area. If warranted by permitting activity, review current wetlands regulations to ensure that standards are adequately protective of resources areas.

Parties involved: Conservation Commission and Division, Shellfish Committee, Marine and Environmental Affairs Division.

7.2.3.4 Develop Permitting Guidelines for Outhauls and Other Private Structures

Guidelines for permitting outhauls, whether designed with posts or moorings, should be developed to ensure protection of shellfish resources and habitat, marsh, eelgrass, public access and navigation. The guidelines should apply throughout the study area, and could be applicable town-wide.

Parties involved: Conservation Commission and Division, Marine and Environmental Affairs Division, Waterways Committee, Shellfish Committee

7.3 Erosion Control Structures

7.3.1 Current Condition and Change Analysis

Despite the relatively calm tidal influences of Nantucket Sound and the inner estuarine shoreline, a significant number of properties in the study area are armored with engineered erosion controls structures that include jetties, seawalls and revetments. A mapping or listing of erosion control structures was not included in the 1990 plan, and so a basis for comparing conditions then and today is not readily available. However it is believed that a number of erosion control structures in existence today predate the 1990 plan.

Figure 20 shows the areas of shoreline erosion control in the study area. The figure shows a concentration of structures on the coastal beach along Sea View Avenue north of Eel River, and in areas of narrow waterways including the West Bay entrance channel, the Narrows and the shoreline of upper Centerville River. Armoring in these latter areas may be designed to protect against wake and wave energy caused by vessel traffic.

7.3.2 Summary of Management Issues: Erosion Control Structures

The Three Bays and Centerville River systems are dynamic coastal systems with extensive stretches of barrier beaches, bluffs and dunes. These landforms provide protection from storm damage and provide natural sources of sediment to feed the shoreline.

On the other hand, the natural erosion of these landforms can result in management challenges. Erosive forces of wind and water prompt property owners to seek measures to protect their property. The movement of sediment throughout the system can alter flushing patterns with implications for water circulation and water quality. Shoaling from sediment migration can also impede navigation in some instances.

Measures are needed to protect, replicate or restore natural sediment transport processes through policies and best management practices for beach nourishment, marsh restoration and by promoting alternatives to hard coastal armoring.

7.3.3.1 Support Recommendations to Develop a Sediment Management Plan

See 6.2.3.3

7.3.3.2 Develop performance standards and design criteria for permitting and maintenance of erosion control structures:

- Encourage the Conservation Commission to establish a policy preference for use of soft approaches to shoreline erosion protection over the use of hard structures.
- Design height of structure to allow sediment release during extreme storm events;
- Require “rough face” surfaces with shallowest possible slope to displace wave energy and cut down on “end effect” erosion without a footprint that encroaches on resource areas;
- Construct hard structures as far landward of MHW as possible;
- Require construction to be staged from the landward side of the structure, where possible, to minimize construction impacts on existing beach front, fringe marsh, and shellfish resources;
- Require vegetative covering and beach nourishment, either immediately following construction or when conditions allow; and
- Require structures to be constructed with stairs, platform walkways, or other acceptable design, which would allow safe public access. Future

erosion of beach-front should be considered relative to preserving public access and addressed in the structure design; and
- Require compliance with beach re-nourishment guidelines.
- Design criteria would also be developed for soft structures, groins and jetties.

Parties involved: Conservation Commission and Division, Marine and Environmental Affairs Division.

Chapter 8.0 Coastal Land Use and Access

8.1 Overview

The Three Bays and Centerville River systems are large geographic areas that each contains numerous locales that have their own unique sense of place. Most residents and visitors recall or relate to the smaller place, whether it's Prince Cove, Eel River, Point Isabella or Scudder Bay, rather than the larger system. The charm and appeal of these special places, sometimes thought of as community character, reflects a confluence of factors: dominant natural resources such as water bodies and marshes, the nature and density of coastal land uses, as well as the historical or cultural significance of buildings or structures. In this context community character is an asset and resource that should be carefully considered as a part of management activities on land and water.

Part of how community character is appreciated is by the use and enjoyment of these areas. The Town has made coastal access for residents and visitors an important priority. Access to waterways by local residents for boating and fishing is an important benefit of coastal living. It is a crucial draw for summer residents and visitors who pump millions into the local economy. Access is also essential for resource stewardship, because it is those on the water or who frequent resource areas that grow to appreciate their special qualities, and who are often the first to observe changes or hazards. The Town supports public access through the maintenance of a variety of public ways to water. Still others access resources visually as they walk or drive by. Visual access, by enjoying views and vistas, is also a component of community character and coastal access.

This chapter addresses resources conditions, management issues and recommended actions for the following topics:

8.2 Coastal Land Use
8.3 Public Access Via Ways to Water
8.4 Waterfront Character

8.2 Management Issue: Coastal Land Use

8.2.1 Current Condition and Change Analysis

As noted in Chapter 1.0, the study area for the 1990 plan encompasses the watersheds of the Three Bays and Centerville River systems, while for the CRMC-09 the study area encompasses shoreline parcels in the two systems. Within the analysis of land use for the 1990 plan is a section on waterfront land use, and that section provided the basis comparison with current conditions.

Shoreline land use as represented in the 1990 plan is similar in character to land use today: predominantly single family residential with some intermittent marine business activity along the shorefront. Recreational and Undeveloped natural wetlands are another dominant feature of the area. Figure 25 shows generalized land use in the study area. The Three Bays shoreline is within the Residential F (RF) and F-1 (RF-1) districts, with areas in the Marine Business A-1 and A-2 (MB-A1 and MB-A2) districts. The Centerville River system shoreline is within the Residential F-1 (RF-1); Residential D-1 (RD-1); Residential D (RD); and Residential C (RC) districts. Both areas are within the Resource Protection Overlay District (RPOD) and Aquifer Protection Overlay District (APOD.)

Potential Newly Subdivided Parcels[1]

A build-out analysis was conducted to determine the potential for the creation of new buildable residential lots along the coastal fringes of the villages of West Hyannisport, Centerville, Osterville, Marstons Mills and Cotuit under existing zoning. Excluded from the analysis were 45 lots owned by the Town, lots subject to a public or private Conservation Restriction, and lots that are unbuildable because of the lack of any upland.

Except for a very small area of the Marine Business District, all of the study area is zoned for single-family residential use. In West Hyannisport, a minimum lot size of one acre is required; over the rest of the study area, a minimum lot size of two acres is required. Where there were multiple buildings on a lot and developable land, a lot was subtracted from the development potential to provide for each existing house. Where there are other uses including private recreational and community lands, these were considered dividable for residential use where there is sufficient acreage, the most notable of which is the Wianno Golf Course with 148 acres.

This report utilized data from the town-wide build-out study[2]. Data derived from that study indicates 59 lots have further development potential and some could be divided to create a total of 144 additional developable lots. When the 59 lots with additional development potential were mapped, six were found not to be developable because of lot configuration and/or access issues leaving 53 lots. When the larger lots were divided, 131 developable lots resulted.

[1] 'Build-out' is an approximation of the maximum development potential under **existing** regulations. A change in the Zoning Ordinance minimum lot size requirement, for example, or a change in Conservation regulations governing docks and piers, would alter the assumptions and therefore the data presented in this report.
[2] Benoit, James. Town of Barnstable GIS Division, 2009.

Table 21 Total Lots in Study Area

	No. lots	%
Public, protected lands, lands excluded from buildout: (283 acres)	45	5%
Lots deemed undevelopable (by Assessors)	112	13%
Fully developed lots	647	76%
Vacant developable lots & lots with additional development potential	53	6%
Total lots in Coastal District	**857**	**100%**

Source: Growth Management Department

Analysis of the 53 lots with additional development potential reveals that 30 are vacant lots that could potentially be developed for one single-family house[3]. The remaining 23 lots could be further divided: 25 lots could be created by dividing off one lot from an existing developed lot; 21 lots would result from the division of larger parcels and 55 lots could be created from the division of the 148 acre Wianno Golf Course[4]

Table 22 Existing Vacant and Dividable Lots in Study Area

Total existing developable lots (prior to division of larger parcels)	**53**
Vacant (single) existing developable lots	30
Lots dividable to create one additional lot	25
Lots divided from larger parcels	21
Division of Wianno Golf course	55
Potentially developable lots	**131**

Source: Growth Management Department

Under current zoning, 131 additional lots could be created for a single-family house, for a total of 778 lots at build-out, which is an increase of 20% over the existing 647 developed lots. If the division of the Wianno Golf Course is excluded, the additional lots are reduced to 76, which represents a potential 12% increase in development for a total of 723 lots at build-out.

Except for the Wianno Golf course, most of the developable land is located along the shores of the Three Bays area. A few lots are located along the Centerville River and its tributaries.

[3] It was assumed for the purposes of this assessment, that undersized lots that may be in same ownership as adjoining land are potentially developable. The Zoning Board of Appeals has the power to grant variances and has done so, especially where prevailing area lots sizes are similar. 15% was subtracted for roads on the two larger lots.

[4] Less wetlands and 15% deduction for roads; 2 acre zoning.

8.2.2 Management Issues: Coastal Land Use

Land use issues and conflicts listed in the 1990 plan included: overdevelopment of the shoreline, visual impacts from development of piers, and high property values making it difficult to expand pubic access. Another issue raised in the 1990 plan is nitrogen loading from on-site sewage disposal systems.

An analysis by the Growth Management Department shows that they study area has not reached its maximum residential development potential under existing zoning. Residential development could increase from twelve to twenty percent (76 to 131 new lots) under current regulations.

The Town has taken and is continuing to develop initiatives to address development pressures in the area. In 2000 the Town enacted the Resource Protection Overlay District, which encompassed a large portion of land in the watersheds of Three Bays and Centerville River systems. The overlay district increased minimum lot size from one acre, which it had been at the time of the 1990 plan, to two acres. This had the effect of reducing the subdivision potential within the study area and the watersheds beyond.

In 2008 the Town obtained a District of Critical Planning Concern (DCPC) designation for Craigville and Centerville. Purposes of the DCPC are to protect community character and prevent growth that overwhelms existing and planned wastewater infrastructure. Implementing regulations, including proposed changes to the zoning bylaw, are under development.

Nitrogen loading from watershed sources continues to pose a major threat to water quality and the health of natural resources in the study area. As described in Chapter 5, nitrogen loading has been comprehensively studied and is being address through other town planning efforts, notably the Wastewater Facilities Plan and the Nutrient Management Plan.

Another significant land use management issue is protection of community character. Preservation of the historic character and economic viability of the working waterfront is a priority of the Town, as documented in the Draft Local

comprehensive Plan (LCP), which includes as a goal the preservation and protection of the working waterfront.

8.2.3 Recommended Actions: Coastal Land Use

8.2.3.1 Protect and Strengthen Waterfront Character

Protect and strengthen existing harbor activities and character, maintain water views and improve public access. Measures could include:

- Harbor and marine uses shall provide a public edge to the water where feasible, and provide views, access and vistas while protecting water dependent activities;
- Amend the Zoning Ordinance to ensure that existing water views are protected or enhanced;
- Amend zoning districts underlying RPOD to combine districts into a single low-density district;
- Review and amend the Subdivision rules and Regulation to include standards for mandatory conservation design cluster subdivision, architectural scale that arises from community context and context sensitive roadway design.

These actions are consistent with Draft Local Comprehensive Plan recommendations 1.5.1 and 1.6.6.
Parties involved: Growth Management Department, Planning Board, Zoning Board of Appeals

8.2.3.2 Swiftly Implement Nutrient Management Initiatives

As described in Chapter 5, the Town should swiftly implement the Wastewater Facility Plan (see 5.2.3.1.1); and the Nutrient Management Plan (see 5.2.3.1.2); and promote compliance with *Interim Regulations for the Protection of Saltwater Estuaries* (§360-45)
(see 5.2.3.1.3)
Parties involved: Public Works Department, Public Health Division

8.2.3.3 Evaluate Sewer Neutral-Growth Neutral Policies (see 5.2.3.1.5)

Sewer neutral controls and growth neutral land use strategies should be evaluated for their potential to control growth facilitated by sewering, in order to protect natural resources and community character and prevent overburdening of infrastructure.
Parties involved: Board of Health, Public Health Division, Department of Public Works, Growth Management Department, Planning Board

8.3 Management Issue: Public Access via Ways to Water

8.3.1 Current Condition and Change Analysis

There are twenty-four town-owned Ways to Water in the study area, including thirteen in the Three Bays System and eleven in the Centerville River System. Table 23 lists the name and features associated with each access point. These access points are shown on Figure 26. The ways to water provide a variety of access opportunities, including three town landings, seven boat ramps, and eleven beach areas. The number and type of access points available along the shoreline today is essentially the same as existed in 1990. The only area not listed in the 1990 plan is Short Beach Road landing, which previously functioned as a town owned access point but had not been listed due to now resolved questions about title.

Within the study area, boat ramps, launching facilities and marina are concentrated in the Three Bays system. Major beach areas, which are the larger of the Ways to Water with greater accommodation of parking, are concentrated in the Centerville River system.

As noted in Chapter 3, the Town Coastal Access Plan (CAP) for municipal ways to water includes repairs to several access points:

- Repairs to the West Bay bulkhead;
- Repairs to the Bay Street Boat ramp, including parking lot improvements and stone wall work;
- Improvements to the Bridge Street parking area and addition of three dinghy tie-up rails;
- Site improvements to Short Beach Road way to water, including parking delineation, stairs and boardwalk to mean high water, and kayak racks

Table 23. Town Ways to Water in the Study Area

	Land Area	Parking*	Town Landing	Boat Ramp	Beach	Features
Three Bays System						
Loop Beach	0.55	50			▲	Bathroom/Bathhouse
Cross Street, Cotuit	End of Road	3			▲	Pedestrian Footpath Only
Cotuit Town Dock	0.32	40				Dock Only, Mooring Access
Ropes Beach	1.04	15			▲	
Hooper's Landing	1.04	2		▲		Launching Facility
Little River Landing	0.05	8	▲			Pedestrian Footpath Only
Cordwood Landing	0.07	4	▲			Mooring Access
Prince Cove Ramp	0.25	9		▲		Launching Facility, Mooring Access
Marina at Prince Cove	0.93	9 (Fee for parking)		▲		Mooring Access
Bay Street	0.12	8		▲	▲	
West Bay Road		0				Bulkhead Only
Bridge Street	0.50	25		▲		
Sea View Avenue	End of Road	4				Footpath Only
Centerville River System						
Wianno Avenue	0.35	4			▲	
Dowses Beach	14.90	190			▲	Bathroom
East Bay Road	0.25	2 (additional sticker required)		▲		Launching Facility
Long Beach	3.50	11			▲	
Cross Street	End of Road	12			▲	Footpath
Long Beach	End of Road	12			▲	
Covell's Beach	7.23	200			▲	Bathroom/Bathhouse/Outdoor Showers
Craigville Beach	10.70	445 (visitor fee parking available)			▲	Bathroom/Bathhouse, Snack Bar
Hayward Landing Road	0.40	12		▲		Dock, Mooring Access
Short Beach Road	End of Road	2	▲			
Katherine Road	End of Road	Roadside				Pedestrian Footpath Only

*Resident Sticker Required Source: Growth Management Department and Property Management Department

8.3.2 Management Issues: Public Access Via Ways to Water

Despite their number and variety of public ways to water, the amount of land area accounted for by these town-owned access points accounts for slightly more than forty-two acres, or two percent of land in the study area. One-quarter of the access points are simply the width of the roadway leading to the water.

The dominance of private ownership of shoreline properties was cited in the 1990 plan as a significant limitation to public access and this continues to be the case today. The relatively small amount of land area includes parking for 1,067 cars, but nearly eighty percent of these spaces are located at Craigville, Coville, and Dowses Beaches and require a resident permit. Parking and access at the boat ramps, launch areas mooring access points is extremely limited and in heavy demand during the boating season from late spring through early fall.

8.3.3 Recommended Actions

8.3.3.1 Enhance or Create New Public Ways to Water (Same as 3.2.3.6)
Identify, prioritize and pursue opportunities to enhance or create new public ways to water. Any expansion of public access should be undertaken in a manner that is consistent with a high degree of environmental protection and respect for community character. The range of opportunities to enhance or expand public access could include:

- Town purchase of properties abutting existing ways to water or non-contiguous parcels with coastal frontage or access;
- Securing access through acquisition of easements over private property; and
- Conditioning local subdivision and Conservation Commission approvals, and by seeking enforcement of Chapter 91 public access requirements.

Parties involved: Town Open Space Committee, Town Manager, Marine and Environmental Affairs Division, Growth Management Department, Department of Public Works, Community Services, Community Preservation Committee, Conservation Commission, Town Attorney.

8.3.3.2 Fund Coastal Access Program (Same as 3.2.3.1)
Identify a mechanism for on-going funding of the Coastal Access Program, for which funding expires in 2010. The CAP maintains a prioritized list of maintenance and improvement projects at town landings and ways to water

across town. These projects go a long way toward maintaining and enhancing public access to the water and in some instances ameliorate negative environmental conditions.
Parties involved: Town Manager, Marine and Environmental Affairs Division, Growth Management Department, Department of Public Works, Community Services, Community Preservation Committee.

8.3.3.3 Survey Town Ways to Water (Same as 3.2.3.2)

Continue the process of conducting and recording surveys of all town landings and ways to water, to avoid potential future disputes over boundaries and land ownership. Parties involved: Town Manager, Marine and Environmental Affairs Division, Growth Management Department, Department of Public Works, Community Services, Community Preservation Committee and Town Attorney.

8.4 Management Issue: Waterfront Character

8.4.1 Current Condition and Change Analysis

8.4.1.1 Three Bays System

The landscape of the Three Bays system is somewhat homogeneous, yet the overall coastal landscape is subdivided into smaller enclosures, each with slightly varying characteristics.

Prince Cove

The smallest of the viewshed areas, Prince Cove is furthest removed from the system of bays and is connected to North Bay by a meandering channel. Views from the local road surrounding the Cove and serving the residences on the Cove, are screened by dense vegetation. At the entrance to the channel is the local marina, and a town way-to-water which provides the only public access to the Cove. Views from this point command virtually the entire perimeter of the Cove. Because the channel turns a corner, the Cove takes on a pond-like atmosphere. The Cove is almost fully developed, with numerous residences and docks. However, the high profile of the vegetation and the steep terrain surrounding the water offer greater screening than other comparably settled areas within the study area. The water surface in the summer is essentially covered with boats on moorings. The channel leading to North Bay is much less developed with several salt marshes along the shore.

North Bay

North Bay is characterized by a diversity of uses and landscape contrasts. The west side is broad and sweeping, providing a large, open water body that is traditionally used for recreation. The eastern shoreline, in contrast, is quite intricate, with lagoons, small tidal streams and marshes.

The major road around the bay is visually separated from the water by distance and dense tree cover. The principle public access points are the Bay Street landing and the town way-to-water at the end of West Bay Road between Nauticus Marine and Crosby Yachts. Although considered as part of the North Bay system, the narrowing passage from the Bay Street landing to Bridge Street, known as the harbor, has a significantly different character from the rest of the area. The presence of marinas and associated marine equipment and docks, as well as the drawbridge itself, is one of the significant visual landmarks of the study area. Once again, although this may not be a typical “scenic” view, it does represent an important facet of the diverse maritime landscape and a long-term historic use.

Overall, North Bay is quite diverse in its coastal features, with most of its visual access concentrated around the marina area.

Cotuit Bay

Cotuit Bay is the largest embayment and, at certain locations, has views of some of the most intense coastal activity in the study area. Bound on the east by Grand Island and on the west by the village of Cotuit, the bay is shaped like a chain of bays, extending from the hooked enclosure formed by Sampson’s Island to the narrow channel at North Bay. The complex coastline and contrasting land uses along the shore provide a diverse series of visual resources.

Loop Beach, located at a sharp turn at the south end of Main Street, is carefully developed and open, providing broad views out to the ocean and across to Dead Neck. The Cross Street access point is less developed, providing limited parking. From this point there is a view directly across the narrow mouth to the ocean or to Sampsons Island. From the water and Grand Island, the village of Cotuit's relatively steep hill, the development density and architecturally consistent buildings, complete with the traditional church steeple breaking the horizon line, all contribute to the effect of the typical maritime village.

Summer views show that Cotuit has the highest concentration of water traffic. The Town Landing, Loop Beach, and Sampson’s Island/Dead Neck are

crowded in the summer with boaters. A heavily used mooring and boat storage area is located along Hooper's Landing.

North of this area is a partially enclosed smaller bay, accessed by Cordwood Road. There is less activity in this area. Views north and south from Cordwood are partially enclosed by the bluffs along the coast. The noticeable landmarks are the tidal flats on the west side of the bay and Tim's Cove on Grand Island.

Further north, the bay tapers to a channel leading to North Bay. Point Isabella, located at the northern end of the bay, is the best point for viewing in this area. Since this area is privately-owned, the view of Cotuit Bay is only available to boaters. Except for the dock and immediate moorings at this point, all other mooring and dock uses tend to be screened from view. The houses are set back along the hillside but are easily seen from the waterfront.

West Bay and Eel River

West Bay is formed largely by the enclosure of Little Island and Oyster Harbors to the north and west. In contrast to the linear corridor-like waterways of Cotuit Bay, much of the landscape of West Bay is characterized by shallows and broad marshes along with several small tidal streams. The vegetation is lower, and the houses are more exposed. There are a number of highly visible buildings along the west and north side of the bay and there are more permanent docks along the shore. The most prominent landmark is the drawbridge connecting Little Island with Osterville on the mainland. The views from this bridge cover the greatest area. Another important vantage point is the relatively large landing off Bridge Street, which offers good views of the bay toward the Seapuit River. The Seaview Avenue access, consisting of a dead end road with a guardrail, provides a good vista of the mouth of the Seapuit River, the entrance to West Bay and the ocean, with limited views of the Bay.

Eel River is actually a narrow stretch of water closed off from the ocean on the southwest end of West Bay. It is extensively developed on the Sound side and the Sound is barely visible to the public because of the young pine trees along Seaview Avenue.

In general, the coast of West Bay has a more developed appearance than many of the other viewshed areas of the study area. The drawbridge in particular is an important landmark, since it is both a highly visible focal point of the principal harbor area when viewed from a distance, and because it provides a good vantage point from which to view the bay.

8.4.1.2 Centerville River System

Development along the southeastern portion of the Centerville River is dominated by small cottages on small lots along the shoreline. This high density

of houses obscures views of the water from roadways in the area. Further west, larger residences dominate on both sides of the river and receive little screening from the sparse shoreline vegetation. The west end of Long Beach is un-developed and vegetative cover is low with a mixture of wild rose, bayberry and blueberry.

Along the River, piers and docks are an integral part of the visual quality of a coastal area. Because the Centerville River is narrow and winding, piers tend to dominate the views of the shoreline from the water, especially along the north side of the River.

Hayward Road Landing, the principle public access point to view the river, is approached by Hayward Road off South Main Street. The landing area is small, with limited parking, and much of the open area is covered with small boats and dinghies. Because it is located at a bend in the river, views upstream and downstream are somewhat restricted creating a sense of enclosure. The Long Beach ways-to-water also offer only limited views upstream and downstream. The majority of the land along the Centerville River is privately-owned, and public views are extremely limited, with the exception of the Bumps River Bridge which provides views north along the Bumps River and south across the Centerville River and an undeveloped stretch of Long Beach into Nantucket Sound.

In contrast with Centerville River, East Bay is sparsely populated, broad and open with extensive marshes and with most of the residences set back into the upland. However, because of the low-lying nature of the area, houses along the shoreline are highly visible from the water in East Bay and in the sound. The coastline is very smooth, and the entire perimeter can be seen from any vantage point. The low terrain provides extensive vistas beyond the bay to the ocean.

The Bay Road boat ramp provides views of the entire Bay and the ocean. At Dowses Beach, the low coastal profile and vegetation surrounding the expansive parking area provide extensive views of the bay and the ocean.

8.4.2 Management Issues: Waterfront Character

The visual quality of the bays and waterways comprising the study area is one of the outstanding values of the region, and at the same time perhaps the most difficult aspect to properly manage and protect. The Town is endowed with many typical maritime features such as small villages, marinas, and mooring areas set in a diverse natural landscape of coves, marshes and beaches. It is the inherent visual quality of these features that attracts so many people to the waterfront; draws so many boats to the harbors and moorings; and brings increasing development along the land bordering the water. Protecting the visual charm of the study area is a significant planning objective.

8.4.3 Recommended Actions: Waterfront Character

8.4.3.1 Protect and Strengthen Waterfront Character

Protect and strengthen existing harbor activities and character, maintain water views and improve public access. Possible actions could include:

- Harbor and marine uses shall provide a public edge to the water where feasible, and provide views, access and vistas while protecting water dependent activities; and
- Amend the Zoning Ordinance to ensure that existing water views are protected or enhanced.

This recommendation is consistent with goal 1.5 of the Draft Local Comprehensive Plan.

Parties involved: Growth Management Department, Planning Board, Zoning Board of Appeals.

Section III: Implementation

Chapter 9.0 Implementation

9.1 Overview

The CRMC was established by the Town Council to review the 1990 plan and present to the Council an updated plan with recommended actions by November 2009. With the submission of the final CRMP-09, the purposes of the CRMC have been served.

The CRMP-09 is a comprehensive plan that addresses a wide range of coastal resource management issues and activities within a broad geographic area. The study area of the Three Bays and Centerville River systems encompasses significant natural, economic and cultural resources of the Town. The CRMP-09 sets forth sixty-five recommended actions that encompass research, regulation, public education and resource management. Almost all of the recommendations will require coordination among multiple Town departments. A dedicated effort will be needed to ensure that progress is made on implementation of recommended actions. The plan will only be effective if there is an implementation structure in place to coordinate actions, monitor results, and adapt programs as necessary in light of changing needs or conditions.

This chapter describes some of the key elements of an implementation framework:

9.2 Coordination;
9.3 Timeframes;
9.4 Resources;
9.5 Priorities.

9.2 Coordination

The CRMP-09 assumes that overall responsibility for implementation of the recommended actions will fall to the Town Manager, or the Town department or entity he designates to coordinate implementation efforts.

The CRMC recommends that the Town Manager consider appointing a standing committee comprised of representatives of key Town departments to coordinate implementation activities. The departments involved with implementation activities would include, at a minimum: Growth Management, Marine and Environmental Affairs Division (Harbormaster, Shellfisheries, Natural Resources), Regulatory Services, Conservation Division, and Department of Public Works. The committee would consult with other departments or experts

as needed to promote implementation efforts. The committee would be responsible for the following actions:

- Ensuring that recommended actions are undertaken as special projects or integrated within departmental work plans;
- Coordinating with the Town Manager on funding and Council actions necessary to implement priority actions (listed below);
- Coordinating special projects as needed;
- Sharing and compiling information on intra-departmental efforts to implement other recommended actions; and
- Reporting progress annually to the Town Manager.

9.3 Timeframes

The implementation of recommended actions will necessarily be a multi-year effort. It is recommended that progress on implementation be reviewed annually and summarized in a report and presentation to the Town Council.

Over time, new information may become available that would require adjustment of recommended actions or their order of priority. The plan assumes that modifications to the plan or its proposed ordering of action items will be undertaken as necessary, in concert with the Town Manager.

The CRMP-09 should be updated in five to seven years, depending on the pace of implementation activities, changing conditions or new information that may become available.

9.4 Resources

As described in 9.5 below and in Table 24, a considerable number of recommended actions, those with a priority rating of 1 or 2, could be accomplished with in existing departmental activities. Another group of activities, with a priority rating of 3, may require additional research, analysis or program development that may include the use of outside consultants.

Several of the priority 1 recommended actions call for funding to continue programs deemed essential to the health of natural resources in the study area, as well as the public's continued safe coastal access and enjoyment of waterways activities. The CRMP-09 does not assign funding amounts to those recommendations. The CRMC would urge the departments involved with those action items to work with the Town Manager to assess needs and resources to determine the appropriate funding amounts and potential sources. Through this deliberative process the CRMC would urge that consideration be given to a full

range of options, including identifying new funding mechanisms or amending existing fee structures, if necessary to implement priority objectives.

9.5 Priority Actions

Table 24 lists abbreviated descriptions of all recommended actions by chapter. All of the recommendations are intended to contribute to the CRMP-09 planning goals listed in Chapter 1. In light of resource limitations, it is helpful to provide an order of priority for undertaking actions. A priority rating of 1,2 or 3 was applied to each action item, in view of resource limitations and other factors. The priority ratings listed in Table 24 are as follows:

1. Of priority importance due to implications for resource health, public access or enjoyment of traditional waterways activities;

2. Of emerging importance and/or likely to be undertaken as part of on-going management activities;

3. Likely to require additional study or development, outside of on-going management activities.

The following is a list of recommended actions that are rated priority 1, of particular importance to the health of resources, public access, or enjoyment of traditional waterways activities.

Implement the following actions to **Protect or Restore Marine Water Quality**:
- Implement the Wastewater Facility Plan (5.2.3.1.1);
- Support swift development and implementation of the Nutrient Management Plan (5.2.3.1.2);
- Complete any unfinished implementation steps from the Draft Three Bays Bacterial TMDL (5.2.3.2.1.); and
- Dedicate funds to provide on-going water quality monitoring (5.2.3.1.1.)

Implement the following actions in light of the **expiration of the Temporary Recreational Shellfish Area and Shellfish Relay Area Overlay District (§240-37.1 found in Appendix B)**:
- Create a zoning ordinance to establish a permanent prohibition on piers for motorized vessels in designated shellfish relay areas and designated recreational shellfishing areas (see Figure 13.) Applications for seasonal piers for non-motorized vessels could be submitted for these areas subject to review under Chapter 703 performance standards. (See 7.2.3.2.1);
- Develop guidelines for selecting and managing shellfish relay areas (See 4.3.3.2.)

Implement Actions to **Enhance Stormwater Management:**
- Fully fund the Coastal Discharge Mitigation Program (5.3.3.2) for stormwater improvement projects and on-going maintenance; and
- Fund water quality monitoring pre- and post construction of stormwater management projects (5.3.3.3).

Implement the following actions to **Enhance Public Access to the Water:**
- Fund Coastal Access Program (See 8.3.3.2 and 3.2.3.1);
- Enhance or create new public ways to water (See 8.3.3.1, and 3.2.3.6).

Implement the following actions to **Promote Healthy Shellfisheries:**
- Complete the *Significant Shellfish Resource and Habitat Mapping Project* (See 7.2.3.1);
- Maintain the cap on commercial shellfish licenses (See 4.4.3.1);
- Ensure adequate funding for propagation programs (See 4.3.3.3);
- Address water quality monitoring in closure areas (See 4.4.3.2);
- Continue dialogue on aboriginal fishing rights (4.4.3.4).

Implement the following actions to **Manage Coastal Structures**:
- Develop permitting guidelines for outhauls and other private structures (See 7.2.3.4);
- Develop performance standards and design criteria for permitting and maintenance of erosion control structures (See 7.3.3.2).

Implement the following actions to **Protect Coastal Landforms**:
- Protect wetlands (5.4.3.1) and coastal landforms and salt marshes (5.4.3.2);
- Assess potential threats posed by accelerated sea level rise (See 6.4.3.2) and develop a local management plan for sea level rise 6.4.3.3;
- Enforce the no disturb buffer zone provision (See 6.2.3.1) and control erosion of coastal landforms to the extent possible (See 6.2.3.2); and
- Develop a sediment management plan (See 6.2.3.3).

Table 24. Summary of Recommended Actions by Chapter
(Please note: these descriptions are abbreviated. See the referenced section for a full description of the recommended action.)

Chapter 3 Marine Services and Facilities: Municipal Boating Access

Recommendation	Parties Involved	Priority
3.2.3.1 Provide Ongoing Funding of Coastal Access Program (CAP) The CAP maintains a prioritized list of maintenance and improvement projects at town landings and ways to water across town.	Town Manager, Marine and Environmental Affairs Division, Growth Management Department, Department of Public Works, Community Services, Community Preservation Committee	1
3.2.3.2 Conduct and Record Surveys Town Ways to Water This will help avoid potential future disputes over boundaries and land ownership.	Town Manager, Marine and Environmental Affairs Division, Growth Management Department, Department of Public Works, Community Services, Community Preservation Committee and Town Attorney	2
3.2.3.3 Enforce Parking and other Use Regulations Evaluate level of resources available for enforcement of resident parking and other regulatory requirements (no pets, no fires, etc.) at town-owned ways to water.	Town Manager, Marine and Environmental Affairs Division, Growth Management Department, Department of Public Works, Community Services, Community Preservation Committee, Regulatory Department, Fire Dept., Police Department	2
3.2.3.4 Evaluate Vessel Removal Needs Evaluate whether the vessel removal program piloted at Ropes Beach is needed at other locations.	Waterways Committee, Marine and Environmental Affairs Division.	2
3.2.3.5 Evaluate Vessel Storage Options Evaluate use of tie-up rails, racks and other vessel storage methods to address crowding, damage to resources, visual effects and potential hazards resulting from vessel storage on town land.	Waterways Committee, Marine and Environmental Affairs Division, Conservation Division	3
3.2.3.6 Enhance or Create New Public Ways to Water Identify, prioritize and pursue opportunities to enhance or create new public ways to water.	Town Manager, Marine and Environmental Affairs Division, Growth Management Department, Department of Public Works, Community Services, Community Preservation Committee, Conservation Division and Commission, Waterways Committee, Shellfish Committee, Town Attorney.	3

Chapter 3 Marine Services and Facilities: Moorings

Recommendation	Parties Involved	Priority
3.3.3.1 Maintain Boundaries of Mooring Fields Maintain the current policy of not expanding the established boundaries of all mooring fields in the study area. Incremental increases in permits may be allowed within boundaries at Harbormaster's discretion, in consideration of environmental protection and community character and community needs	Waterways Committee, Marine and Environmental Affairs Division.	2
3.3.3.2 Evaluate Changes to Mooring Policies, Regulations and Enforcement Practices To facilitate public access to coastal waters, improve the efficient use of moorings, reduce environmental impacts resulting from moorings or their use, and minimize the potential for user conflicts.	Waterways Committee, Shellfish Committee, Marine and Environmental Affairs Division.	3
3.3.3.3 Continue to Review, Refine and Update GPS Delineation of Mooring Fields and Moorings GPS delineation of these areas is important to avoid conflicts with dredging projects, shellfishing, and other historic activities within the study area.	Marine and Environmental Affairs Division.	2
3.3.3.4 Evaluate Alternative Mooring Technologies Continue experimentation with alternative technology moorings that could reduce negative environmental impacts	Waterways Committee, Marine and Environmental Affairs Division.	2

Chapter 3 Marine Services and Facilities: Marinas and Boat Yards

Recommendation	Parties Involved	Priority
3.4.3.1 Encourage Use of Environmentally Protective Best Management Practices Operators should comply with all existing federal, state and local water quality protection measures and regulations, and voluntarily adopt the most environmentally protective best management practices	Waterways Committee, Marine and Environmental Affairs Division, Marina and Boat Yard Operators.	2
3.4.3.2 Ensure Any Proposed Expansion Protects Resources and Community Character Review the provisions of applicable zoning districts as well as the provisions of site plan review to ensure comprehensive review of expansion proposals.	Planning Board, Growth Management Department, Conservation Commission, Marina and Boat Yard Operators.	3

Chapter 3 Marine Services and Facilities: Environmental Impacts and No Discharge Area

Recommendation	Parties Involved	Priority
3.5.3.1 Launch a Clean Boating Education Campaign Launch a Clean Boating public education campaign, in concert with public education for the No Discharge Area (NDA.) The campaign should promote information on the NDA and other environmentally protective boat operation and maintenance practices.	Waterways Committee, Marine and Environmental Affairs Division, Marina and Boat Yard Operators.	3
3.5.3.2 Encourage Use of Environmentally Protective Best Management Practices Encourage marinas and boat yard operators to voluntarily adopt environmentally protective best management practices for their operations	Waterways Committee, Marine and Environmental Affairs Division, Marina and Boat Yard Operators	2

Chapter 3 Marine Services and Facilities: Navigation Aids and Regulations

Recommendation	Parties Involved	Priority
3.6.3.1 Provide Adequate Funds for Aids to Navigation and Enforcement Activity Ensure that adequate resources are provided to: • Mark channels and posting of speed zones at current levels; • Support a presence of law enforcement and Harbormaster patrol at the 1990 level at a minimum; • Enforce speed controls and evaluate the need for additional speed controls, particularly in North Bay; • Sustain adequate pump-out service and seek grants to expand capacity if needed; • Re-instate the position of seasonal mooring assistant.	Waterways Committee, Marine and Environmental Affairs Division, Police Department	2

Chapter 3 Marine Services and Facilities: Dredging and Material Disposal

Recommendation	Parties Involved	Priority
3.7.3.1 Continue Maintenance Dredging In previously licensed dredge sites to historically navigable depths, provided that all local, state and federal licensing requirements are met	Waterways Committee, Shellfish Committee, Marine and Environmental Affairs Division, Conservation Commission and Division	2
3.7.3.2 Carefully Evaluate Any Proposed Improvement Dredging for Clear Public Benefit Evaluate the need for or extent of proposed improvement dredging projects based on a demonstrated potential to promote public benefits such as habitat restoration, public safety, all-tide navigation or improved water quality.	Waterways Committee, Shellfish Committee, Marine and Environmental Affairs Division, Conservation Commission and Division	3

Chapter 4 Fisheries and Aquaculture: Shellfish Resource Sustainability

Recommendation	Parties Involved	Priority
4.2.3.1 Complete Significant Shellfish Resource and Habitat Mapping Project Complete the *Significant Shellfish Resource and Habitat Mapping Project* including unrated areas; review/update every ten years.	Shellfish Committee, Marine and Environmental Affairs Division, Conservation Division and Commission	1
4.2.3.2 Promote Town-wide Initiatives to Mitigate Pollution Sources Promote local initiatives to reduce or mitigate pollution sources that pose a threat to shellfish habitat. These initiatives include: • Stormwater improvement projects; • Measures identified in the Bacterial TMDL; • Wastewater Facilities Plan; • Nutrient Management Plan; and • Enforcement of the No Discharge Area.	Shellfish Committee, Board of Health, Department of Public Works, Waterways Committee, Marine and Environmental Affairs Division, Conservation Commission, Growth Management Department	1

Chapter 4 Fisheries and Aquaculture: Public Shellfish Propagation

Recommendation	Parties Involved	Priority
4.3.3.1 In light of the Expiration of the Recreational Shellfish Area and Shellfish Relay Area Overlay District (§240-37.1 found in Appendix B): • Create a zoning ordinance to establish a permanent prohibition on piers for motorized vessels in shellfish relay areas and recreational shellfishing areas as shown in Figure 13. Applications for seasonal piers for non-motorized vessels could be submitted for these areas subject to review under Chapter 703 performance standards. (See 7.2.3.2.1);	Shellfish Committee, Marine and Environmental Affairs Division, Conservation Division and Commission, Planning Board, Growth Management Department, Town Council	1
4.3.3.2 Develop Guidelines for Selecting and Managing Shellfish Relay Areas. Maintain existing designated shellfish relay and shellfish recreation areas. Develop guidelines and procedures for proposals to amend or establish designated shellfish relay areas to allow public vetting of pertinent issues.	Shellfish Committee, Waterways Committee, Marine and Environmental Affairs Division, Conservation Commission and Division	1
4.3.3.3 Ensure Adequate Funding for Propagation Programs Continue the Town's successful public propagation programs. Provide dedicated funds to sustain programs at a level commensurate with public demand.	Shellfish Committee, Marine and Environmental Affairs Division, Town Manager	2

Chapter 4 Fisheries and Aquaculture: Commercial and Recreational Shellfish Permitting and Management

Recommendation	Parties Involved	Priority
4.4.3.1 Maintain Cap on Commercial Shellfish Licenses The Town should continue to cap the number of commercial shellfishing licenses as a way to prevent overfishing of the resource. In weighing whether to increase the cap, the Shellfish Committee should consider the worst-case impacts in terms of fishing effort associated with new licenses, and assess the cumulative impact of total outstanding licenses.	Shellfish Committee, Marine and Environmental Affairs Division.	2
4.4.3.2 Address Water Quality Monitoring in Closure Areas The Town should approach MA Division of Marine Fisheries to identify an acceptable protocol for water quality monitoring in areas subject to lengthy or permanent closure for the purposes of assessing and possibly modifying the closure status.	Shellfish Committee, Marine and Environmental Affairs Division, MA Division of Marine Fisheries.	1
4.4.3.3 Monitor Extent of Hydraulic Shellfish Harvesting Continue to monitor use of this harvesting technique see if there is a change in intensity or impacts.	Shellfish Committee, Marine and Environmental Affairs Division	3
4.4.3.4 Continue Dialogue on Aboriginal Fishing Rights The Town currently is working with representatives of Native American heritage to understand and resolve issues surrounding aboriginal fishing rights. These discussions should continue as needed.	Town Manager, Legal Department, Marine and Environment Affairs Division, Shellfish Committee	1

Chapter 4 Fisheries and Aquaculture: Disease Threats

Recommendation	Parties Involved	Priority
4.5.3.1 Public Education on Disease Threats Develop a public education effort to inform homeowners, boaters and shellfish harvesters about the signs of water quality degradation or of disease threats, urging quick reporting of incidents to the Marine and Environment Affairs Division.	Shellfish Committee, Marine and Environmental Affairs Division, Barnstable Association of Recreational Shellfishing.	3
4.5.3.2 Continue Working with Regional Institutions and State Agencies to Understand and Address Disease Threats Efforts to understand the causes of disease threats and to develop effective prevention or management responses should continue. The Town should continue to work closely with regional governmental and institutional researchers on this management topic.	Marine and Environmental Affairs Division, Barnstable County Cooperative Extension Service, Woods Hole Oceanographic Institution, other Regional Institutions.	2

Chapter 4 Fisheries and Aquaculture: Private Aquaculture Grants

Recommendation	Parties Involved	Priority
4.6.3.1 Thoroughly Review Proposals to Alter Grant Area or Grant Operations Proposals should be thoroughly evaluated and publicly vetted in terms of: compatibility with other traditional waterways uses and activities, impacts to natural resource conditions, and visual impacts or intrusions.	Town Council, Town Manager, Shellfish Committee, Marine and Environmental Affairs Division	2
4.6.3.2 Encourage Best Management Practices Grant operators should be required to use latest best management practices, and should seek to minimize conflicts or visual impacts associated with equipment, landside impacts (parking, noise, etc.) and disease potential.	Marine and Environment Affairs Division, Barnstable County Cooperative Extension Service, MA Division of Marine Fisheries, Grant Holders	1

Chapter 4 Fisheries and Aquaculture: Finfish Resource Sustainability

Recommendation	Parties Involved	Priority
4.7.3.1 Support Recommended Actions to Protect or Restore Water Quality, Eelgrass and Salt Marsh See Recommended Actions 5.2.3.1, 5.2.3.2, 5.3.3.2, 5.4.3.1, 5.4.3.2, 5.4.3.3	Comprehensive Town Effort	1
4.7.3.2 Support Recommended Actions to Protect and Enhance Public Access for Boating See Recommended Actions 3.2.3.1 and 3.2.3.6.	Comprehensive Town Effort	2

Chapter 5 Natural Resources: Water Quality

Recommendation	Parties Involved	Priority
5.2.3.1.1 Dedicate Funds to Provide on-going Water Quality Monitoring Provide dedicated funds to ensure that comprehensive monitoring is continued or augmented to meet the following objectives: • Measure Total Nitrogen and Bacterial TMDL compliance; • Assess effectiveness of stormwater management projects (see 5.3.3.3); • Evaluate shellfishing areas under indefinite closure (4.4.3.2).	Public Health Division, Department of Public Works, Town Manager, Marine and Environmental Affairs Division	1
5.2.3.1.2 Implement Wastewater Facility Plan The plan would extend sewer service to portions of the Centerville River watershed, helping to address water quality degradation from nutrients and bacteria from underperforming or failed septic systems.	Department of Public Works, Comprehensive Town Effort	1

5.2.3.1.3 Support Swift Development and Implementation of the Nutrient Management Plan Support town efforts to develop a Nutrient Management Plan to address nutrient loading in areas that are not included in the 2007 Town Wastewater Facilities Plan. Alternatives may include: package treatment plants, de-nitrifying septic technology, growth controls to curb further development of single family homes, storm water management improvements, and fertilizer controls.	Comprehensive Town Effort	1
5.2.3.1.4 Compliance with *Board of Health Interim Regulations for the Protection of Saltwater Estuaries* (§360-45) Continue to enforce the Board of Health Interim Regulation aimed at limiting growth in nutrient flow in watersheds of impaired embayments.	Public Health Division, Board of Health	1
5.2.3.1.5 Evaluate Sewer Neutral-Growth Neutral Policies Sewer neutral controls should be evaluated to ensure that sewers would not allow growth in flow other than what would be allowed under Title V or more stringent local regulation. Growth management strategies should be evaluated to address growth in development facilitated by sewers which could alter community character or encroach on sensitive resources.	Public Health Division, Board of Health, Department of Public Works, Growth Management Department	2
5.2.3.2.1 Complete Implementation Steps from Three Bays/Centerville River Bacterial TMDL Proceed with any unfinished implementation steps outlined in the Draft Three Bays Bacterial TMDL.	Public Health Division, Department of Public Works	1

Chapter 5 Natural Resources: Stormwater Management

Recommendation	Parties Involved	Priority
5.3.3.1 Make Stormwater Management a High Priority Support implementation of priority stormwater remediation projects in the study area and continue to identify new projects to address areas of concern.	Department of Public Works, Town Manager, Town Council	1
5.3.3.2 Fully Fund the Coastal Discharge Remediation Program Explore funding alternatives to ensure that adequate resources are available to implement and maintain improvements to stormwater management, particularly a need with regard to newer "low impact" project designs that incorporate natural features.	Public Health Division, Department of Public Works, Town Manager, Town Council	1

5.3.3.3 Monitor Water Quality Pre and Post Management Project Water quality data before and after implementation of a stormwater management projects is needed to measure remediation benefits and provide a basis for adapting or altering projects if anticipated improvements are not achieved.	Department of Public Works, Public Health Division, Marine and Environmental Affairs	1
5.3.3.4 Promote Low Impact Development Practices Ensure that regulations and ordinances require or promote application of low impact development practices and best management practices in private developments and subdivisions.	Growth Management Department, Planning Board, Conservation Commission and Division	2

Chapter 5 Natural Resources: Wetlands Resources

Recommendation	Parties Involved	Priority
5.4.3.1 Protect Wetlands through Regulatory Reviews Protecting wetlands resources should be a priority consideration the review of shoreline projects (residential expansion, piers, marina/boat yard expansion, erosion control structures and dredging.) Promote strict adherence to the regulatory no disturb zone.	Conservation Division and Commission	1
5.4.3.2 Protect Coastal Landforms and Salt Marshes Protect coastal landforms and salt marshes that provide critical storm damage prevention and are integral to the coastal landscape. The efforts could include: • Identification of shoreline properties that could be protected or acquired to allow inland migration of salt marshes; and • Development of re-nourishment guidelines or a sediment management plan to guide the placement of material to sustain coastal landforms on public and private lands.	Conservation Division and Commission	1
5.4.3.3 Address Lack of Eelgrass Undertake efforts to restore eelgrass by: • Implementing the Wastewater Facilities Plan and Nutrient Management Plan, and increasing public awareness of best management practices for fertilizer use; • Exploring the potential for an eelgrass restoration project that would identify areas that have a high likelihood of being able to re-establish eelgrass through planting and management.	Marine and Environmental Affairs Division, Conservation Commission and Division	3

Chapter 5 Natural Resources: Wildlife and Plant Biodiversity

Recommendation	Parties Involved	Priority
5.5.3.1 Promote Compliance with Requirements of NHESP Town departments involved in regulatory reviews and inspections should develop a protocol to ensure that projects not requiring a Notice of Intent but located within areas of either Priority and Estimated Habitat, as mapped on the 2006 Atlas of the Natural Heritage of Endangered Species Program (NHESP), are required to file a request for information with the Massachusetts Natural Heritage and Endangered Species Program to determine which species may be mapped on the site, and how that might inform project design.	Growth Management Department, Conservation Division and Commission, Regulatory Services Department	3
5.5.3.2 Promote Open Space and Habitat Protection Prevent degradation of critical habitat, maintain existing species diversity, and support natural breeding, feeding and migration by: • Limit clearance of vegetation in mapped sensitive habitat areas; and • Establish policies to limit fragmentation of wildlife habitat. These actions are consistent with Draft Local Comprehensive Plan recommendations 2.5.1.1 and 2.5.1.2	Growth Management Department, Planning Board, Town Council	3
5.5.3.3 Land Stewardship and Best Management Practices for Site Clearance or Alteration Best management practices for clearance or alteration of vegetation on large land areas should be developed, and possibly codified as a site clearance ordinance. This action is consistent with Draft Local Comprehensive Plan recommendation 2.5.1.3.	Growth Management Department, Planning Board, Town Council	3
5.5.3.4 Develop Best Management Practices to Control or Eradicate Marine or Freshwater Invasive Species Managing invasive species in the study area. Work with state, regional and local organizations to inventory and prioritize invasive species in the study area, and to develop and disseminate best management practices.	Conservation Commission and Division, Marine and Environment Affairs Division.	3

Chapter 5 Natural Resources: Fish Runs

Recommendation	Parties Involved	Priority
5.6.3.1 Continue Fish Run Stewardship Continue to maintain the Marstons Mills and Centerville River fish runs. Evaluate whether, through municipal or volunteer efforts, maintenance activity could be extended to the Bumps River and Little River fish runs.	Marine and Environment Affairs Division, Conservation Division and Commission	2

Chapter 6 Coastal Landforms and Processes

Recommendation	Parties Involved	Priority
6.2.3.1 Ensure Application of No Disturb Provision Promote strict adherence to the regulatory 50-foot no disturb zone (See 5.4.3.1.) Additionally, re-nourishment coastal landforms with the potential to be altered by a project should be required.	Conservation Commission and Division	2
6.2.3.2 Control Erosion of Coastal Landforms to the Extent Possible Minimize impacts to coastal landforms from development and redevelopment. This action is consistent with Draft Local Comprehensive Plan recommendation 2.2.2.2.	Growth Management Department, Planning Board, Zoning Board of Appeals, Conservation Commission and Division	2
6.2.3.3 Develop a Sediment Management Plan The plan would: • Assess the potential needs, benefits and detriments of maintenance and improvement dredging in specific locations and prioritize areas where dredging may be needed or desirable; • Identify and prioritize areas for placement of dredged material for shoreline stabilization, habitat restoration and protection of public access; • Identify priority areas for proactive beach nourishment; • Identify strategies for disposing of fine-grained material not compatible for beach nourishment; • Establish nourishment guidelines for public and private projects; and • Identify areas where beach profile monitoring should be undertaken.	Conservation Commission and Division, Marine and Environmental Affairs Division, Waterways Committee, Shellfish Committee.	3

Chapter 6 Coastal Landforms and Processes: Bathymetry and Hydrodynamics

Recommendation	Parties Involved	Priority
6.3.3.1 Continue Periodic Monitoring of Bathymetry and Hydrodynamics Periodic updates to the bathymetry or hydrodynamic modeling of the Three Bays and Centerville River systems should be undertaken. Efforts should coordinate with similar studies by Three Bays Preservation, Inc.	Marine and Environmental Affairs Division, Three Bays Preservation, Inc.	3

Chapter 6 Coastal Landforms and Processes: Relative Sea Level Rise

Recommendation	Parties Involved	Priority
6.4.3.1 Protect the Integrity of Coastal Features that Provide Storm Damage Protection Based upon further evaluation, actions to protect coastal features that provide storm damage could include: • Town land acquisitions in FEMA A and V zones, • Limiting development in FEMA V zones, • Ensuring regulations allow for reasonable use of property, • Adoption of a sewer neutral regulation, • Adoption of a Flood Plain ordinance. This recommendation is consistent with Draft Local Comprehensive Plan recommendation 2.2.2.1	Growth Management Department, Planning Board, Board of Health and Health Division, Conservation Commission and Division, Department of Public Works	3
6.4.3.2 Assess Potential Threats posed by Sea Level Rise Determine the extent of threats posed by the general outcomes anticipated with Relative Sea Level Rise: This may include collection of data on shoreline elevations, coastal land uses, and detailed elevations and conditions of wetlands resources.	Growth Management Department, Information Technology (GIS) Department, Conservation Commission, Marine and Environmental Affairs Division, Department of Public Works.	3
6.4.3.3 Develop a Local Management Plan for Sea Level Rise • Based on the assessment in 6.4.3.2 above, develop a local management plan for addressing effects of sea level rise.	Growth Management Department, Information Technology (GIS) Department, Conservation Commission, Marine and Environmental Affairs Division, Department of Public Works.	3

Chapter 7 Coastal Structures: Piers and Docks

Recommendation	Parties Involved	Priority
7.2.3.1 Complete *Significant Shellfish Resource and Habitat Mapping Project* Complete the *Significant Shellfish Resource and Habitat Mapping Project* begun in 2001 to include all shoreline and intertidal areas in the study area, including those that are as yet unrated. The assessments should be reviewed every five years and updated as necessary.	Marine and Environmental Affairs Division, Conservation Commission and Division, Shellfish Committee	1
7.2.3.2 Amend the Existing Regulatory Framework Continue to regulate piers in the study area through a combination of zoning and wetlands regulations. Modify the current regulatory framework as follows: 7.2.3.2.1 1 In light of the Expiration of the Recreational Shellfish Area and Shellfish Relay Area Overlay District (§240-37.1 found in Appendix B), create a zoning ordinance to establish a permanent prohibition on piers for motorized vessels in designated shellfish relay areas and recreational shellfishing areas (see Figure 13.) Applications for seasonal piers for non-motorized vessels could be submitted for these areas subject to review under Chapter 703 performance standards. 7.2.3.2.2 Implement regulatory or policy changes to ensure enforcement of the prohibition called for in 7.2.3.2.1. Measures could include an ordinance to require color markers on all piers to identify legal use. 7.2.3.2.3 Continue to enforce the accessory use requirements of zoning and the occupancy permit requirements of wetland regulations (§703-4B) to prevent dock parcels and to prevent docks from being placed on unbuildable lots 7.2.3.2.4 Convey to the Planning Board the importance of avoiding amendments to the zoning bylaw that would increase potential for single-family lot development—and therefore dock development potential—in the study area.	Planning Board, Growth Management Department, Town Council, Conservation Commission and Division	1
7.2.3.3 Monitor Pier Development and Effectiveness of Chapter 703 Performance Standards Provide an annual and cumulative count of new piers permitted throughout the study area. If warranted by permitting activity, review current pier regulations to ensure that standards are adequately protective of	Conservation Commission and Division, Shellfish Committee, Marine and Environmental Affairs Division.	2

resources areas.		
7.2.3.4 Develop Permitting Guidelines for Outhauls and Other Private Structures Guidelines for permitting outhauls, whether posted or designed with moorings, should be developed to ensure protection of shellfish resources and habitat, marsh, eelgrass, public access and navigation. The guidelines could be applicable town-wide.	Conservation Commission and Division, Marine and Environmental Affairs Division, Waterways Committee, Shellfish Committee	2

Chapter 7 Coastal Structures: Coastal Erosion Control

Recommendation	Parties Involved	Priority
7.3.3.1 Support Recommendations to Develop a Sediment Management Plan See 6.2.3.3	Conservation Commission, Marine and Environmental Affairs Division, Waterways Committee, Shellfish Committee	3
7.3.3.2 Develop performance standards and design criteria for permitting and maintenance of erosion control structures Establish a policy preference for use of soft approaches to shoreline erosion protection over the use of hard structures. Develop design standards to minimize negative impacts from hard structures where needed.	Conservation Commission and Division, Marine and Environmental Affairs Division.	3

Chapter 8 Coastal Land Use and Access: Coastal Land Use

Recommendation	Parties Involved	Priority
8.2.3.1 Protect and Strengthen Waterfront Character Protect and strengthen existing harbor activities and character, maintain water views and improve public access. Possible measures could include amendments to the zoning ordinance to ensure protection of public access and views. This recommendation is consistent with recommendation 1.5.1 and 1.6.6 in the Draft Local comprehensive Plan.	Growth Management Department, Planning Board, Zoning Board of Appeals	3
8.2.3.2 Swiftly Implement Nutrient Management Initiatives Implement the Wastewater Facility Plan (see 5.2.3.1.1); and the Nutrient Management Plan (see 5.2.3.1.2); and promote compliance with *Interim Regulations for the Protection of Saltwater Estuaries* (§360-45) (See 5.2.3.1.3)	Department of Public Works, Board of Health and Public Health Division	1
8.2.3.3 Evaluate Sewer Neutral-Growth Neutral Policies (Same as 5.2.3.1.5)	Board of Health, Public Health Division, Growth Management Department, Planning Board	2

Chapter 8 Coastal Land Use and Access: Public Access Via Ways to Water

Recommendation	Parties Involved	Priority
8.3.3.1 Enhance or Create New Public Ways to Water (See as 3.2.3.6) Identify, prioritize and pursue opportunities to enhance or create new public ways to water. Any expansion of public access should be undertaken in a manner that is consistent with a high degree of environmental protection and respect for community character.	Parties involved: Town Manager, Community Preservation Committee, Marine and Environmental Affairs Division, Growth Management Department, Department of Public Works, Community Services, Community Preservation Committee, Conservation Commission, Town Attorney.	1
8.3.3.2 Fund Coastal Access Program (same as 3.2.3.1) Identify a mechanism for on-going funding of the Coastal Access Program, for which funding expires in 2010.	Town Manager, Marine and Environmental Affairs Division, Growth Management Department, Department of Public Works, Community Services, Community Preservation Committee.	1
8.3.3.3 Survey Town Ways to Water (same as 3.2.3.2) Continue the process of conducting and recording surveys of all town landings and ways to water, to avoid potential future disputes over boundaries and land ownership.	Town Manager, Marine and Environmental Affairs Division, Growth Management Department, Department of Public Works, Community Services, Community Preservation Committee and Town Attorney.	2

Chapter 8 Coastal Land Use and Access: Waterfront Character

Recommendation	Parties Involved	Priority
8.4.3.1 Protect and Strengthen Waterfront Character Protect and strengthen existing harbor activities and character, maintain water views and improve public access. Possible measures could include amendments to the zoning ordinance to ensure protection of public access and views. This recommendation is consistent with goal 1.5 in the Draft Local comprehensive Plan.	Growth Management Department, Planning Board, Zoning Board of Appeals.	3

Section IV: Figures

Section V: Sources and Appendices

Sources

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Appendix A: List of Citizens Providing Public Comment

Providing Testimony at the Public Meeting, August 31, 2009
Town Council Hearing Room:
(Alphabetically)

Steve Brown, Centerville
Len Clark, West Barnstable
James Crocker, Town Councilor
John Ferrine, West Barnstable
Gerard Ganney, Cotuit
Andrew Newman, Marstons Mills
Chas Orr, Centerville
Richard Ossen, West Barnstable
Matthew Ostrowski, West Barnstable
Peter Sampou, Ph.D., West Barnstable
Arlene Wilson, Marstons Mills

Submitting Written Comments:
(Alphabetically)

Andrea Adams, Cape Cod Commission
Frederick B. Dempsey, West Barnstable
Warren Nickerson, Cotuit
Mark D. Olken, MD, Marstons Mills

Appendix B: §240-37.1 Temporary Recreational Shellfish Area and Shellfish Relay Area Overlay District.

[Added 4-3-2008 by Order No. 2008-091 *Editor's Note: This order also provided that it shall cease to be effective 18 months from its effective date.* **]**

A.

Purpose.

(1)

The purpose of this section is to protect the general public's interest in the recreational harvesting of shellfish by creating a Temporary Recreational Shellfish Area and Shellfish Relay Area Overlay District within said overlay zoning district.

(2)

The purposes of the Temporary Recreational Shellfish Area and Shellfish Relay Area Overlay District include:

(a)

Maintaining public access along the shore and to shellfish and shellfish beds, whether existing or potential, for the purposes allowed by law.

(b)

Prohibiting docks and piers and the harvest of shellfish utilizing the hydraulic method in coastal waters designated as "significant shellfish habitat."

(c)

To allow time to conduct an update of the 1990 Coastal Resources Management Plan.

B.

Establishment of district.

(1)

In order to implement the purposes of this section, the Temporary Recreational Shellfish Area and Shellfish Relay Area Overlay District is hereby established and shall be considered as superimposed over any other districts established by this chapter as amended from time to time. The Temporary Recreational Shellfish Area and Shellfish Relay Area Overlay District shall include those areas shown on the map entitled "Temporary Recreational Shellfish Area and Shellfish Relay Area Overlay District," dated February 28, 2008, filed with the Town Clerk, up to and including the area seaward of the mean high water line, which map, together with all explanatory material thereon, is hereby incorporated in

and made part of this chapter.

C.

Overlay District Map. The boundaries of the Temporary Recreational Shellfish Area and Shellfish Relay Area Overlay District established by this section are shown on the Official Zoning Map, § **240-6A**, Identification of Zoning Map, as amended with a file date of August 30, 2000.

D.

Prohibition. Within the Temporary Recreational Shellfish Area and Shellfish Relay Area Overlay District, the harvest of shellfish utilizing the hydraulic method and the construction and/or installation of docks and piers is prohibited, unless such dock or pier has the benefit of a valid order of conditions issued prior to August 17, 2007, and receives all other necessary local, state and federal permits, in which case the construction and/or installation and maintenance of said dock or pier shall not be prohibited.

E.

Reestablishment of damaged or destroyed nonconforming docks or piers. The reestablishment of a lawful preexisting nonconforming dock or pier which has been destroyed or damaged by fire, acts of nature or other catastrophe shall be permitted pursuant to § **240-95A(1)** and **B**, provided that such reestablishment shall include only materials currently allowed for such construction by the Barnstable Conservation Commission, and, for the purposes of this section, the "pursuit of construction continuously to completion" shall mean that construction shall be completed within one year of receipt of all required permits. The redeployment of a lawful preexisting nonconforming seasonal dock or pier is permitted.

F.

Expansion of existing docks or pier. For the purposes of Article **VIII**, Nonconformities, the expansion of an existing dock or pier located within the Temporary Recreational Shellfish Area and Shellfish Relay Area Overlay District shall be deemed to be substantially detrimental and shall be prohibited.

G.

Definitions. The terms "dock" and "pier" shall be used interchangeably for the purposes of these regulations and shall mean the entire structure of any pier, wharf walkway, or float, and any part thereof, including pilings, ramps, walkways, float, tie-off pilings, dolphins and/or outhaul posts, that is located on a coastal bank (310 CMR 10.30), land under water bodies

and waterways (310 CMR 10.56), land under the ocean (310 CMR 10.25), land under a salt pond (310 CMR 10.33), rocky intertidal shore (310 CMR 10.31), or that portion of a coastal beach (310 CMR 10.27) seaward of the mean high water line. Notwithstanding the above, either a swimming float or work float, kept at a mooring, that receives a permit from the Harbormaster and is not connected with the shore, is not a float subject to these regulations. Bulkheads duly permitted for the purpose of erosion control are not subject to this section.

H.

Coastal Resources Management Plan.

(1)

During the time this temporary overlay district is in effect, the Town Manager shall appoint an ad hoc committee ("Coastal Resource Management Committee") to be comprised of a representative from the following: Conservation Commission, the Waterways Committee, the Shellfish Committee, the marina industry, the dock and pier construction industry, the commercial shellfish community, the recreational shellfish community, the marine permitting community, a wastewater professional, an owner of property in the temporary overlay district, and an interested party identified by the Town Manager.

(2)

The ad hoc committee shall evaluate the 1990 Camp, Dresser & McKee study and identify areas requiring update and any potential benefits of creating a state-approved Harbor Management Plan. The committee will deliver to the Town Council progress reports within six months and 12 months from the adoption of this section. The committee will submit to the town council a final updated plan along with its recommendations with regard to any land use enactments, water sheet zoning or other harbor management tools as deemed appropriate within 18 months from the adoption of this section. The Committee shall work with Town staff and any private consultant that may be hired by the Town for these purposes.

Appendix C: Division of Marine Fisheries and Town of Barnstable Shellfish Relay Area and Recreational Shellfishing Area Definitions

WEST BAY

The **West Bay Relay Area** ("Joe's Grant") is defined as: the waters and shoreline of that portion of West Bay from the Bridge Street bridge south to the pier at 227 Bridge Street to the sign/buoys located offshore at the channel.
(DMF/SC22.22) Spring 1996

The **West Bay Relay Area** (West) is defined as: the waters, flats and all tributaries of that portion of West Bay from the sign at 134 South Bay Road to the sign at the pier at 52 South Bay Road and extending to the sign/buoys located offshore.
(DMF/SC22.21) Spring 1997

The **West Bay Recreational Shellfishing Area** is defined as**: t**he waters, flats and shoreline within an area beginning from the West Bay Landing at Bridge Street to the Wianno Yacht Club pier to the sign buoys located offshore.
(DMF/SC22.11) 1998

NORTH BAY

The **North Bay Relay Area** is defined as: the waters, flats and shoreline of that portion of North Bay from the pier at 79 Sand Point Road to the pier at 86 Sand Point Road extending to the navigational channel at the northern entrance to Cotuit Bay and to the offshore sign/buoys in North Bay.
(DMF/SC23.22) Spring 1996

The **Bay Street Relay Area** is defined as: the waters, flats and tributaries of that portion of North Bay from the Town landing at Bay Street to the sign at the tip of the salt marsh at 237 Seapuit Road and extending to the offshore sign/buoys.
(DMF/SC23.20) Spring 1996

COTUIT BAY

The **Cotuit Bay Relay Area** is defined as: the waters, flats and shoreline of that portion of Cotuit Bay between the signs located along the shoreline at 884 Main Street extending to the offshore sign/buoys.
(DMF/SC21.22) Spring 1996

The **Bluff Point Relay Area** is defined as: the waters and shoreline of that portion of Cotuit Bay southwest of an imaginary line drawn from the end of the pier at 124 Bluff Point Drive to a sign along the western shore of Cotuit Bay at 996 Main Street, Cotuit Ma.
(DMF/SC21.20) Spring 1995

The **Cordwood Lane Relay Area** is defined as: the waters, flats and shoreline of that portion of Cotuit Bay northwest of a line drawn from the Cotuit Oyster Company pier to the green navigational buoy at the southern entrance of the Cotuit Narrows to the "No Shellfishing" sign at #797 Old Post Road.
(DMF/SC 21.21) Spring 1995.

The **Cordwood Landing Recreational Shellfishing Area** is defined as**:** the waters, flats and shoreline within an area beginning from the sign/post located on the shore at 671 Old Post Road thence northeasterly to the sign/post located on the shore at 721 Old Post Road to the sign buoys located offshore.
(DMF/SC21.21) 9/10/1996.

Shellfish Recreational & Relay Areas
As approved by Town Council on February 28, 2008 for the
"Temporary Recreational Shellfish Area & shellfish Relay Area Overlay District"

Name	Area (sq. ft.)	Area (acres)
Cotuit Bay Relay Area	246,286.98	5.65
Cordwood Lane Relay Area	1,204,200.87	27.64
Cordwood Landing Recreational Shellfish Area	170,410.03	3.91
West Bay Relay Area (East)	446,257.90	10.24
West Bay Relay Area (West)	347,686.57	7.98
Bluff Point Relay Area	227,608.50	5.23
Bay Street Relay Area	277,532.34	6.37
North Bay Relay Area	58,665.71	1.35
Grand Island Shellfish Propagation Area	61,577.80	1.41
West Bay Recreational Shellfish Area	58,171.97	1.34
Totals:	3,098,398.68	71.13