Pleasant Bay Resource Management Plan 2008 Update

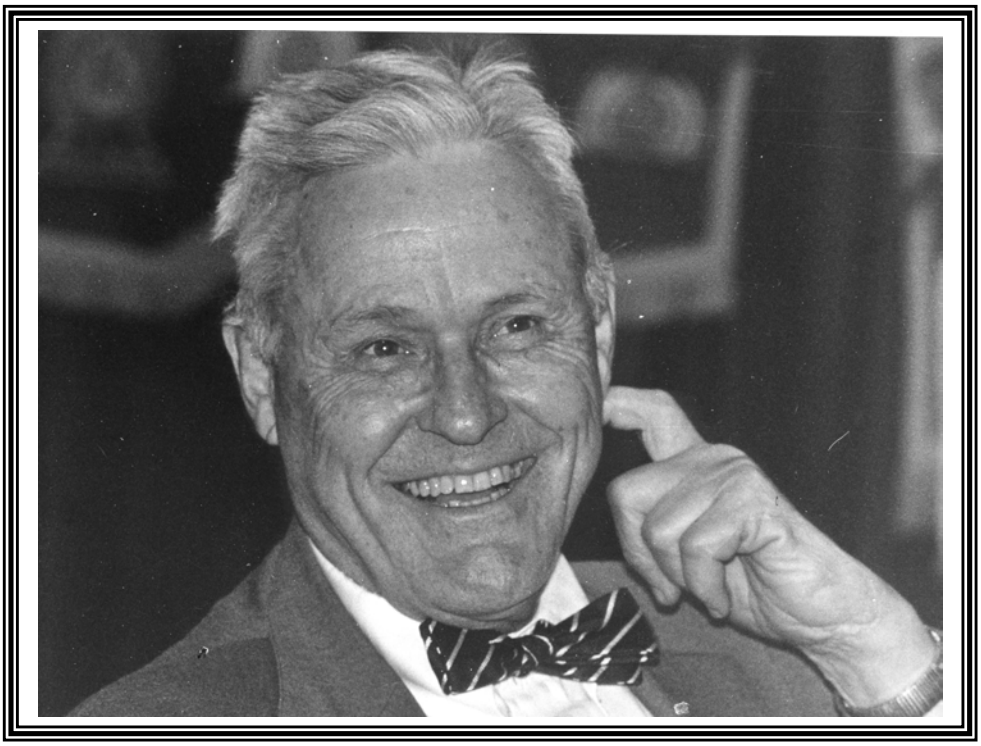
March 2008

Pleasant Bay Resource Management Alliance

Ridley & Associates, Inc.

IN MEMORIAM - ALAN MCCLENNEN
1916-2007

The *Pleasant Bay Resource Management 2008 Update* is dedicated to the memory of Alan McClennen. Alan drafted the application that led to the designation of Pleasant Bay as an Area of Critical Environmental Concern, and was a member of the Steering Committee during the development of the initial Pleasant Bay Resource Management Plan. He continued to be a vital advisor and supporter of the Pleasant Bay Alliance. We remember Alan as a man whose vision, dedication and lifelong love of Pleasant Bay provide us with a firm foundation for stewardship today and for years to come.



PLEASANT BAY RESOURCE MANAGEMENT PLAN 2008 UPDATE

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Special thanks to Paul Lagg, GIS Coordinator for the Town of Chatham, for developing the maps included in this update.

The Alliance also wishes to express its appreciation to our tireless water quality monitoring volunteers and many others who have contributed in countless ways to the accomplishments outlined in this report, including:

Fred Volpicelli, Mikron Computers, for maintaining our website.
Friends of Pleasant Bay, Inc.
Friends of Chatham Waterways, Inc.
Friends of Arey's Pond, Inc.
Friends of Meetinghouse Pond, Inc.

The Alliance greatly appreciates the technical and financial support provided by the Alliance Towns.

List of Figures, Tables and Charts

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List of Terms and Abbreviations

ACEC – Area of Critical Environmental Concern

ACMH – Areas of Critical Marine Habitat

CCNS – Cape Cod National Seashore

CWMP – Comprehensive Wastewater Management Plan

HAB – Harmful Algal Blooms

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

SAV – Submerged Aquatic Vegetation

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

TMDL – Total Maximum Daily Load

SECTION I. OVERVIEW OF RESOURCE MANAGEMENT PLAN UPDATE

Chapter 1.
Introduction

1.0 Overview

A little more than twenty years ago a group of citizens and officials from the Towns of Orleans, Chatham, Harwich and Brewster petitioned the state Executive Office of Environmental Affairs to designate Pleasant Bay and Area of Critical Environmental Concern (ACEC). That visionary step signified an important acknowledgement among the towns that the beauty and health of Pleasant Bay could not be taken for granted as something secure and unchanging. It also reflected awareness that the towns shared responsibility for safeguarding the Bay's health for future generations.

A decade later, in 1998, the Towns of Orleans, Chatham and Harwich adopted the Pleasant Bay Resource Management Plan and formed the regional Alliance to implement the plan. The Alliance pledged to update the resource management plan every five years, and issued the first update report in 2003. This 2008 report fulfills the update requirement on the ten-year anniversary of the plan. This report summarizes implementation actions taken by the Alliance and the member towns to date, with emphasis on achievements in the last five years, and provides additional issues and recommendations for action. It is intended to describe progress, and to chart a course for the coming five years of coordinated management activity.

Much has changed over the ten years since the plan was initially adopted. At that time much of our attention was focused on the increasing number of private docks, an influx of jet skis, and burgeoning aquaculture grants. Today, management pressures from these issues have been addressed or have receded and our attention is focused on new challenges. These new challenges include understanding how the recently formed inlet is re-shaping our barrier beach and coastline, and developing strategies to cut in half the amount of nitrogen coming from more than 5,000 individual septic systems in our watershed.

Over the coming five years the Alliance will join with its member communities, interested citizens and organizations, institutions and state, county and federal agencies, to address these and other challenges. With a solid record of accomplishment, a clear course for the future and the dedication of all four-watershed communities, the Alliance is well positioned to accomplish the work ahead.

1.1 Guiding Principles

This 2008 update carries forward the same planning principles that guided the 1998 and 2003 documents. These principles reflect a commitment to stewardship that cuts across many distinct and often competing activities and interests, as well as town boundaries:

To sustain and, wherever practicable, regenerate the health and productivity of the Bay's eco-system, including its water quality, diverse animal and plant life, tidal marshes, ponds, rivers, bays, islands, and beaches;

To encourage levels of recreational, residential, and commercial activity in the Bay and its watershed, including physical structures, that are consistent with resource sustainability and that promote a high degree of public safety and enjoyment;

To enhance opportunities for public access to and enjoyment of the Bay, in balance with resource sustainability and private property rights; and

To preserve the features that contribute to the Bay's unique character including its natural beauty, tranquility, history and accessibility.

1.2 Planning Area

The study area for the resource management plan and this update remains unchanged, and includes the boundary of the ACEC and the entire marine water re-charge area (watershed) for the Bay (see Figure 1.)

The ACEC designation is a formal state designation directed principally to the actions and jurisdictions of state environmental agencies. The ACEC regulations generally direct EOEA agencies to take actions, administer programs, and revise regulations in order to preserve, restore or enhance the resources of an ACEC. An ACEC designation does not create new regulations to implement the goals of the designation, but works through the existing state environmental regulatory framework.[1]

The boundary of the Pleasant Bay ACEC covers 9,240 acres including the Bay's waters and a perimeter of land approximately one hundred feet in from shore (see Figure 2.) The area within the ACEC boundary is generally protected by more stringent state environmental reviews for certain projects other than single-family homes. The rationale for the protections afforded an ACEC is based on the area's extensive resources and its value as an eco-system. Pleasant Bay met all fourteen ACEC criteria established by the state, far more than the five criteria needed to qualify for the designation.

The watershed encompasses 21,600 acres located in Orleans, Chatham Harwich and Brewster (see Table 1.) The watershed feeds overland run-off and groundwater into Pleasant Bay and its sub-embayments and tributaries.

[1] More information on the ACEC program can be obtained at www.mass.gov/dcr/stewardship/acec

Table 1. Pleasant Bay Watershed Area by Town

Watershed Area	Orleans	Brewster	Harwich	Chatham	Total
Land	5,293 (35%)	3,527 (23%)	2,643 (17%)	3,655 (24%)	15,118 (100%)
Estuary Surface	3,528 (54%)	--	153 (2%)	2,802 (43%)	6,483 (100%)
Land & Estuary	8,822 (41%)	3,527 (16%)	2,795 (13%)	6,456 (30%)	21,600 (100%)

Source: Cape Cod Commission

1.3 Organization of the Plan Update

The update is organized into three main sections, each of which contains one or more chapters.

Section 1: Overview of the Resource Management Plan Update provides background on the original plan, a description of the process undertaken to develop the plan update, and a key highlights of the plan update.

Section 2: Update on Resource Management Plan Issues and Recommendations contains in-depth discussion on resource management issues, implementation activities and new or updated recommendations. The section has seven chapters, which encompass the management areas outlined in the 1998 plan and 2003 update. The seven chapters in this section of the update are:

Chapter 3: Biodiversity and Habitat Protection
Chapter 4: Wetlands Protection
Chapter 5: Watershed Planning
Chapter 6: Fisheries Management
Chapter 7: Coastal Processes and Structures
Chapter 8: Waterways Safety and Navigation
Chapter 9: Public Access and Historic Resources

Section Three: Implementation, addresses the issues and accomplishments associated with the Alliance's administrative and organizational structure. A matrix summarizing past and proposed implementation activities is included.

As with the original resource management plan and 2003 update, the 2008 update provides a blueprint for action, requiring on-going steps to implement recommendations monitor progress, and provide for adjustments as needed.

1.4 Community Review Process

The plan update was developed over the past year by the Alliance Steering Committee, Technical Resource Committee and work groups, with input on various sections from representatives of the Cape Cod Commission, Massachusetts Coastal Zone

Management, Massachusetts Department of Environmental Protection, Massachusetts Department of Environmental Management, Cape Cod National Seashore, Barnstable County, and other local municipal and civic organizations.

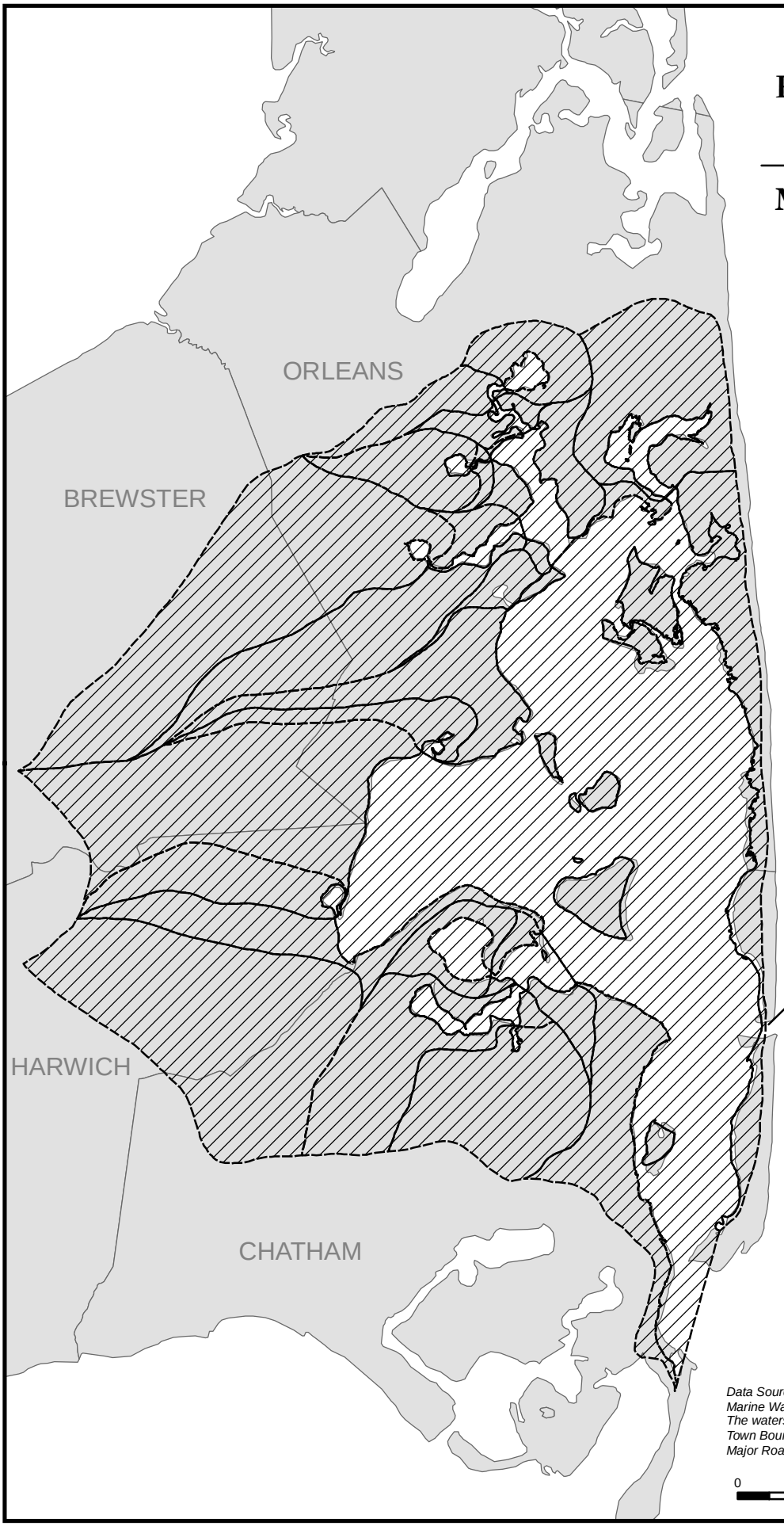
A public review draft of the plan update was submitted to the Boards of Selectmen in each Alliance town in February 2008. At that time each Board was asked to sponsor an article at their Annual Town Meeting to adopt the plan and renew the Memorandum of Agreement forming the Alliance. Copies of the draft plan update were available for review at the Town Hall and main public library in each Alliance town, and on the Alliance's website, www.pleasantbay.org. A public comment period was established, and a public meeting was held to solicit comments and answer questions.

The Alliance reviewed input received from the public comment process and modified the draft plan update accordingly. In March 2008 the Alliance forwarded the final plan update to the Towns. Copies of the plan update are available at the Town Hall and main public library in each Alliance town and on the Pleasant Bay Alliance website www.pleasantbay.org.

Pleasant Bay Resource Management Plan 2008

Marine Water Recharge Area (Watershed)

Figure 1



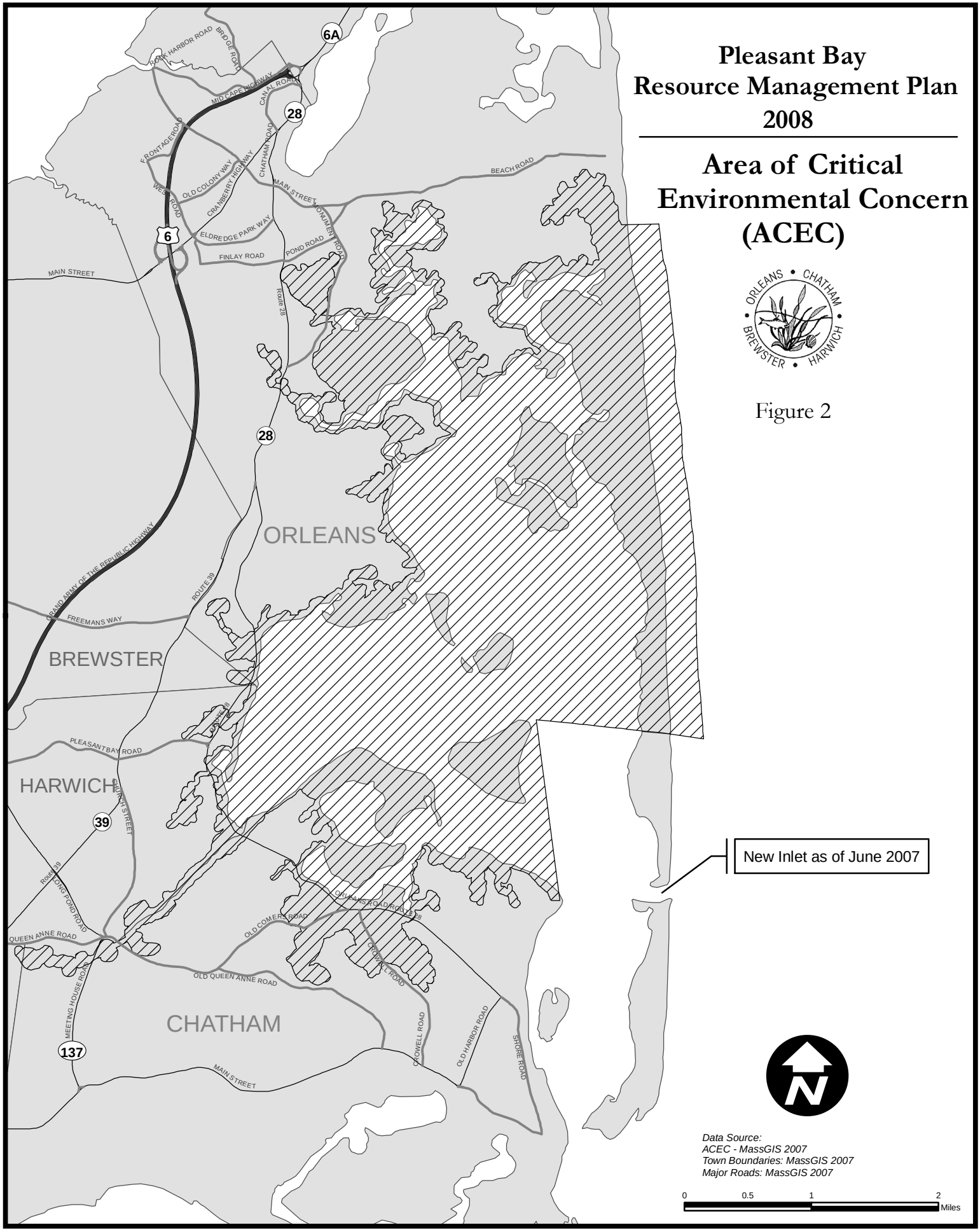
Data Source:
Marine Water Recgarge Area:
The watershed of Pleasant Bay, delineated by the CCC Water Resources staff 1997
Town Boundaries: MassGIS 2007
Major Roads: MassGIS 2007

0 0.5 1 2 Miles

Pleasant Bay Resource Management Plan 2008

Area of Critical Environmental Concern (ACEC)

Figure 2



Chapter 2.
Summary of Accomplishments and Recommendations

2.0 Overview

This chapter provides a summary of progress on the previous recommendations of the approved resource management plan and update, and sets forth the recommended action plan for the coming five years of proposed activity. It should be noted that both the accomplishments and future recommendations described below reflect highlights of program activities. More detail and additional activities are described in the following chapters and are summarized in a matrix of implementation actions and proposed recommendations following Chapter 10.

2.1 Summary of Accomplishments

2.1.1 Biodiversity & Habitat Protection

The Alliance continued its progress in understanding the habitats that support diverse species in the study area.

- The Citizens Water Quality Monitoring Program has completed eight consecutive monitoring seasons with a sample recovery rate above 90 per cent in each season. Samples were collected at 16-25 stations over the past five years. More than 150 citizen volunteers from the Chatham Water Watchers, Orleans Water Quality Task Force and the Towns of Harwich and Brewster have been trained to participate in the program. Nutrient related water quality data collected through the program supported the nitrogen threshold modeling and analysis conducted through the Massachusetts Estuaries Project (MEP).
- The MEP Technical Report included analyses of changes in eelgrass coverage over the past thirty years, and of benthic infauna. Eelgrass, benthic and water quality data were used to develop an index of nutrient related habitat health for seventeen locations throughout Pleasant Bay.
- Information generated by the intertidal habitat assessment and related studies were used to update the list of Areas of Critical Marine Habitat (ACMH). Some previously designated areas were removed from the list due to upland development which diminished unique habitat value. Areas encompassing the backside of Nauset Beach and the shoreline of the Bay islands were expanded within ACMH.

2.1.2 Wetlands Protection

Wetlands protection continued to be a major focus of the Alliance.

- Guidelines for permitting docks in eleven freshwater ponds in the ACEC were developed and soon will be submitted to the towns and the state for endorsement. The guidelines provide performance standards and design criteria for structures that

reflect the information generated by the resource assessment of rare and endangered species conducted in 2003.

- A salt marsh monitoring program was designed and implemented to complement ongoing monitoring of sites by the Cape Cod National Seashore. The program currently monitors vegetation and pore water salinity at Jackknife marsh in Chatham and Sparrowhawk marsh in Orleans.
- The Alliance reviewed and provided comments to local and state agencies regarding several proposed projects as well as legislation. The comments reflected the resource management goal of enhancing wetlands protections in the study area.

2.1.3 Coastal Processes

Recent changes in the barrier beach and inlet configuration underscore the importance of the Alliance's work in this area.

- The Alliance hosted the first Pleasant Bay Symposium, entitled *Understanding and Managing a Dynamic Coastal System*. The symposium, attended by more than 200 people, convened researchers of different disciplines to address the various ways in which the barrier beach system affects habitat conditions within the Bay.
- A complete aerial flyover of the Bay was conducted in July 2005, complementing a similar flyover completed in 2000. Aerial photography dating back to 1938 was identified and digitally archived for historical reference. The new and historical aerial photography provides an indispensable resource for monitoring shoreline dynamics, changes in aquatic vegetation and shoaling patterns.
- The Alliance sponsored a shoreline-marshline change study and tide gage monitoring effort to provide additional information on changes in the geomorphology of the Bay.
- Following the Patriot's Day storm (2007), the Alliance hosted a public forum to review the status of the inlet formation and possible management responses. Subsequently, the Alliance began working with the Town of Chatham, and U.S. Army Corps of Engineers to update the hydrodynamic model for the Bay in light of the new inlet formation. The Friends of Pleasant Bay, Inc. also provided financial support for this effort.
- The Alliance continued to provide input on public and private projects of significance with respect to coastal resource management.

2.1.4 Watershed Planning

Watershed planning activities have focused on technical analysis of nutrient loading in the Bay and development of nitrogen loading thresholds to guide local nutrient management planning. A complementary focus has been on fostering a collaborative regional approach to nutrient management planning, implementation and monitoring.

- The Alliance obtained $120,000 in local share funds necessary to include the entire Bay in MEP modeling.
- The final Technical Report for Pleasant Bay developed under the Massachusetts Estuaries Project (MEP) was released in May 2006. The report, entitled *Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for*

the Pleasant Bay System, Orleans, Chatham, Brewster and Harwich, Massachusetts, was the culmination of five years of system-wide data collection, computer modeling and analysis.

- The MEP Technical report provides the scientific basis for the *Pleasant Bay System Total Maximum Daily Loads for Total Nitrogen (TMDL) Report* developed by the Massachusetts Department of Environmental Protection (MassDEP) in accordance with the Federal Clean Water Act. The draft TMDL report was released for public comment in August 2006. The TMDL report was approved by the U.S. Environmental Protection Agency in 2007. The Alliance worked with the MEP and MassDEP on the development of the reports, provided extensive comments to the agencies on the Technical Report and TMDL Report and assisted in coordinating the public meetings around the reports.
- The Technical Report and TMDL Report provide the foundation for comprehensive wastewater planning that is underway in the watershed towns. The Alliance convened a regional work group to discuss strategies for the towns to work together in coordinating the development and implementation of wastewater management plans for the Pleasant Bay watershed.
- The Alliance obtained $75,000 in funds from the Cape Cod Water Protection Collaborative's *Shared Watersheds, Shared Responsibilities* grant program to develop a fertilizer management study for the Pleasant Bay watershed, and to assess the resource, permitting and cost allocation issues associated with the re-installation of a dike in Muddy Creek for the purpose of natural nitrogen attenuation.

2.2 New Directions

The Alliance will proceed in implementing recommendations in each of the seven areas identified in this plan update and described in the following chapters. The following recommendations are priorities for implementation within twelve months of adoption of the plan update by the towns and the state. Some of the recommendations call for immediate actions, and others provide the foundation for future phases of action or further research.

1. Continue to Facilitate Watershed-based Collaboration to Address Nitrogen Loading

Support and encourage the four watershed towns to make progress in developing and implementing comprehensive wastewater management plans (CWMPs) that encompass the Pleasant Bay watershed.

Promote watershed-based collaboration to achieve total nitrogen Total Maximum Daily Loads (TMDLs) through the efforts of the Alliance's watershed work group to:

- Coordinate wastewater planning by undertaking plans and studies that will benefit multiple towns and coordinating relevant sections of towns' CWMPs.
- Sponsor technical studies and model runs that explore system-wide issues and conditions and help to identify cost effective solutions to achieve targeted thresholds.

- Work with MassDEP, MEP and regional entities to develop protocols for monitoring, analysis and documentation of eelgrass health, benthic infauna health and water column nitrogen concentrations.
- Explore strategies to equitably allocate cost and responsibility for planning, monitoring, and implementing facilities and other management strategies.
- Act as communication link on key implementation issues between the watershed communities, and state and regional entities.

2. Develop a Baywide sediment management plan

The Alliance will coordinate the development of a Bay-wide Sediment Management Plan to:

- Identify and prioritize areas for accepting dredge material for purposes of shoreline stabilization, habitat restoration and protection of public access, consistent with Chapter 91 regulations;
- Identify priority areas for proactive beach nourishment;
- Identify strategies for disposing of silt or other non-compatible material;
- Provide a starting point for permitting for dredging and material disposal on a system wide or intermunicipal basis, and
- Assess the potential needs, benefits and detriments of maintenance and improvement dredging in specific locations and prioritize areas where dredging may be needed.

3. Develop Guidelines for Permitting Erosion Control Structures

The Alliance will develop performance standards and design criteria for erosion control structures in the study area to guide local and state permitting authorities. In cases where the use of hard structures is deemed the only feasible alternative, the standards and criteria would be used to minimize negative environmental impacts. Standards and criteria would also be developed for fortified soft structures. Until such time as performance standards and design criteria are developed and implemented locally and adopted by the state, MassDEP is urged to apply regulatory discretion allowed under 310 CMR 9.3.2 (2) when reviewing applications for Chapter 91 licenses that would fall under the categorical restriction. In so doing, MassDEP is urged to consider the issues enumerated in the resource management plan update.

4. Seek Designation of Pleasant Bay as a No Discharge Area

The Alliance will coordinate development and submission of an application to the U.S. Environmental Protection Agency (EPA) to designate Pleasant Bay as a No Discharge Area (NDA). The designation results in a prohibition on the discharge of treated (macerated or chlorinated) boat sewage. The application process will include analysis of the adequacy of facilities to meet demand for pump out services. Public information materials to support compliance with the designation will also be developed.

5. Promote Strengthening of Wetland Protections

The Alliance will continue to work to strengthen local wetlands protection regulations and review procedures by recommending modifications to local conservation regulations and bylaws needed to:

- Establish a goal of *no loss of wetlands* within the study area;
- Limit impacts resulting from projects within the ACEC granted limited project status under state wetland protection regulations;
- Requesting all towns treat the ACEC as a resource in their wetlands regulations;
- Promote consistent application of MassDEP wetlands delineation guidelines;
- Recommend a 2:1 mitigation ratio for encroachment within the 50-foot buffer to the resource area in the ACEC;
- Promote adoption of a Flood Plain Bylaw in towns where one does not exist;
- Develop performance standards for activities within the area of jurisdiction;
- Promote policies to limit landscaped coverage and site clearance;
- Develop best management practices and performance standards for landscaping;
- Promote use of County-developed standards for re-vegetation and restoration; and
- Seek to allow conservation commissions to levy more meaningful fines for violations.

6. Develop Best Management Practices to Protect Biodiversity

The Alliance will develop best management practices designed to protect and enhance the biodiversity within the study area:

- Develop best management practices to control or eradicate invasive species in fresh and marine resource areas; and
- Develop best management practices for the clearance or alteration of large areas of previously undisturbed vegetation.

7. Continue Monitoring Programs.

Continue the Citizens' Water Quality Monitoring Program in concert with the TMDL Monitoring and Compliance protocols being developed by MassDEP/MEP/Alliance.

Address needs for eelgrass and benthic monitoring and reporting, in concert with the TMDL Monitoring and Compliance protocols being developed by MassDEP/MEP/Alliance.

Continue aerial flyovers of the entire Pleasant Bay system every five years, or more frequently as needed and use the aerial data to support other monitoring and management activities.

Support ongoing monitoring of water quality conditions in freshwater ponds in the ACEC and in the Pleasant Bay watershed.

Continue research and monitoring efforts designed to deepen knowledge about intertidal and subtidal habitats including:

- Creating a map of intertidal habitats based on tidal regime, sediment type and vegetative cover,
- Evaluating the potential for a quahog nursery restoration project, and
- Supporting other research and initiatives aimed at understanding the role of the Bay as a spawning and nursery area.

Continue annual vegetation monitoring of the Jackknife and Sparrowhawk salt marsh sites, in consultation with the Cape Cod National Seashore, and evaluate expansion of the monitoring program to include additional sites.

8. Build Stewardship through Public Education

Continue to develop and disseminate periodic water quality reports for public information.

Continue to promote public information and education on issues and initiatives through enhancements to the Pleasant Bay Alliance website, www.pleasantbay.org.

Develop a *Citizen's Guide to the Ecology of Pleasant Bay*.

Continue to build public support and awareness of the need for nitrogen management strategies and adherence to the TMDLs through publication of *Citizens Guides to Estuarine Protection* for additional subwatersheds.

SECTION II. UPDATE ON RESOURCE MANAGEMENT ISSUES & RECOMMENDATIONS

Pleasant Bay Resource Management Plan 2008

Marine Features

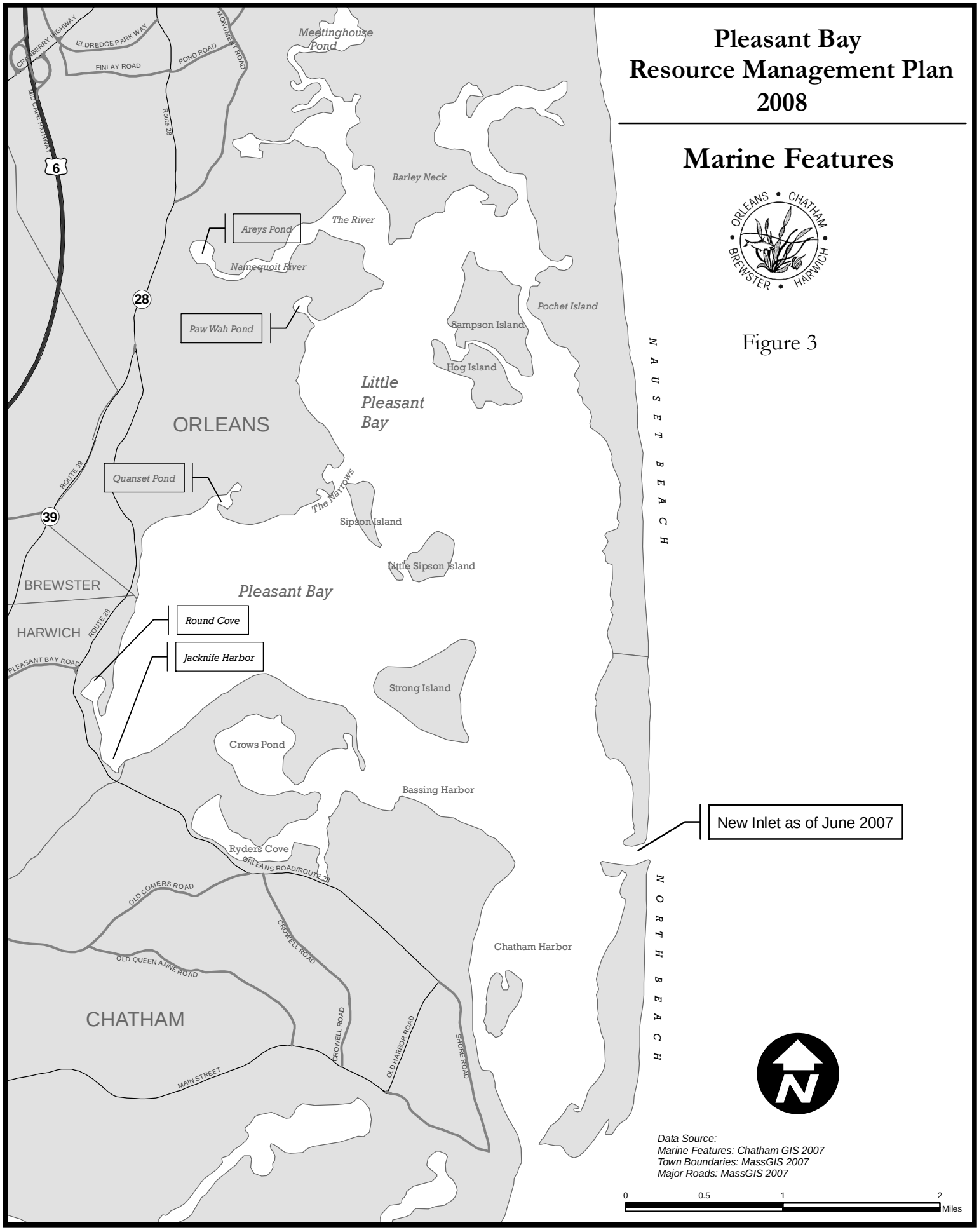


Figure 3

Data Source:
Marine Features: Chatham GIS 2007
Town Boundaries: MassGIS 2007
Major Roads: MassGIS 2007

0 0.5 1 2 Miles

Chapter 3.
Protecting Biodiversity and Habitat

3.0 Overview

It is widely recognized that Pleasant Bay constitutes one of the richest and most diverse eco-systems in the northeast region. Pleasant Bay's biodiversity encompasses the health, productivity and variety of its natural resources: its salt and fresh waterbodies (see Figures 3,4), its wetlands and vegetation, and its marine and terrestrial animal life. The Bay's biodiversity reflects the size and vitality of this estuarine system. It also supports our ability to enjoy the Bay's abundant resources for shellfishing, finfishing, scenic viewing, swimming, boating, among other activities.

The 1998 plan and 2003 update identify a number of threatened resources, which are key to the health and diversity of Pleasant Bay's ecology. These include:

- Water quality, the foundation of resource vitality as well as human use and enjoyment of the Bay, is threatened by excessive nutrients from land uses within the watershed, as well as impacts from marine uses such as boating.
- Wetland resources that cleanse groundwater of pollutants and provide critical animal habitats, are being encroached upon by surrounding land development, sea level rise, development of shoreline structures, and trampling from public uses.
- The tremendous diversity of terrestrial and aquatic animal and plant life is threatened by conflicts with and secondary impacts from a number of Bay uses, including land development, pollution, turbidity, and noise from boating.

In light of these trends the 1998 plan and 2003 update call for development of programs to inventory and monitor the extent and health of key resources: water quality, salt marsh, intertidal areas, and eel grass, among others. This 2008 plan update will report on the status of those efforts as well as new initiatives underway.

3.1 Resource Management Issue: Water Quality and MEP Modeling

The Pleasant Bay Citizen Water Quality Monitoring Program is an outgrowth of the plan adopted by the Towns of Orleans, Chatham and Harwich in 1998. The plan identified the need for consistent and comprehensive water quality data to gauge nutrient inputs from the watershed and other sources. In 1999, with support of grants from the Executive Office of Environmental Affairs and the Friends of Pleasant Bay, Inc., the Alliance designed the bay-wide monitoring program, developed a Quality Assurance Project Plan (QAPP)[1], and purchased state-of-the-art monitoring equipment. The Alliance, in cooperation with the Friends of Chatham Waterways and Orleans Water Quality Task Force, helped to recruit and train more than 150 volunteers to monitor field conditions and collect water quality samples throughout the Bay. Samples are transported to the School for Marine Science and Technology (SMAST) Laboratory at the University of Massachusetts-Dartmouth campus for nutrient analysis.

[1] The Massachusetts Department of Environmental Protection approved a final QAPP in 2000.

Pleasant Bay Resource Management Plan 2008

Freshwater Features

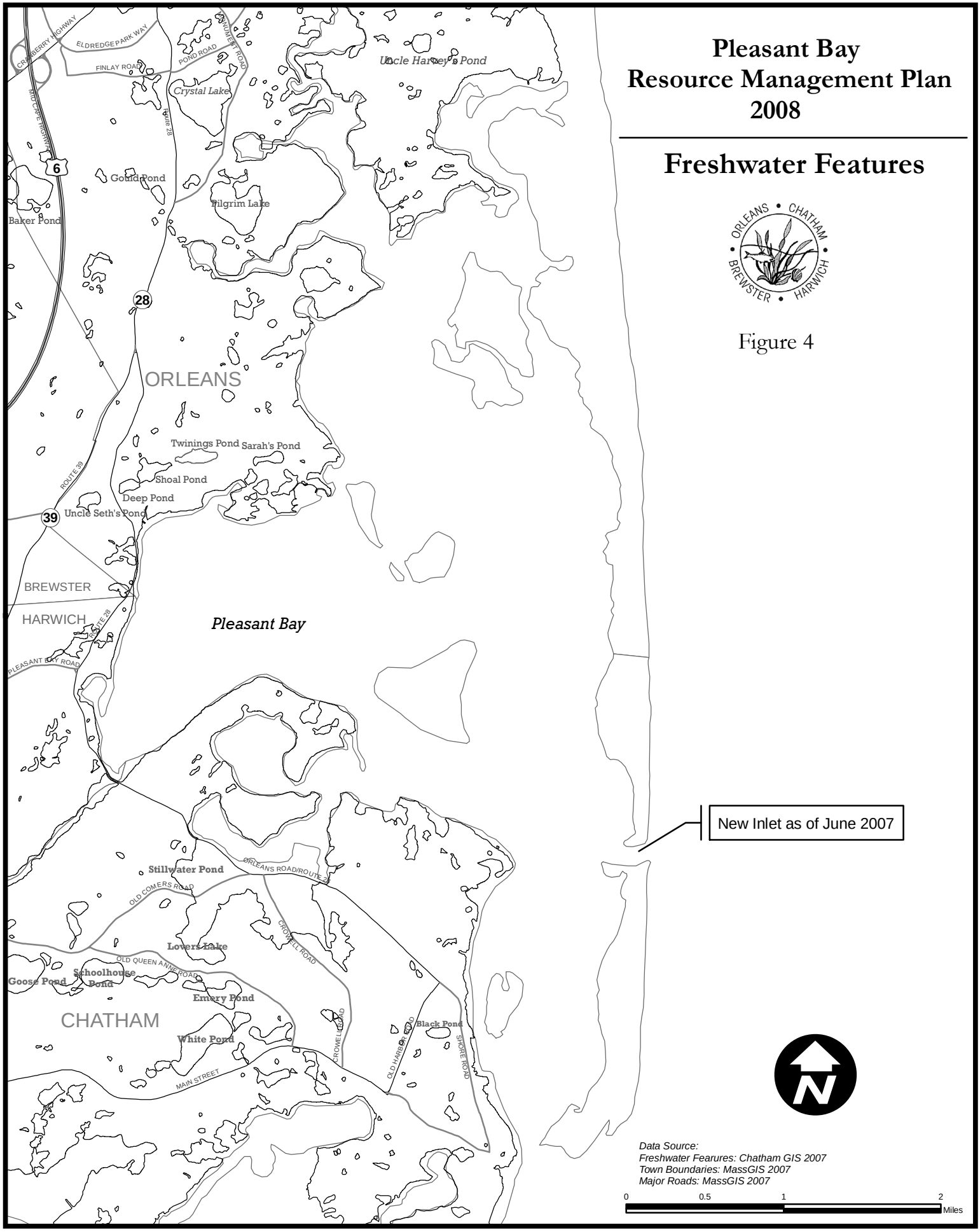


Figure 4

Data Source:
Freshwater Fearures: Chatham GIS 2007
Town Boundaries: MassGIS 2007
Major Roads: MassGIS 2007

Monitoring occurred at sixteen locations from 2000-2001. In 2002 five more stations were added by the Alliance to provide data necessary for modeling of the Bay through the Massachusetts Estuaries Project (MEP). These were augmented by additional stations maintained by the Towns of Orleans and Chatham. As shown in Figure 5, at the height of monitoring for the MEP there were 36 stations located throughout the Bay. Following the release of the MEP Technical Report for Pleasant Bay in May 2006, the number of stations was reduced to nineteen and then to sixteen in 2007.

Figure 5. Water Quality Monitoring Stations for MEP (courtesy SMAST)

Data from the first four years of monitoring were compiled and presented in a series of interim reports. The data were used to calculate the e*utrophication index* for each of the monitored subembayments. The index[2] is widely accepted as a tool for describing the impact of excessive nutrients from surrounding land uses and for monitoring the general condition of the Bay's water quality. In 2003, four stations registered indices in the good to excellent range: Chatham Harbor, Bassing Harbor, Big Bay-Mid and Minister's Point. This was up from only one station in the good to excellent range—Chatham Harbor—in 2002. Nearly the same number of stations registered in the fair and eutrophic ranges in 2002 and 2003, respectively. Ten stations were found to be in the eutrophic range in 2002 and nine in 2003. Seven stations were measured as being eutrophic for each of the four years monitored: Frost Fish Creek, Muddy Creek, Muddy Creek-Upper (only monitored for two seasons), Paw Wah Pond, Arey's Pond, Kescayogansett Pond, and Meetinghouse Pond.

Data collected by the water quality monitoring program was necessary for modeling Pleasant Bay through the MEP. The MEP analysis confirmed and illuminated many of the same findings demonstrated by the Alliance's Interim Reports. Notably, the report documented signs of nutrient related stress throughout the system and found that thirteen of seventeen subembayments exhibited some level of impaired or degraded habitat health due to overloading of nitrogen[3]. The report also documented excessively low dissolved oxygen levels in some subembayments such as Muddy Creek, Paw Wah Pond, Lonnie's Pond, Areys's Pond, Quanset Pond and Meetinghouse Pond, where surrounding land is densely developed and tidal flushing is restricted. The MEP report

[2] The Buzzards Bay Baywatcher's program developed and has used the index since 1992.
[3] For more information see Table VIII-1, Massachusetts Estuaries Project, Final Report, 2006.

provided the basis for establishing total nitrogen Total Maximum Daily Loads (TMDLs) for sixteen subembayments in Pleasant Bay. The TMDLs provide the nutrient targets for local and regional nutrient management planning.

With eight years of monitoring completed, the Pleasant Bay Water Quality Monitoring Program has made a significant contribution to our understanding of nutrient related water quality impacts in Pleasant Bay. As a major component of the MEP Technical Report and subsequent TMDL analyses, the water quality data has provided a foundation for planning nutrient management strategies on a watershed-wide basis. In the coming five years the program will continue to collect baseline data and develop protocols for long-term monitoring needed to evaluate the effectiveness of nutrient management strategies.

3.2 Resource Management Recommendations to Address Water Quality and MEP Modeling

3.2.1 *Continue the Citizens' Water Quality Monitoring Program in concert with the TMDL Monitoring and Compliance protocols being developed by MassDEP/MEP/Alliance*. Baywide water quality monitoring through the Alliance will continue on an annual basis for the next five years. Modifications in the number or location of stations or selected parameters could occur in light of TMDL monitoring and compliance protocols being developed by MassDEP and the MEP. It will be important to review and, as necessary, revise the program QAPP to ensure that it reflects any new or modified strategies or methods for data collection, analysis or quality control.

3.2.2 Update MEP water quality model as needed to reflect changing conditions. One of the great advantages of the MEP model is that it enables communities to adjust assessment of nutrient impacts and nutrient reduction thresholds in light of changing conditions. The formation of a new second inlet in April 2007 is believed to have changed the hydrodynamics and water quality conditions throughout Pleasant Bay. The Alliance, in partnership with the Town of Chatham, U.S Army Corp of Engineers and Friends of Pleasant Bay is updating the hydrodynamic model to reflect the dual inlet configuration. Using this updated hydrodynamic data, water quality modeling will be conducted for three complementary scenarios: the pre-1987 inlet configuration, the current dual inlet configuration, and a single northern (i.e., newly formed) inlet configuration. The three model runs will provide important guideposts for community wastewater planning. The watershed work group will develop additional modeling scenarios to support watershed-based nutrient management planning continues.

3.2.3 *Continue to develop and disseminate periodic water quality reports for public information*. The Alliance will continue to publish periodic reports on water quality conditions and data analysis from the monitoring program. These could include interim reports, as well as other public educational brochures explaining the nature and implications of water quality conditions in the Bay.

3.2.4 *Address needs for eelgrass and benthic monitoring and reporting, in concert with the TMDL Monitoring and Compliance protocols being developed by MassDEP/MEP/Alliance.* The main purpose of the MEP is habitat restoration. In order to assess whether nutrient management strategies are having a beneficial impact on habitat conditions, MassDEP will also require surveys of eelgrass and benthic animals. It is expected that the protocols being developed for monitoring will rely on state generated eelgrass monitoring, and state or regional benthic monitoring. The Alliance will support and participate in these monitoring efforts as needed, and will assist in compiling all monitoring data for compliance reporting and public information.

3.2.5 *Support ongoing monitoring of water quality conditions in freshwater ponds in the ACEC and in the Pleasant Bay watershed.* The ACEC includes eleven freshwater ponds and lakes, and many more freshwater bodies are located in the watershed. Among other things, these water bodies play an important role in taking up nitrogen from groundwater before it reaches the Bay. The health of these resources is of critical importance. The Alliance will support on-going pond monitoring efforts, and will work with the Cape Cod Commission, Orleans Pond Coalition and Town of Chatham to track and assess available water quality data for ponds in the ACEC and watershed.

3.2.6 *Track bacterial and other water quality issues*. Bacterial contamination is a continuing concern for the communities surrounding Pleasant Bay. The towns are required to conduct regular bacterial monitoring of public swimming areas in accordance with the *Massachusetts Beaches Act* adopted in 2001. The *Beaches Act* now requires weekly testing of swimming beaches, and closure of a beach after one reading of higher than acceptable bacteria counts.[4] State and local officials also closely monitor public shellfishing areas. The Alliance supports on-going local, state and regional efforts to monitor bacterial contamination. To help prevent bacterial contamination, the Alliance will continue to work with the Orleans Pond Coalition, Town of Chatham and other groups to maintain nineteen Mutt Mitt placements at existing public access locations on Pleasant Bay. The Alliance will also work with the watershed communities to promote application of best management practices for stormwater management (See recommendations 5.5.1-5.5.3.)

3.2.7 *Participate in the development of a Geographic Response Plan (GRP) for oil spill preparedness with MassDEP and related agencies*. GRP are oil spill response plans tailored to protect a specific sensitive area from impacts following a spill. These response plans are map-based strategies that can save time during the critical first few hours of an oil spill response. A draft GRP has been developed for Pleasant Bay and will continue to be refined through resource mapping, local knowledge, site surveys, agency input, and public comment. The Alliance will be participant in the review and development of the Pleasant Bay GRP.

[4] Barnstable County Coastal Resources Committee. Coastal Resource Protection Update. Barnstable, MA. 2002.

3.3 Resource Management Issue: Salt Marsh Dieback

Salt marshes play an important role in the ecology of Pleasant Bay. The approximately 1,100 acres of salt marsh in the Pleasant Bay system provide storm damage prevention, pollution attenuation, flood storage, and fisheries and wildlife habitat. As described in Chapter 7, the Alliance sponsored a shoreline change study based on maps and aerial photography from 1868 to 2005. The study found that, although there was little change in the shoreline of Pleasant Bay measured from the High Water Line over the 137-year period, there were areas of both marshline growth and depletion during this same time period. It is widely believed that the long- term geomorphology of Pleasant Bay may include increased salt marsh formation as the Nauset barrier beach erodes over the very long term.

There is growing concern that the viability of salt marshes is threatened by rising sea level, pollution, encroachment or disease. Numerous studies have documented instances of salt marsh dieback along the East Coast of the U.S, although the exact causes are unknown. Limited areas of degrading salt marsh have been identified in Pleasant Bay. Stephen Smith, Plant Ecologist with the National Park Service, Cape Cod National Seashore (CCNS) is one of the scientists involved in the tracking and analyzing salt marsh trends in the U.S. Dr. Smith and CCNS have been monitoring salt marsh conditions on the backside of Nauset Beach for several years and have helped the Alliance select sites and develop a protocol for monitoring salt marsh conditions in Pleasant Bay. Transects have been installed at marsh areas adjacent to Jackknife town landing in Chatham and Sparrowhawk town landing in Orleans. Monitoring of vegetation at those locations was initiated in 2007. Several years of annual monitoring, coupled with aerial surveys of the Bay, will be needed to discern trends in salt marsh growth or degradation in these two areas.

3.4 Recommendations to Address Shoreline/Salt Marsh Monitoring

3.4.1 *Continue annual monitoring of the Jackknife and Sparrowhawk salt marsh sites.* Monitoring data will be shared with the CCNS monitoring program. Monitoring in future years should include vegetation as well as pore water salinity. The benefits of expanding the monitoring program to include additional sites in future years should also be evaluated.

3.4.2 *Continue aerial flyovers of the entire Pleasant Bay system every five years, or more frequently as needed, and use the aerial data to periodically update the shoreline and marshline study*.

3.5 Resource Management Issue: Understanding and Managing Ecological Diversity

Pleasant Bay and the surrounding watershed area are renowned for an abundance of terrestrial, aquatic and avian wildlife and vegetation. The Bay's varied topography and vegetation – including stands of pitch pine, scrub oak, and cedar -- provide a number of

significant and increasingly rare forms of habitat. Human activities can conflict with the functioning or quality of the habitats. Several of the Bay's habitats are threatened by encroaching land uses and the introduction of invasive species. There is concern, for example, that excessive clear cutting of large areas of land that remove the vegetative understory and destabilize topsoil, even when trees remain, may have significant impacts on wildlife habitat, as well as drainage patterns and erosion. The growing presence of invasive species of vegetation and aquatic life is also of concern. Invasive species pose a management challenge in freshwater and marine habitats within the Pleasant Bay study area. Invasive species tend to consume limited food supplies and overpower native species, leading to the creation of a monoculture that undermines biodiversity.

The viability of the many diverse habitat types and species found throughout the study area is essential to biodiversity. This issue is underscored by the presence of a number of rare and endangered species in the Pleasant Bay study area. According to the Massachusetts Natural Heritage and Endangered Species Program (NHESP), there are twenty-four rare plant and animal species that occur in the Pleasant Bay area that are listed as either Endangered, Threatened or of Special Concern. Founded in 1978, NHESP is responsible for the conservation and protection of Massachusetts' biodiversity, with particular focus on the approximately 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.

Table 2. Rare Species in the Pleasant Bay Watershed

Scientific Name	Common Name	Taxonomic Group	State Status
Anax longipes	Comet Darner	Dragonfly/Damselfly	Special Concern
Charadrius melodus	Piping Plover	Bird	Threatened
Circus cyenius	Northern Harrier	Bird	Threatened
Dichanthelium ovale ssp. Pseudopubescens	Commons's Panic-grass	Plant	Special Concern
Enallagma laterale	New England Bluet	Dragonfly/Damselfly	Special Concern
Enallagma pictun	Scarlet Bluet	Dragonfly/Damselfly	Threatened
Enallagma recurvatum	Pine Barrens Bluet	Dragonfly/Damselfly	Threatened
Helianthemum dumosum	Bushy rockrose	Plant	Special Concern
Isoestes acadiensis	Acadian Quillwort	Plant	Endangered
Lachmanthes caroliana	Redroot	Plant	Endangered
Liatris scariosa var. novae-angliae	New England Blazing Star	Plant	Special Concern
Lipocarpha micrantha	Dwarf Bulrush	Plant	Special Concern
Malaclemys terrapin	Diamondback Terrapin	Reptile	Threatened
Papaipema sulphurata	Water-willow stem Borer	Butterfly-Moth	Threatened
Persicaria setacea	Strigose Knotweed	Plant	Threatened
Ploygonum puritanorum	Pondshore knotweed	Plant	Special Concern
Rhynchospora scirpoides	Long-beaked Bald-sedge	Plant	Special Concern
Sabatia kennedyana	Plymouth gentian	Plant	Special Concern
Sagittaria teres	Terete Arrowhead	Plant	Special Concern
Sterna antillarum	Least Tern	Bird	Special Concern
Sterna dougallii	Roseate Tern	Bird	Endangered
Sterna hirundo	Common Tern	Bird	Special Concern
Sterna paradisaea	Artic Tern	Bird	Special Concern
Terrapene Carolina	Eastern Box Turtle	Reptile	Special Concern

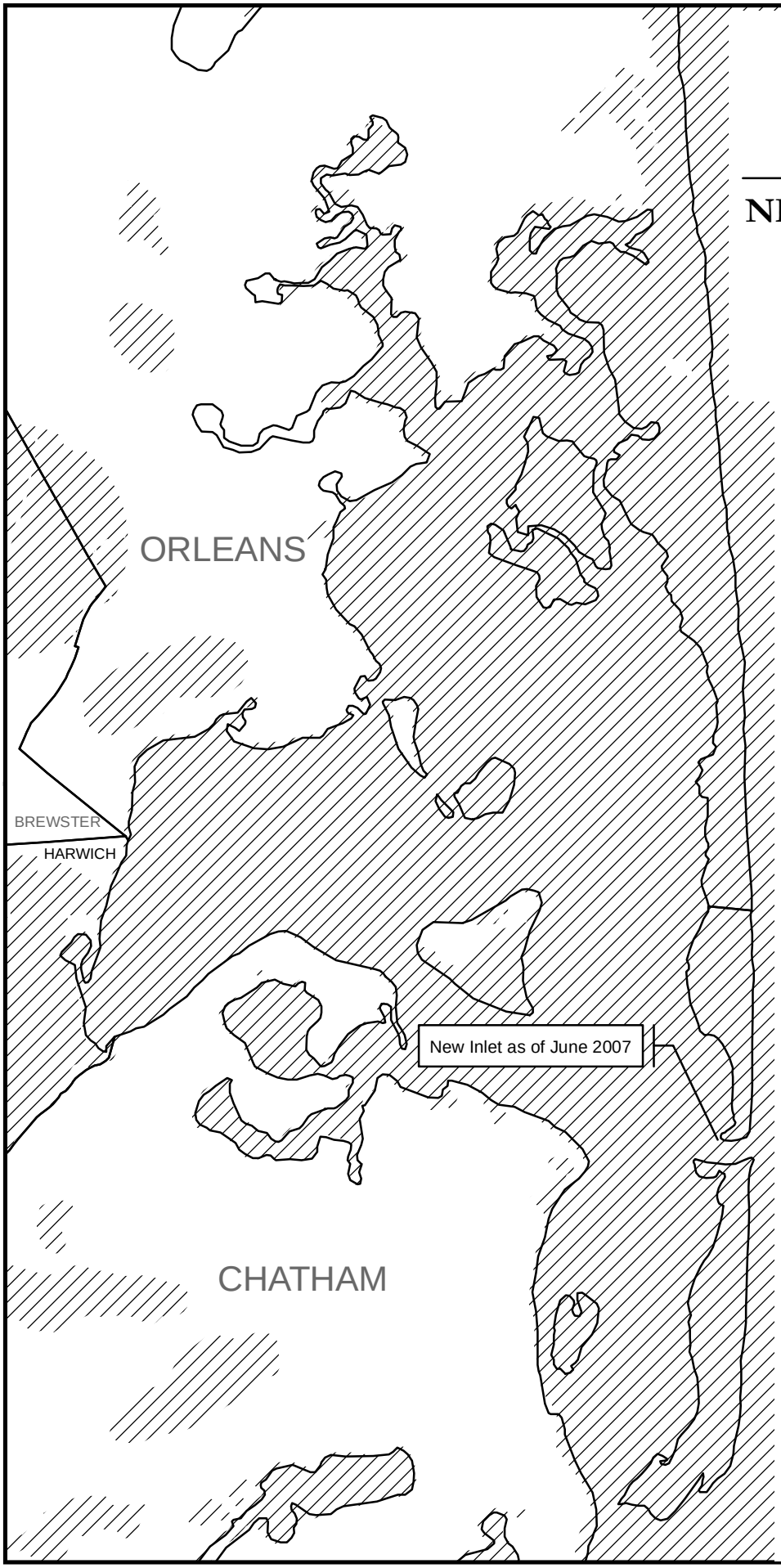
Source: MA Natural Heritage and Endangered Species Program, Division of Fisheries and Wildlife, 2007

Pleasant Bay Resource Management Plan 2008

NHESP Estimated Habitats of Rare Wildlife

Natural Heritage & Endangered Species Program

Figure 6



Estimated Habitats are for use with the Wetlands Protection Act regulations (310 CMR 10.00). The Estimated Habitats of Rare Wildlife datalayer contains polygons that are a subset of the Priority Habitats of Rare Species. They are based on occurrences of rare wetland wildlife observed within the last 25 years and documented in the Natural Heritage & Endangered Species Program (NHESP) database. They do not include those areas delineated for rare plants or for rare wildlife with strictly upland habitat requirements. The Estimated Habitats presented here are those published in the 12th Edition of the Massachusetts Natural Heritage Atlas, and are effective beginning October 1, 2006.

Data Source:
NHESP Data: MassGIS 2006
Town Boundaries: MassGIS 2007
Major Roads: MassGIS 2007

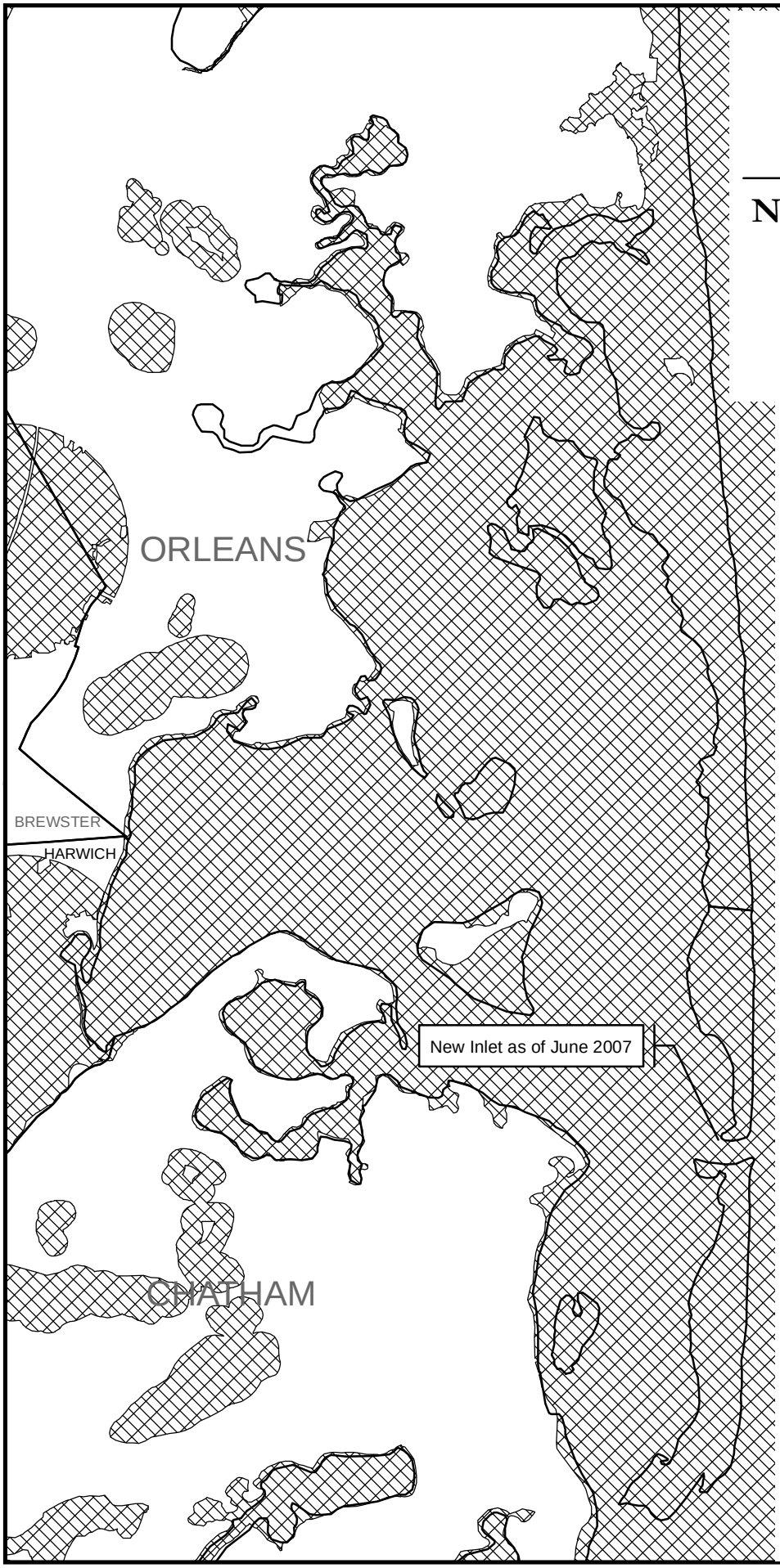
0 0.5 1 2 Miles

Pleasant Bay Resource Management Plan 2008

NHESP Estimated Habitats of Rare Species

Natural Heritage & Endangered Species Program

Figure 7



The Priority Habitats of Rare Species datalayer contains polygons representing the geographic extent of Habitat of state-listed rare species in Massachusetts based on observations documented within the last 25 years in the database of the Natural Heritage & Endangered Species Program (NHESP). Priority Habitats are the filing trigger for proponents, municipalities, and other stakeholders for determining whether or not a proposed project must be reviewed by the NHESP for compliance with the Massachusetts Endangered Species Act (MESA). The Priority Habitats presented here are those published in the 12th Edition of the Massachusetts Natural Heritage Atlas, and are effective beginning October 1, 2006.

Data Source:
NHESP Data: MassGIS 2006
Town Boundaries: MassGIS 2007
Major Roads: MassGIS 2007

0 0.5 1 2 Miles

NHESP maintains the Natural Heritage Atlas, which identifies statewide areas of Priority Habitat and Estimated Habitat for state-listed species data in a GIS format. Figures 6 and 7 show significant habitat areas mapped by NHESP.

3.6 Recommendations for Understanding and Managing Ecological Diversity

3.6.1 *Promote compliance with the Massachusetts Natural Heritage and Endangered Species Program (NHESP.)*. The Alliance will work with member towns 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.

3.6.2 *Develop best management practices to control or eradicate freshwater and marine invasive species*. A comprehensive and coordinated approach to managing invasive species in the study area is needed. The Alliance will 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. In developing best management practices for invasive species, the Alliance will consult 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 will incorporate an understanding of the types of invasive plant and animal species in the Pleasant Bay 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.

3.6.3 *Develop Best Management Practices for Site Clearance or Alteration*. The Alliance will develop best management practices for clearance or alteration of vegetation on large land areas. 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.

3.6.4 *Develop a Citizen's Guide to the Ecology of Pleasant Bay*. The guide or series of guides would be geared toward acquainting citizens and Bay users with aquatic and terrestrial vegetation and wildlife in the Pleasant Bay study area. A major theme explored would be the role of species diversity in the overall health of the ecosystem.

3.6.5 *Support ongoing research*. The Alliance will continue to support and collaborate with other scientific and advocacy groups involved with research and monitoring efforts aimed at understanding population dynamics and trends associated with a variety of species found in the Pleasant Bay study area, including but not limited to:

- Horseshoe crabs;
- Piping plovers;
- Least terns;

- Gray seals;
- Diamond back terrapin;
- Razor clams; and
- Cormorants.

3.6.5 *Promote Open Space and Habitat Protection*. The Alliance will continue to support a range of measures aimed at accomplishing protection of meaningful open space and particularly areas identified by an analysis of priority open space developed by the Compact of Conservation Trusts. Among the measures the Alliance will undertake include:

- Advocacy for land purchases and adoption of conservation restrictions in the study area;
- Support for expanded use of policies such as Open Space Residential Development (cluster) bylaws, which could help to limit impervious surface area, facilitate centralized wastewater treatment, and protect areas of undisturbed habitat throughout the study area; and
- Identification of significant wildlife areas and creation of overlay protection areas for inclusion in local bylaws, open space plans and local comprehensive plans.

3.7 Resource Management Issue: Areas of Critical Marine Habitat

The 1998 plan designated ten intertidal areas of significant habitat value as *Areas of Critical Marine Habitat* (ACMH). The designated areas encompassed several distinct habitat types including sandy tidal flats, muddy tidal flats, eelgrass beds, fringe marsh, and areas of freshwater up-welling, among other areas of relatively unaltered shoreline. Many ACMH were selected because of their adjacency to undisturbed uplands that were inhabited by species that rely on both land and water access for survival. These ACMH serve as habitats, feeding areas, nesting areas, spawning areas and nursery areas for hundreds of species of marine invertebrates and vegetation that are food sources for other species, as well as amphibians, shellfish, fin fish, migratory shorebirds, and some species of upland fauna. The ten areas identified in the 1998 plan were:

1. The intertidal zone and flats north of Tern Island, south of Minister's Point, and west of the channel.

2. The intertidal zone and flats south, east, and west of Strong Island.

3. The intertidal zone of Nickerson's Neck from the Strong Island Town Landing to the southeastern tip of Fox Hill.

4. The intertidal zone of Nickerson's Neck from the Chatham Yacht Club north to the 7th tee of Eastward Ho! Country Club.

5. The intertidal zone of Pleasant Bay from the southwest entrance of the Narrows westward to the eastern end of the Winslow revetment.

6. The intertidal zone of Little Pleasant Bay from Namequoit Point west to the entrance to Paw Wah Pond.

7. The intertidal zone and flats west and south of Little Sipson's Island.

8. The intertidal zone and flats west of Nauset Beach from the Chatham breakthrough northward to the southern entrance of Broad Creek, and including Hog Island Creek, the south side of Hog Island, and the west side of Sampson Island to its northern tip.

9. The intertidal zone along Barley Neck.

10. The intertidal zone along the conservation property on the south side of Kent's Point, and along both sides of The River from Kent's Point to the entrance of Meetinghouse Pond (east of Lucy Snow's Point), including Frost Fish Cove.

The plan recommended that an ecological inventory and monitoring program be developed that would study theses areas and confirm their status as critical habitats or suggest modifications to the designations. Interim protection of these areas was deemed necessary for the sustainability of several species and the potential re-introduction of some lost or endangered species, such as the diamond-backed terrapin.

To ensure that these sensitive habitat areas would be protected from adverse impacts pending further study, the following activities were prohibited within ACMH:

- Placing a shoreline structure (no effect for existing structures);
- Placing a mooring (no effect for existing moorings);
- Aquaculture (no effect for existing aquaculture grant areas);
- Shellfishing in areas other than those permitted by the local shellfish official in cooperation with the Pleasant Bay Management Alliance.

There was widespread agreement that information on sediments in the Bay was desirable because of its relation to many types of vegetation and animal habitats. Second, a greater understanding of the types and functions of intertidal areas was necessary to further evaluate the areas designated in the plan as ACMH. An intertidal habitat and sediment assessment was undertaken to help evaluate ACMH. In addition, observation and studies of different species, including diamond-backed terrapin, horseshoe crabs and shore birds, have been undertaken. The following recommendations to modify the designation of ACMH are based on the information generated from these activities.

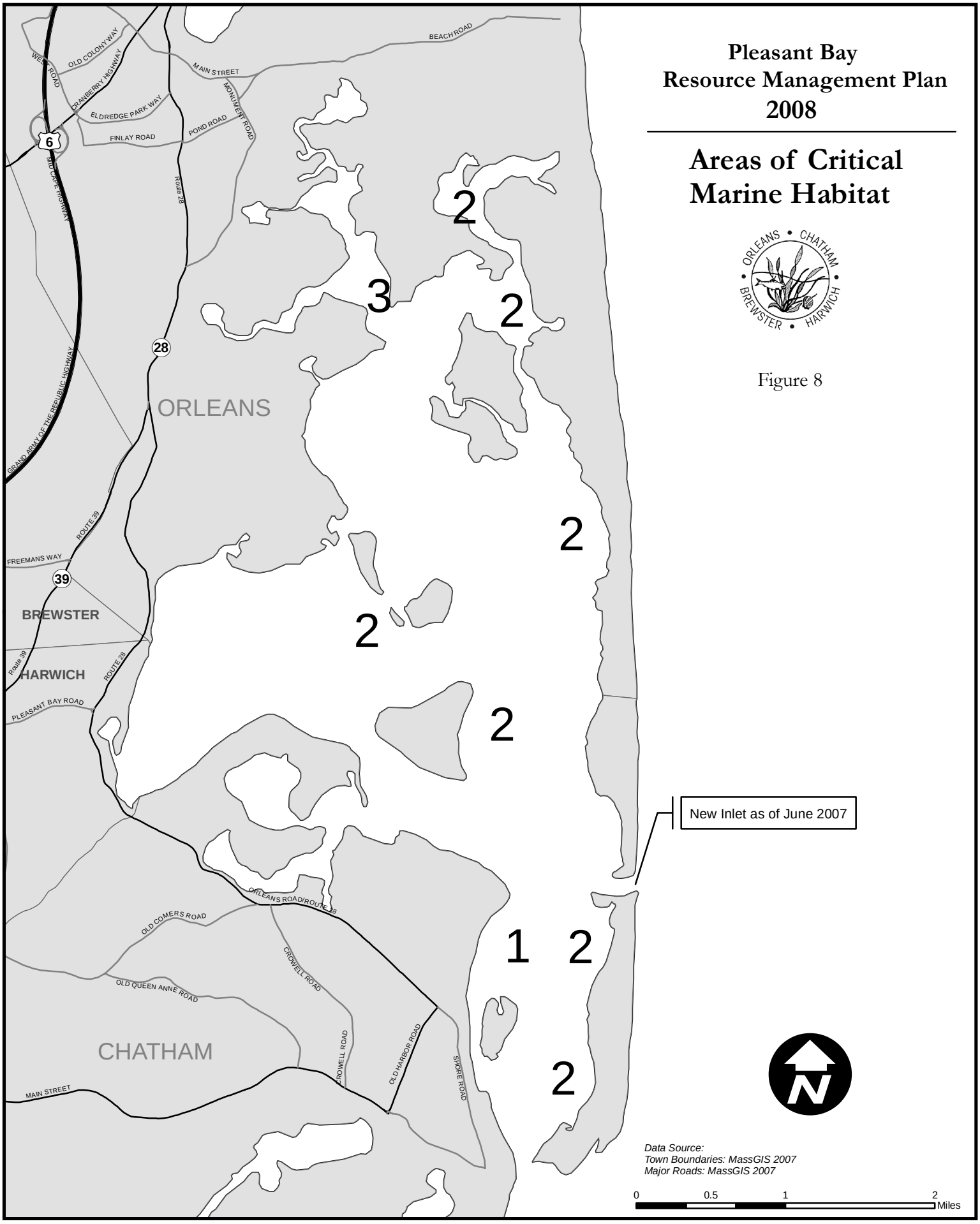
3.8 Recommendations to Address Areas of Critical Marine Habitat

3.8.1 *Revise the list of ACMH based on newly available information.* The modified designation of ACMH, shown on Figure 8, is as follows:

Pleasant Bay Resource Management Plan 2008

Areas of Critical Marine Habitat

Figure 8



1. *The intertidal zone, marsh and tidal flats surrounding Tern Island and Minister's Point, west of the channel, including any tidal flats newly formed due to shoaling*. This area has experienced an increase in bird use for feeding and roosting. Terns, plovers and Roseate Terns are among the species that frequent these intertdial areas. The formation of the new inlet is also expected to have an ongoing influence on habitat characteristics in this area and may result in an increase in tidal flats due to shoaling.

2. *The intertidal zone, marsh and tidal flats in the area west of Nauset Beach from the Chatham breakthrough northward to the headwaters of Pochet Creek, and extending westward to include the western sides of Hog, Sampson's and Little Sipson's Islands, and the western and southern sides of Strong Island.* This area is a composite of ACMH 2, 7 and 8 as listed in the 1998 plan, and now also includes Pochet Creek. This area includes the relatively remote and pristine environments of the backside of the barrier beach and the shoreline of several bay islands, which provide unique or significant habitat value for a wide range of species, including horseshoe crabs, shore birds, and migratory birds.

3. *The intertidal zone along the conservation property on the south side of Kent's Point, and along both sides of The River from Kent's Point to the entrance of Meetinghouse Pond (east of Lucy Snow's Point), including Frost Fish Cove.* This area adjacent to conservation lands was previously listed and is stilled considered an important habitat for birds as well as for the diamond back terrapin.

4. *Areas 3, 4, 5, 6 and 9 are no longer considered ACMH.* The significance of these areas as habitat has been diminished due to development of adjacent upland.

3.8.2 *Revise limitations on activities within ACMH*. The prohibitions in ACMH outlined in the 1998 plan should remain in effect with the following modifications:

Regarding aquaculture:
Expansion or addition of grants within ACMH should only be allowed if:

Compliance with all applicable local, state and regional regulations, policies and best management practices can be demonstrated;

It can be documented and demonstrated that there will be no negative impact on other marine invertebrates, shorebirds, migratory birds, or other rare or endangered species; and

Based on historical harvest data and an objective site investigation there is no likelihood of a natural recurrence of wild shellfish population.

Regarding docks in ACMH #2:
ACMH are not suited to placement of new structures due to their unique habitat value. It is recognized that ACMH#2 includes the shoreline of bay islands.

Structures located on the shoreline of bay islands should only be considered where they are necessary to provide safe and reasonable access, and only when it has been demonstrated that all alternative forms of access are impractical. In such cases where a structure is deemed necessary to provide reasonable access, it should be the minimal size necessary and must meet all applicable performance standards and design criteria as defined in the Pleasant Bay Management Alliance Dock and Pier Guidelines (1999) and local and state regulations. Multiple structures on a single island or otherwise within 1,000 feet of another structure are strongly discouraged, and steps to promote sharing of structures among multiple user groups should be a condition of approval.

3.8.3 *Continue research and monitoring efforts designed to deepen knowledge about ACMH*. The following research and restoration efforts within ACMH are recommended:

- Creation of a map of intertidal habitats based on tidal regime, sediment type and vegetative cover, to deepen our understanding of how intertidal habitats may be changing over time, especially due to recent changes in the inlet configuration, which are likely to influence these intertidal areas.

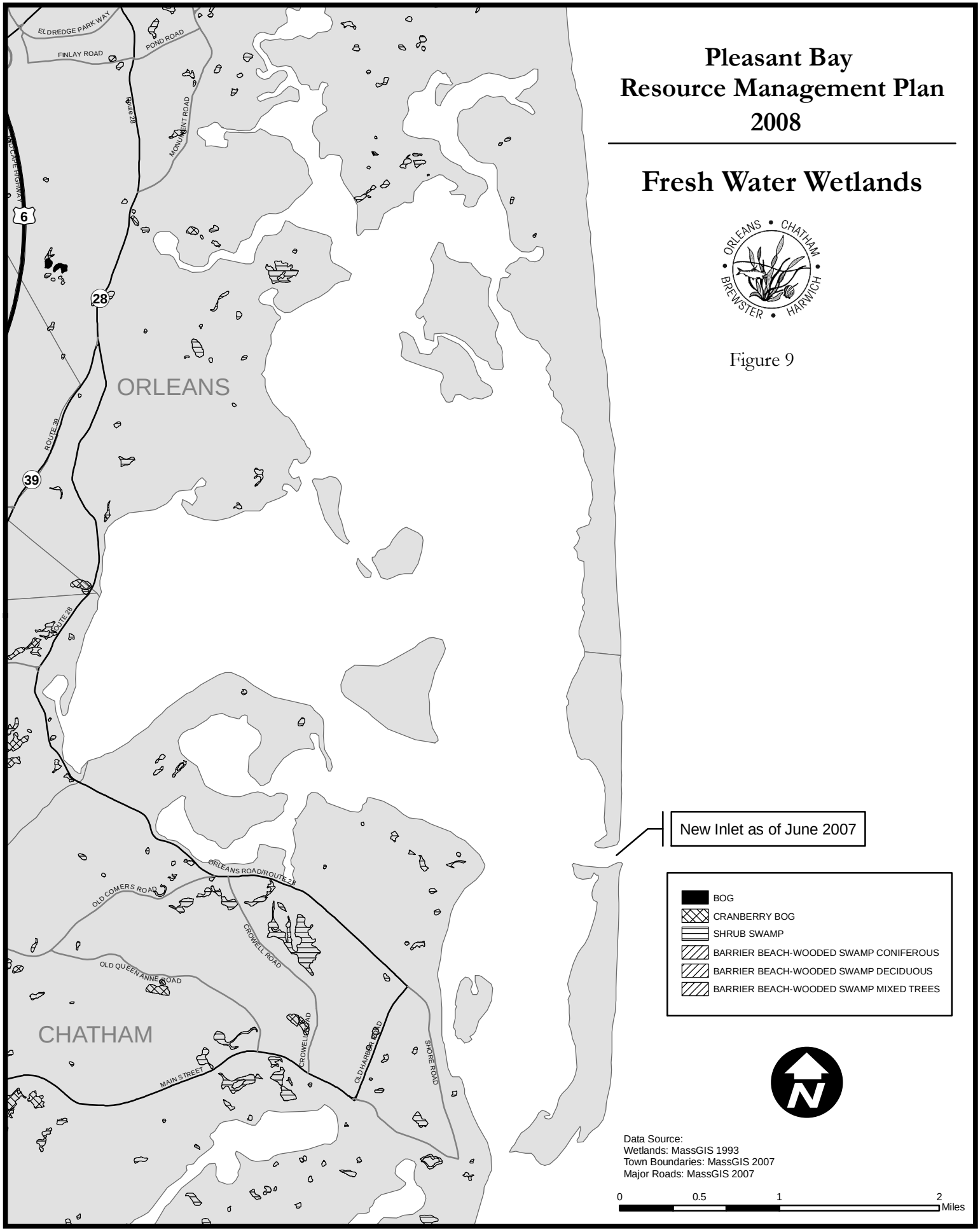
- Evaluation of the potential for a quahog nursery restoration project, possibly creating a spawning sanctuary that would help sustain an adult population capable of generating sufficient amounts of larvae. This would also protect razor and softshell clams, as well as birds, horseshoe crabs, and other species; and

- Other research and initiatives aimed at understanding the role of the Bay as a spawning and nursery area, the natural and man-made impacts on that role, and efforts to mitigate negative impacts on these important habitat functions.

Pleasant Bay Resource Management Plan 2008

Fresh Water Wetlands

Figure 9



Chapter 4
Wetlands Protection

4.0 Overview

Characteristic of the region, the watershed of the Pleasant Bay estuary is rich in wetlands resources that are vital to the area's ecology, its natural beauty, and its commercial and recreational values. Wetland resources cover more than 2,300 acres, or 12%, of the Pleasant Bay study area (see Figures 9 and 10.) When open water bodies are included in the tally, wetlands cover approximately 47% of the area. The abundance of Pleasant Bay's wetland resources is matched by the variety and condition of those resources. Sixteen categories of wetland resources have been identified in the study area, and most are in generally healthy condition. It is both the variety and the condition of wetland resources found here that make the Pleasant Bay system unique. Each type of wetland resource acts as a building block in the estuarine system. Loss or degradation of one or more types of wetland resources can easily upset or destroy the system's delicate ecological balance.

Table 3. Wetland Resources in the Pleasant Bay Study Area

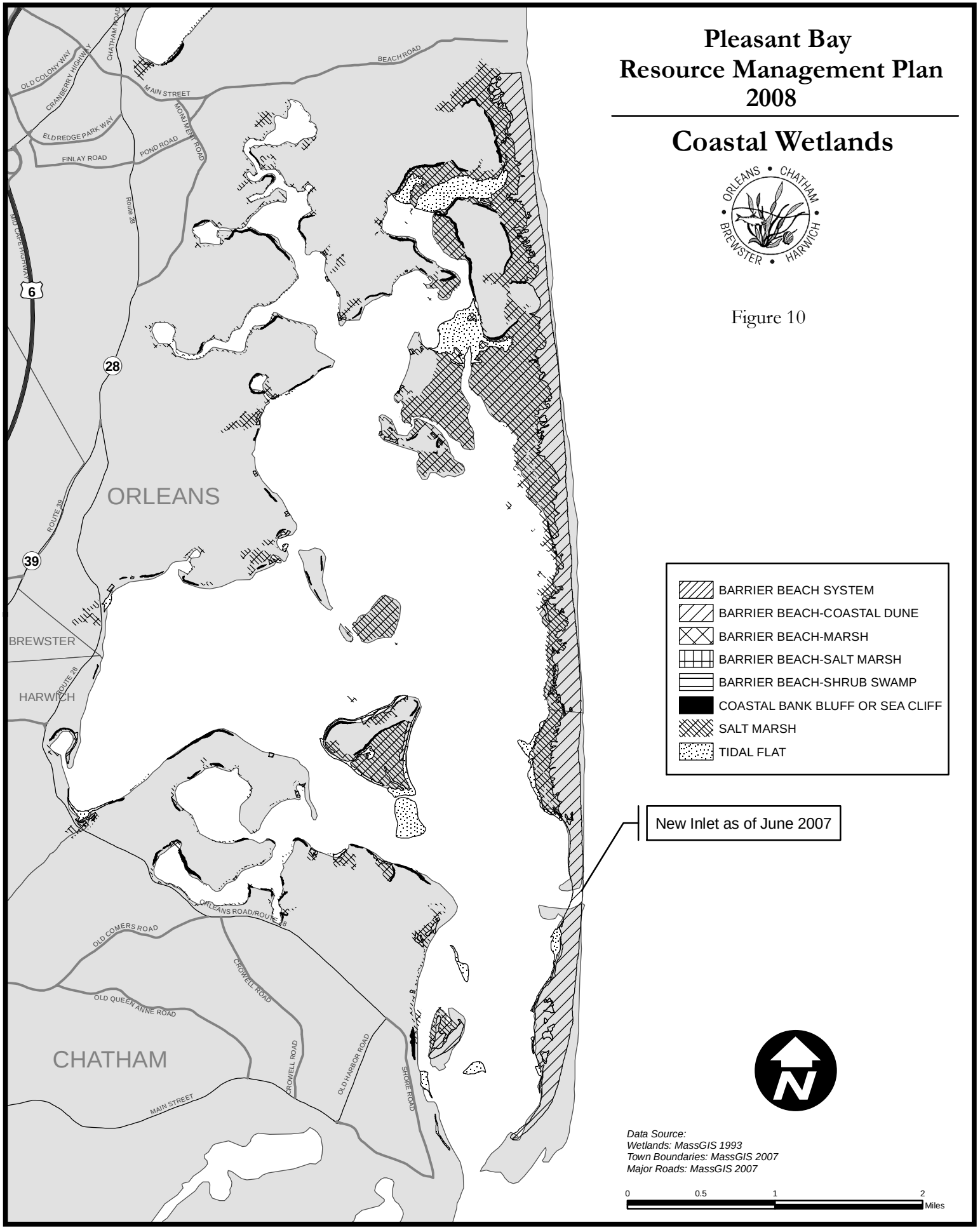
Wetland Resource Type[1]	Acres in Study Area (1998)
Barrier Beach System	36.7
Bog	5.7
Coastal Bank Bluff or Sea Cliff	68.1
Coastal Beach	81.2
Coastal Dune	50.2
Cranberry Bog	31.7
Deep Marsh	24.7
Rocky Intertidal Shore	1.3
Salt Marsh	1,101.1
Shallow Marsh Meadow or Fen	28.7
Shrub Swamp	179.9
Tidal Flat	224.5
Wooded Swamp Deciduous	66.6
Barrier Beach - Coastal Beach	37.8
Barrier Beach - Coastal Dune	352.4
Barrier Beach - Marsh	6.9
Barrier Beach - Shrub Swamp	10.3
Wooded Swamp Coniferous	30.0
Wooded Swamp Mixed Trees	23.9
Total Acres of Wetlands Resources	2,361.7
Wetlands as % of Total Watershed Acres	11.5%
Marine water surface area (MHW)	7,000
Freshwater surface area[2]	657
Total	10,018.7

[1] Source: MassDEP, Wetlands Conservancy
[2] MEP Technical Report for Pleasant Bay, 2006, Table IV-6.

Pleasant Bay Resource Management Plan 2008

Coastal Wetlands

Figure 10



Data Source:
Wetlands: MassGIS 1993
Town Boundaries: MassGIS 2007
Major Roads: MassGIS 2007

Marine and freshwater wetlands serve many critical environmental functions. They act as pollution filters, buffers against storm damage and flooding, and habitat for many spawning and juvenile species. Wetland resources are protected by federal, state and local regulations. The 1998 plan recommended steps to strengthen local regulations and increase their consistency.

To date, the Alliance has addressed wetland protection issues primarily through the development of permitting guidelines for structures in wetland resource areas, which have been implemented through changes in local regulations. These include:

Guidelines and Performance Standards for Permitting Docks and Piers in Pleasant Bay (1999);

Guidelines for Private Walkways and Stairways in Fresh and Marine Resource Areas in Pleasant Bay (2002, revised 2007); and

Guidelines for Permitting Shoreline Structures on Freshwater Lakes and Ponds in the Pleasant Bay Area of Critical Environmental Concern (2007).

Each set of guidelines was developed based on a comprehensive understanding of resource conditions and the threats imposed by either unmanaged access or a proliferation of structures. The guidelines seek to balance resource protection with recognition of the desirability of access to resource areas for a wide range of recreational pursuits (e.g., kayaking, canoeing, bird watching, fishing, nature viewing) as well as stewardship activities such as monitoring water quality, or plant or animal species. Local Conservation Commissions and MassDEP now use the respective guidelines in reviewing and administering permits for structures in wetland resource areas.

The permitting guidelines offer a consistent resource-based approach to providing access to sensitive wetland resource areas. However, as outlined below, further steps can be taken to strengthen local wetland protection regulations in the ACEC and watershed, and these will be the focus of the Alliance's wetland protection efforts in the coming five years.

4.1 Resource Management Issue: Strengthening Wetlands Regulations and Compliance

As noted above, wetlands resources provide important ecological functions that include storm protection and flood control, pollution filtration and habitat for a wide variety of species. It is widely accepted that once wetlands are degraded or destroyed, restoration of the resource, if even possible, is likely to be more costly and less effective than protection of naturally occurring resources. Therefore, regulations to protect wetland resources have a critical economic component as well. Cape Cod is fortunate in that one in four acres of land is a wetland resource.[3] However, the vast expanse of wetland resources on Cape Cod means that local Conservation Commissions have a huge

[3] Cape Cod Regional Policy Plan, 2003, Cape Cod Commission, page 53.

task in reviewing and administering the variety of projects that are located within Wetland Resource Areas and their Buffer Zones. As demonstrated by their adoption of the permitting guidelines listed above, the Conservation Commissions in the Pleasant Bay watershed have made strides in bringing consistency to their respective regulations for coastal and pondshore wetland resources in the Pleasant Bay ACEC. However, on a broader level, Commissions face several additional challenges in their efforts to provide necessary protection of wetland resources. A comparison of local wetland regulations conducted for the 1998 plan and included in the 2003 update identified differences in the treatment of several issues:

- *Additional Interests and Resources Protected*. Additional interests are those community values not addressed in the state Wetland Protection Act (WPA) that should be protected in the administration of local regulations. Some towns have included additional interests not covered in the WPA, such as aesthetics (Orleans and Brewster); water quality (Harwich, Orleans, Chatham, Brewster), rare and endangered species (Harwich, Chatham); recreation (Harwich, Orleans, Chatham); erosion and sedimentation control (Harwich, Orleans, Chatham), and marshland and eelgrass beds (Chatham). Consistency among towns in terms of protected values is desirable.

- *Buffers and Setbacks.* One way to strengthen protection of wetland resources is to increase the buffer area of jurisdiction. Increased buffer width enhances water quality by filtering sediments and pollutants, particularly nitrogen, before they reach ponds and embayments. Buffers also increase the associated wildlife habitat value of the resource area. Designations of setbacks for no Disturb Areas and/or Limited Activity Areas within the Buffer Zone also serve to enhance protection of these wetland values. Each of the towns has enacted a form of buffer, no build or no disturb zones. Differences between and benefits of these various requirements should be evaluated to determine if a preferred buffer or setback regulations should be recommended. Consistency of enhanced buffer and setback requirements may be desirable to protect resources.

- *ACEC Standards*. Within the ACEC, the standard that an activity may be allowed as long as it has no adverse effect on wetlands resources is incorporated in local regulations. However, there are no specific criteria for conservation commissions to rely on in applying the *no adverse effect* standard. Development of specific criteria for the ACEC impact standard was identified in the 1998 plan as a need and remains a priority.

4.2 Recommendations to Strengthen Wetlands Regulations and Compliance

4.2.1 *Strengthen local wetlands protection regulations and review procedures*. The Alliance will continue to review existing wetlands protection regulations in the Alliance communities, and where advisable, develop recommendations for strengthening regulations in the following areas:

- Establishing a goal of *no loss of wetlands* within the study area. This goal would apply to the direct loss of wetlands through filling or encroachment, as well as the loss of functionality due to cumulative impacts from adjacent uses or activities.
- Limit impacts resulting from projects within the ACEC granted limited project status under state wetland protection regulations,
- Develop specific criteria for applying the ACEC standard of "no adverse impact" by requesting all towns to treat the ACEC as a resource in their wetlands regulations and to develop performance standards;
- Promote consistent application of MassDEP wetlands delineation guidelines, and allow for periodic review and revisions to boundaries as needed;
- Recommend a 2:1 mitigation ratio for encroachment within the 50-foot buffer to the resource area in an ACEC (currently there is no MassDEP requirement);
- Promote adoption of a Flood Plain Bylaw in towns where one does not exist, and review existing flood plain bylaws for consistency and comprehensiveness;
- Develop performance standards for activities within the area of jurisdiction, including the potential for establishing n*o build* and/or *limited activity* zones;
- Promote policies to limit landscaped coverage and develop best management practices for land clearance that address the issue of clear cutting (see recommendation 3.6.3);
- Develop best management practices and performance standards for landscaping and restoration of lawn areas;
- Promote use of County-developed standards for re-vegetation and restoration of vegetation; and
- Seek to amend state law to allow conservation commissions to levy more meaningful fines for significant violations of clear-cutting or of orders of conditions.

4.2.2 *Undertake a* p*ublic education effort regarding landscaping practices within resource areas*. The Alliance will work with conservation commissions, landscapers and the Barnstable County Cooperative Extension to develop a public information campaign focused on best management practices for landscaping within resource areas, including:

- General lawn care practices (soil preparation, grass and plant types, watering and fertilizer use);
- Promoting use of native species in landscaping and re-vegetation;
- Promoting the importance of maintaining contiguous natural areas;
- Pruning and maintenance of vegetation; and
- Management of invasive species (see recommendation 3.6.2.)

The effort will also explore the feasibility of training and certification for contractors.

4.3 Resource Management Issue: Restricted Wetlands

Muddy Creek and Frost Fish Creek both discharge into the Pleasant Bay estuary through undersized culverts located under Route 28. Muddy Creek is a long meandering tidal river with fringe marsh, whereas Frost Fish Creek is more accurately characterized as a marsh system. The magnitude of impairment resulting from restricted tidal flow is

more severe at Muddy Creek where, due to dense residential development, the high concentration of nitrogen contributed from the surrounding land uses is not adequately dispersed by tidal flushing. The sustained tidal restriction at Frost Fish Creek is believed to have resulted in lower salinity and potentially more nitrogen attenuation.

Hydrodynamic and water quality studies conducted as part of the MEP for the Chatham embayments have documented the water quality impacts of these hydrologically restricted wetlands and have modeled potential water quality improvements resulting from culvert improvements and other measures. The Alliance will continue to work with the Towns of Chatham and Harwich to study the relative merits of different remediation options to improve resource conditions.

4.4 Recommendation to address Restricted Wetlands

4.4.1 *Study resource impacts, permitting requirements and cost allocation methods associated with the Muddy Creek dike re-installation.*

A hydrodynamic analysis conducted as part of the MEP looked at three scenarios to improve flushing and thereby improve water quality in Muddy Creek.[4] One scenario would revert the entire Muddy Creek into a freshwater system. This scenario was rejected based on the potential loss of significant salt marsh at the lower end of the Creek. A second alternative would enlarge the culverts to improve flushing. However, water quality modeling indicated insufficient potential water quality improvement to justify this scenario. A third would re-install an historic dike located mid-way up the Creek, thereby reverting the upper portion to a fresh water system, and improving tidal flushing in the lower portion.

The Alliance has obtained funding through a grant from the Cape Cod Water Protection Collaborative to study the feasibility of this third alternative. The project will assess the wetland and habitat resource impacts associated with re-installation of a dike in Muddy Creek. The dike would restore the upper Creek to a freshwater system for the purposes of natural nitrogen attenuation in a heavily overloaded subembayment of Pleasant Bay. The potential resource impacts from the re-installation of the dike would then be balanced against nitrogen attenuation and associated habitat restoration impacts to determine the overall feasibility of re-installation, in concert with other nitrogen management strategies under consideration by the towns. The project will also identify a critical path for permitting and will recommend cost allocation strategies for re-installation and maintenance of the dike.

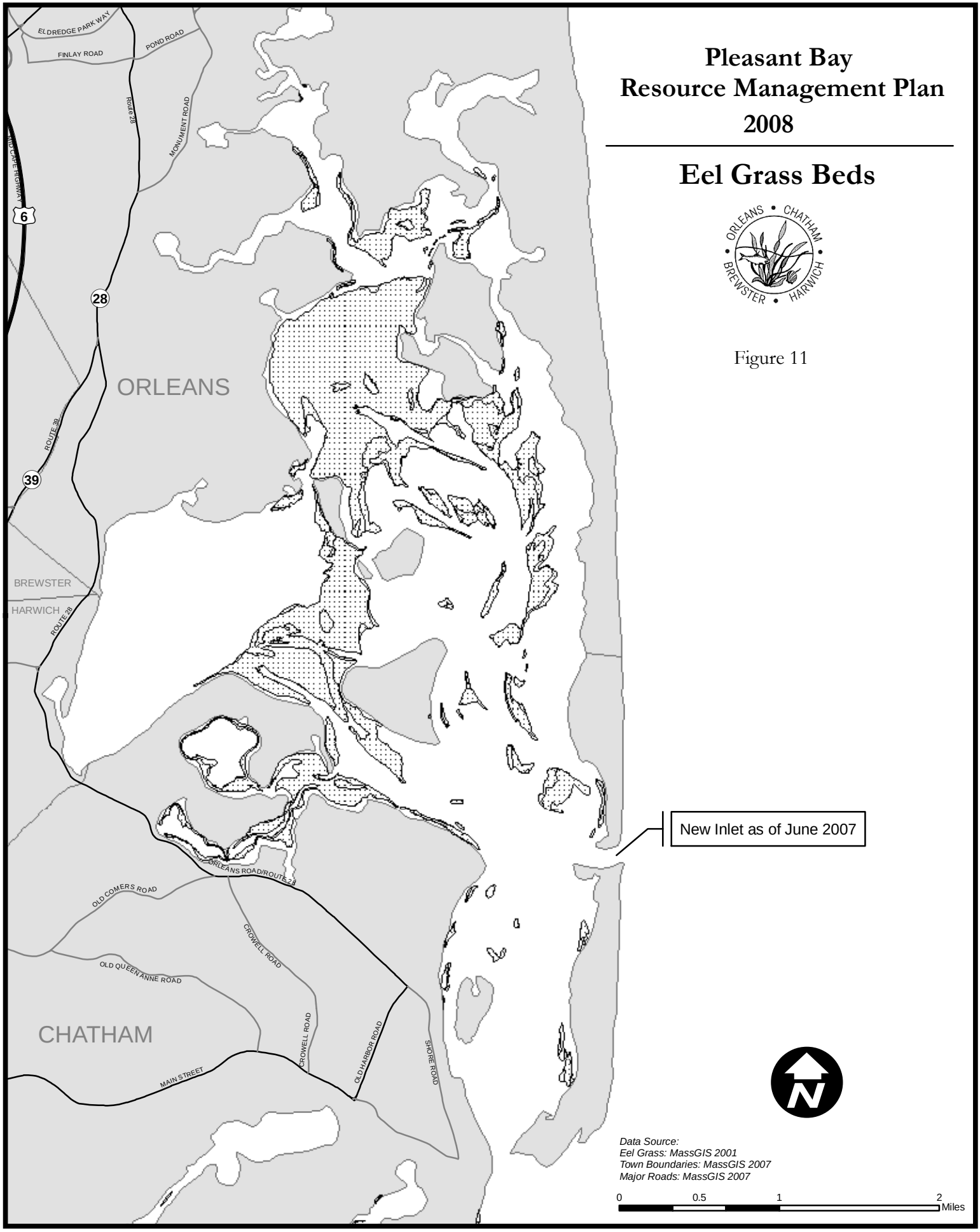
4.4.2 *Support efforts by the Town of Chatham and Massachusetts Highway Department to evaluate design alternatives to increase flushing and improve water quality, habitat and other natural resources in Frost Fish Creek.*

[4] Ramsey, John, Tidal Flushing Analysis of Coastal Embayments in Chatham, MA, Chapter VI, pp. 86-89.

Pleasant Bay Resource Management Plan 2008

Eel Grass Beds

Figure 11



Data Source:
Eel Grass: MassGIS 2001
Town Boundaries: MassGIS 2007
Major Roads: MassGIS 2007

0 0.5 1 2 Miles

Pleasant Bay Resource Management Plan 2008

Open Space

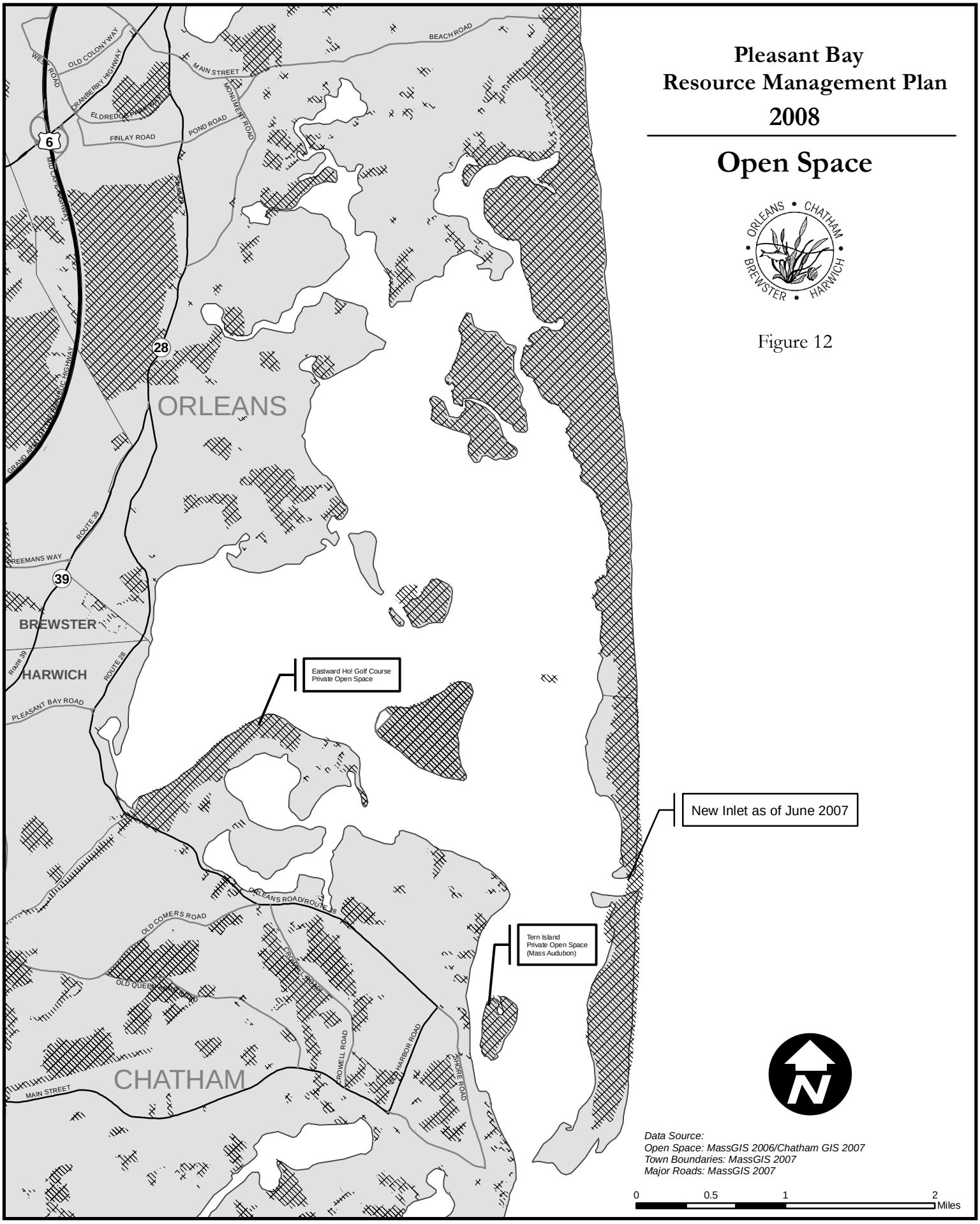


Figure 12

Data Source:
Open Space: MassGIS 2006/Chatham GIS 2007
Town Boundaries: MassGIS 2007
Major Roads: MassGIS 2007

Chapter 5.
Watershed Planning

5.0 Overview

Recognizing that land use in the watershed is perhaps the most important influence on water quality and marine habitat in the Bay, the 1998 resource management plan defined the study area as encompassing the entire contributing watershed for the Bay.[1] The Pleasant Bay watershed consists of some 21,600 acres[2] located in four towns: Orleans (41%), Chatham (30%), Harwich (13%) and Brewster (16%) (See Table 1, Chapter 1 and Figure 13 below.) The western-most boundary of the watershed extends nearly two miles from the shoreline of the Bay.

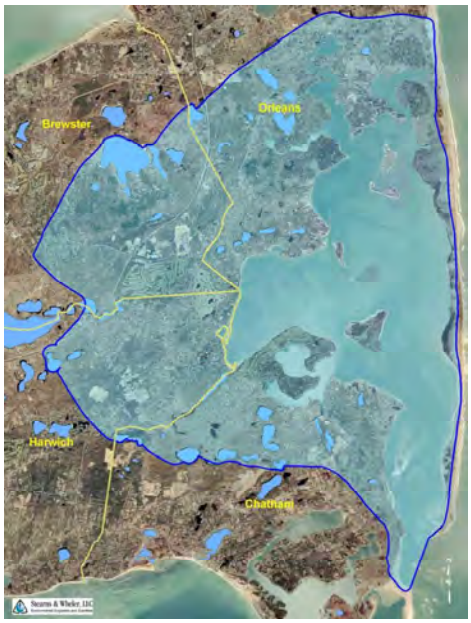


Figure 13 Watershed Area

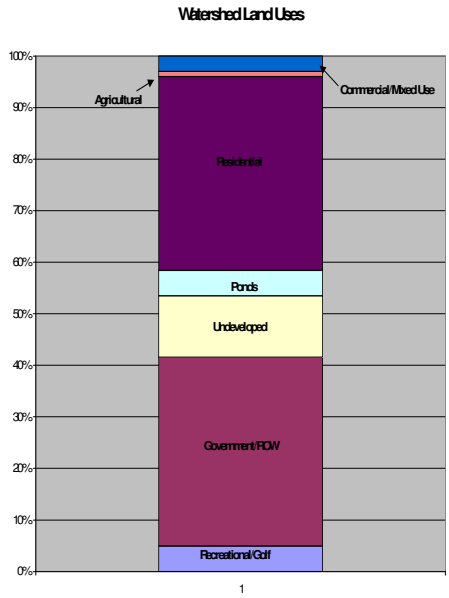


Chart 1. Watershed Land Uses

Land use in the watershed is primarily residential. Residences account for 38% of the total land area in the watershed, of which 90 % is accounted for by single-family dwellings. The next largest land use category is government-owned land, buildings, roads and rights of way. Golf courses and recreational areas account for 5% of total land area, and mixed use, commercial and industrial land uses account for less than 5% of total land area in the watershed. Twelve percent or 2,500 acres of land in the watershed

[1] A watershed is an area of land that contributes groundwater or surface water to a stream, river, pond, estuary or other water body. On Cape Cod, groundwater elevations generally determine watersheds or recharge areas rather than land surface elevations. Smaller watersheds within larger watersheds are referred to as sub-watersheds.

[2] Refers to total land area and estuarine surface area.

is undeveloped although not all of it will remain that way. Current open space in the watershed is shown on Figure 12.

The character of land use in the watershed is an important factor in the health of the Bay. The 1998 Plan and 2003 Plan Update note that one of the most significant threats to the overall health of the Pleasant Bay system is the overloading of nitrogen from watershed sources, including septic systems and road runoff. Over the past five years, the major thrust of the Alliance's watershed management efforts has been to study the extent of nitrogen loading in the watershed, and to work with our member communities to develop effective nitrogen management strategies.

5.1 Massachusetts Estuaries Project (MEP)

One of the primary ways the Alliance has learned more about the extent of nutrient loading in Pleasant Bay has been through its participation in the Massachusetts Estuaries Project (MEP). The main objective of the MEP is to restore and protect estuaries from the degradation that results from nutrient enrichment. The MEP was established in 2001 by the Massachusetts Department of Environmental Protection (MassDEP) and the School of Marine Science and Technology at UMASS-Dartmouth. The purpose of the program is to provide communities with a quantitative tool (the Linked Watershed –Embayment Management Model) for nutrient management of their coastal embayments. The program uses actual water quality, hydrodynamic, and land use data in a model to determine critical nitrogen loads in estuaries. When first announced by MassDEP, the program did not list Pleasant Bay in its entirety as being among the first or second level of priority embayments for modeling. In fact, modeling within the Bay was focused on the Orleans and Chatham sub-embayments only. In 2004 the Alliance secured $120,000 in matching funds from the communities of Orleans, Chatham and Harwich to extend the MEP study to encompass the entire Pleasant Bay system.

The final MEP Technical Report[3] for Pleasant Bay, released in May 2006, was the culmination of more than two years of research, computer modeling, and data analysis undertaken by the MEP, and incorporated five years of water quality data collected by the Alliance through the Pleasant Bay Citizen Water Quality Monitoring Program. Key findings of the Technical Report included:

- **Watershed Delineations.** Because groundwater and surface waters are conduits to nitrogen flowing into the Bay, delineations of the entire Pleasant Bay watershed and subwatersheds were updated and refined as part of the MEP. Using USGS simulated groundwater flows and particle-tracking program to delineate subwatersheds, the MEP identified 95 subwatershed areas within the Pleasant Bay watershed, including 25 freshwater ponds and 7 public water supply well fields. A previous delineation conducted by the Cape Cod Commission in 1998 identified 21 subwatersheds in the entire watershed. The size of the overall watershed according to the MEP

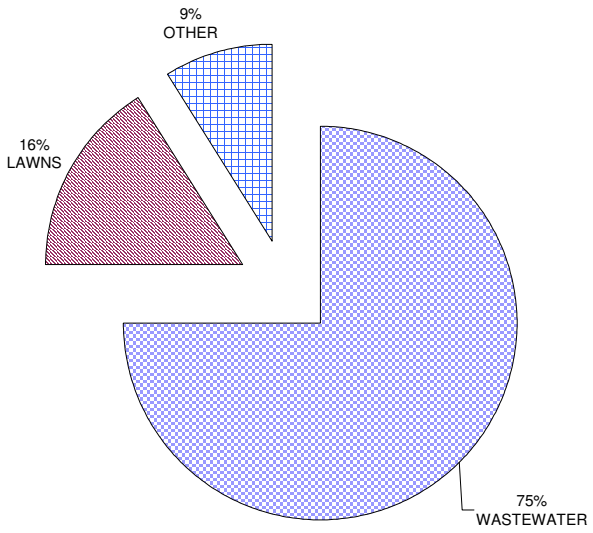
[3] The Technical Report, entitled *Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for the Pleasant Bay System, Orleans, Chatham, Brewster and Harwich, Massachusetts*, can be downloaded from the Alliance's website, *www.pleasantbay.org*.

delineations was only 164 acres or one percent larger than previously measured by the Commission. However, refinements in the areas of some individual subwatersheds were on a larger scale.

- **Nitrogen Loading.** The MEP measured nitrogen inputs into Pleasant Bay from key sources including: land-based nitrogen loading (primarily from septic systems, fertilizers and runoff, and factoring in attenuation through ponds and wetlands); nitrogen that settles into bottom sediments and re-circulates in the Bay; and nitrogen from atmospheric sources. The report found that nitrogen from wastewater sources (septic systems) accounts for 42% of nitrogen in the Bay from all sources, and 75% of the share of nitrogen that can be controlled through local action.

  The levels of nitrogen in Bay waters from all sources were calculated at the then current (2004) level of watershed development and at full "build out"[4]. The MEP Technical Report concluded that watershed nitrogen load at full build out would be 30.1% higher than nitrogen loads under the current level of watershed development [5].

Chart 2 Nitrogen Sources



- **Ecological Health**. The MEP Technical Report contained a detailed assessment of water quality conditions and the respective health of the Bay's eelgrass and shellfish communities, which are sensitive to the effects of nitrogen and serve as indicators of

[4] Build out is a term that refers to the maximum amount of development that could occur under current zoning laws.
[5] Massachusetts Estuaries Project, Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for the Pleasant Bay System, Orleans, Chatham, Brewster and Harwich MA, May 2006, Table VI-5, p. 144.

the Bay's overall health. The report documented definite signs of nutrient related stress throughout the system and found that 13 of 17 subembayments exhibited some level of impaired or degraded habitat health due to nitrogen[6]. The report found excessively low dissolved oxygen levels in some salt ponds, particularly those where surrounding land is densely developed and tidal flushing is restricted. The report also cited a 24% decline in the number of acres of eelgrass in the Bay over the past thirty years as evidence of the degrading effects of nitrogen. However, the remaining 1,807 acres of eelgrass represents a valuable resource with strong potential for restoration.

5.2 Resource Management Issue: Nutrient Management

Estuaries are extremely sensitive to the effects of nitrogen. It is not the nutrients themselves that cause problems, but the increased plant growth they cause. Certain algae—opportunistic seaweed and phytoplankton—become so abundant that they shade the bottom and decrease light penetration. As the plants decay they use up oxygen and the decayed plant material settles to the bottom. The excessive production and decay can reduce the amount of oxygen in the water column and can ultimately lead to anoxic (no oxygen) or hypoxic (low oxygen) conditions. Even short periods of low oxygen can cause serious damage to bottom dwelling organisms and eventually lead to "fish kills" and losses of other plant and animal species. Phosphorous is another type of nutrient that poses similar problems in freshwater ponds and lakes. However, most of the Alliance's emphasis has been on studying and addressing nitrogen as a key threat to estuarine water quality.

The MEP Technical Report documents the sources and amount of nitrogen entering Pleasant Bay, and the impacts of that nitrogen on water quality and ecosystem health. The report provides the scientific basis for the *Pleasant Bay System Total Maximum Daily Loads for Total Nitrogen (TMDL) Report* developed by MassDEP in accordance with the Federal Clean Water Act. The TMDL report indicates the threshold amounts of nitrogen the waters can receive and remain healthy, and how much of the current nitrogen load needs to be removed in order to meet the threshold. While the MEP report demonstrates that not all of the nitrogen entering Pleasant Bay comes from the watershed, it points out that only the watershed sources are considered *controllable* for the purposes of achieving targeted reductions. The Technical Report and TMDL Report together provide the foundation for comprehensive wastewater planning that is underway in the watershed towns.

The TMDL report indicates that system wide, 36% of the controllable watershed load needs to be reduced in order to achieve a targeted level of water column nitrogen that is associated with a healthy estuarine system. The TMDL report contains thresholds for nineteen separate areas of the Bay. Reductions needed to achieve thresholds range from a high of 83 percent in Meetinghouse Pond, to 0 percent in Chatham Harbor. It is

[6] Massachusetts Estuaries Project, Linked Watershed-Embayment Model to Determine Critical Nitrogen Loading Thresholds for the Pleasant Bay System, Orleans, Chatham, Brewster and Harwich MA, May 2006, Table VIII-1, p. 203.

important to note that the TMDLs represent one combination of load reductions among the Bay's subembayments. Because the Bay is an integrated system, what happens in one area ultimately will affect other areas. Therefore a comprehensive and coordinated approach to achieving threshold nitrogen levels is necessary.

Over the past five years the Alliance has served as a clearinghouse for review and comment on development of the MEP and TMDL reports, and has helped to foster coordination and communication among the four watershed towns. The Alliance convenes a regional watershed work group which meets monthly to discuss strategies and actions and pursue projects in support of development and implementation of wastewater management plans for the Pleasant Bay watershed. This role will continue to be a major focus in the five years ahead.

5.3 Recommendations to address Nutrient Management

5.3.1 *Support comprehensive wastewater management planning*. The Alliance will continue to support and encourage all four watershed towns to make progress in developing and implementing comprehensive wastewater management plans (CWMPs) that encompass the Pleasant Bay watershed. The Alliance will continue to act as a clearinghouse for towns to share information and communicate progress to each other. Through the activities outlined under 5.3.2 below, the Alliance will provide resource analyses in support of CWMPs.

5.3.2 *Promote watershed-based collaboration to achieve TMDLs*. The Alliance will continue to convene the watershed work group in support of projects and activities designed to:

- *Coordinate planning for CWMPs*. This encompasses promoting plans and studies that will benefit multiple towns as well as looking at ways to coordinate relevant sections of watershed towns' CWMPs.
- *Explore model scenarios*. The Alliance will sponsor and support technical studies and model runs that explore system-wide issues and conditions and will help to identify the most cost effective solutions to achieve targeted thresholds and to augment town CWMP development.
- *Provide ongoing monitoring and reporting*. The Alliance will continue to work with MassDEP, MEP and regional entities to develop protocols for monitoring, analysis and documentation of eelgrass health, benthic infauna health and water column nitrogen.
- *Explore strategies to equitably allocate cost and responsibility*. The Alliance will promote exploration of equitable ways to allocate costs and responsibility for planning, monitoring, and implementing facilities and other management strategies.
- *Act as communication link on key implementation issues*. The Alliance will continue to work with the watershed communities, MassDEP and the Cape Cod Water Protection Collaborative to address on-going questions concerning permitting, point of compliance, reporting and adaptive management.

5.3.3 *Continue to build and support public awareness of the need for nitrogen management strategies and adherence to the TMDLs.* To accomplish this the Alliance will:

- Continue to review projects within the ACEC and watershed where there are significant potential nitrogen loading or other resource impacts.
- Develop *Citizen's Guides to Estuarine Protection* for all sub-watersheds. Thus far guides have been developed for the Arey's Pond and River Complex subwatersheds. One is planned for the Muddy Creek watershed in Chatham and Harwich. The scope of *Citizen's Guides* should include lawn care practices, proper disposal of animal waste, phosphates, bacterial contamination and testing.
- Increase public education efforts to limit nitrogen and phosphate loading from fertilizer and other household or commercial products, and promote water conservation.
- Support smart growth land use strategies that direct development away from sensitive natural resources areas and provide better opportunities for effective wastewater management and open space protection.
- Encourage coordination among health, conservation, planning and public works departments involved in the review and permitting of public and private projects and developments.
- Support additional open space purchases to further reduce nitrogen inputs and protect habitat.

5.4 Resource Management Issue: Stormwater Management

Stormwater runoff results from rainfall and snowmelt and poses a major threat to water quality in ponds and estuaries. Stormwater is categorized as coming from a point source, such as a discharge pipe from a municipal stormwater system, and non-point source, which emanates from diffuse sources such as rooftops, driveways and roads. In the Pleasant Bay watershed, most stormwater runoff comes from non-point sources and is therefore more difficult to manage.

Many layers of federal, state and local regulations govern stormwater discharges. The National Pollutant Discharge Elimination System (NPDES) program phase I requires that all point sources of stormwater discharge such as large commercial or industrial facilities or municipal stormwater systems obtain a permit from the US Environmental Protection Agency (EPA)[7]. Under Phase II of the NPDES, small municipalities with populations under 100,000 are required to prepare and implement stormwater management plans by 2008.

Not all communities in the Pleasant Bay watershed have achieved compliance with Phase II of NPDES. Local and state regulations exist to address non-point sources of stormwater, such as local wetlands regulations, and subdivision regulations. However, local stormwater management often is not coordinated and regulations and standards are not always applied in a consistent or comprehensive manner.

[7] US EPA delegates the issuance of NPDES permits to some states, but Massachusetts is not one of them.

In 1996 MassDEP developed a series of storm water management policy documents to assist towns in managing stormwater and in achieving compliance with NPDES Phase II. The policy documents address site planning, non-structural measures and best management practices to prevent or reduce pollutants and reduce runoff volume, and provide other technical assistance. In addition to the state guides, a number of towns in Massachusetts have adopted stormwater management bylaws and regulations.

5.5 Recommendations to Address Stormwater Management

5.5.1 *Phase II Stormwater Management Compliance*. Encourage the Alliance towns to complete and implement Phase II Stormwater Management Plans as required by the EPA and MassDEP. Components of the plans include mapping the towns' stormwater management system, identifying impacts to resources from stormwater discharges in specific areas; and remediation of negative impacts to resources.

5.5.2 *Promote adherence to MassDEP's Stormwater Management Policy and Best Management Practices*.

5.5.3 *Evaluate the benefits of adopting a stormwater management bylaw*. Some towns in Massachusetts have adopted stormwater management bylaws. The various model bylaws and experiences of these communities should be compiled and evaluated for their potential benefit to the Pleasant Bay communities.

5.5.4 *Encourage Towns to fund implementation and maintenance of stormwater management infrastructure*. Long term funding for implementation and maintenance of stormwater management infrastructure poses a major challenge to towns. Maintenance of existing facilities and planned improvements is critical in order for improvements in the treatment of stormwater to be realized. The Alliance towns are encouraged to explore means of ensuring adequate funding on an ongoing basis. The creation of a stormwater utility, or other dedicated funding mechanism, are among the financing options that should be explored.

5.6 Resource Management Issue: Bacterial Contamination

Bacterial contamination is an on-going concern for the communities surrounding Pleasant Bay. During the summer of 2001 a number of public swimming areas in Pleasant Bay were closed due to high levels of bacteria. According to the County's *Coastal Resources Protection Update*, the increased incidence of beach closures may have been tied to changes in testing procedures mandated by the state. Methods used by towns to monitor for bacteria in swimming areas prior to the enactment of the *Massachusetts Beaches Act* in 2001 were not consistent or always rigorously applied. The previously employed method of sampling a "suspect" area over a period of days to determine a sustained high level of bacteria may have revealed a high reading to be a one-time "spike" in bacteria levels. The *Beaches Act* now requires weekly testing of

swimming beaches, and closure of a beach after one reading of higher than acceptable bacteria counts.[8]

However, the fact remains that high levels of bacteria were measured at the closed Pleasant Bay locations, and the sources of bacteria need to be better understood and managed. The prime indicator of bacterial contamination associated with the beach closings is enterococcus, commonly found in warm-blooded mammals. Stormwater and overland run-off may be a carrier of the bacteria. Heavy rains following periods of dry, hot weather may result in excessive run-off carrying fecal matter from birds and other animals down gradient to coastal embayments. Outmoded, malfunctioning or overloaded septic systems – even if located close to coastal waters -- are not likely to be a source of bacterial contamination because of the ability of soils to thoroughly filter bacteria. The type and source of bacteria may vary for different waters. Knowing the primary type of bacterial contamination is necessary to pinpoint the source and plan effective mitigation measures and policies.[9]

5.7 Recommendations to Address Bacterial Contamination

5.7.1 *Monitor trends in bacterial monitoring data*. In areas experiencing sustained high levels of bacterial contamination, the Alliance will encourage efforts to identify sources of bacteria. Methods used to identify bacteria sources could include detailed sanitary surveys, DNA testing, or other appropriate method of evaluation.

5.7.2 *Mutt Mitt Dispensers*. Through a state ACEC stewardship grant, the Alliance obtained funding to place Mutt Mitt dispensers at 19 public access points along the entire Bay. Volunteers from the Orleans Pond Coalition and Town of Chatham restock the dispensers throughout the year. The Alliance will continue to support maintenance of existing Mutt Mitt placements and promote public awareness of the ecological impacts of pet waste.

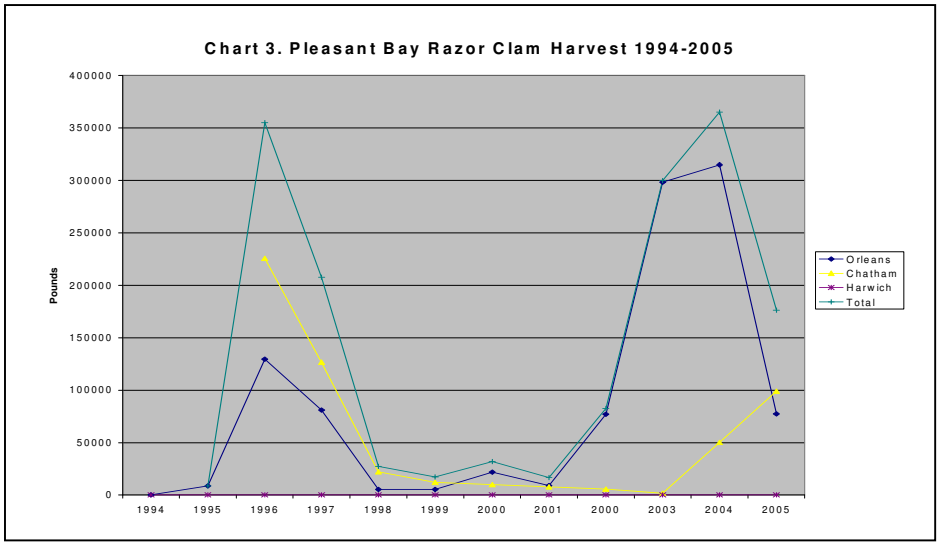
[8] Barnstable County Coastal Resources Committee. Coastal Resource Protection Update. Barnstable, MA. 2002.
[9] Ibid.

Chapter 6.
Fisheries Management

6.0 Overview

Shellfishing and finfishing are important commercial and recreational activities in Pleasant Bay. Of the numerous species of shellfish in the Bay, quahogs, scallops and soft shell clams are, historically, the most popular for commercial and recreational fishing. Quahogs, softshell clams and scallops were noted in the 1998 plan as the primary commercial species. However, in the last decade razor clams have emerged as a significant commercial species.

6.1 Status of the Fisheries



Razor Clams

Harvests of razor clams spiked in the early part of the decade and are now beginning to decline. A combination of a prolific natural set and the increased market popularity of this species are credited with influencing the larger harvest.

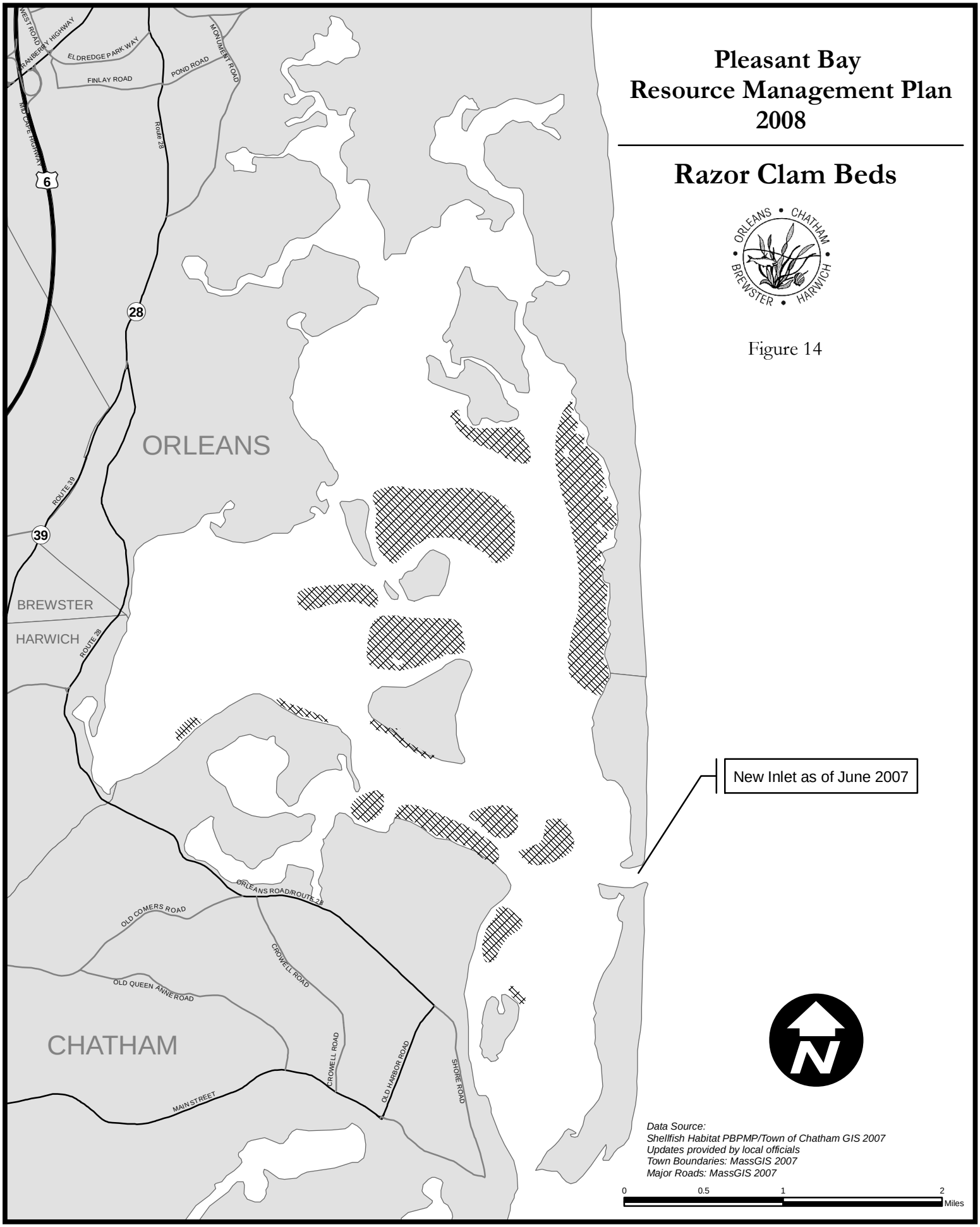
Figure 14 shows an increase in razor clam bed area over the area mapped in 1998. The identification of more areas of the Bay as razor clam beds may be due in part to the use of salting as a harvesting technique. Salting, which involves injecting or spraying a saline solution into or onto the substrate to draw out the animals, has made harvesting in subtidal areas more accessible, and also has allowed harvesting to occur year-round.[1]

[1] Salting tidal flats or injecting saline water into tidal flats to draw razor clams to the surface has been called into question as a viable harvesting technique. Research by the Orleans Shellfish Department and Dr. Dale Leavitt of Roger Williams University indicated no adverse impacts to the razor clams or surrounding benthic animals from salting.

Pleasant Bay Resource Management Plan 2008

Razor Clam Beds

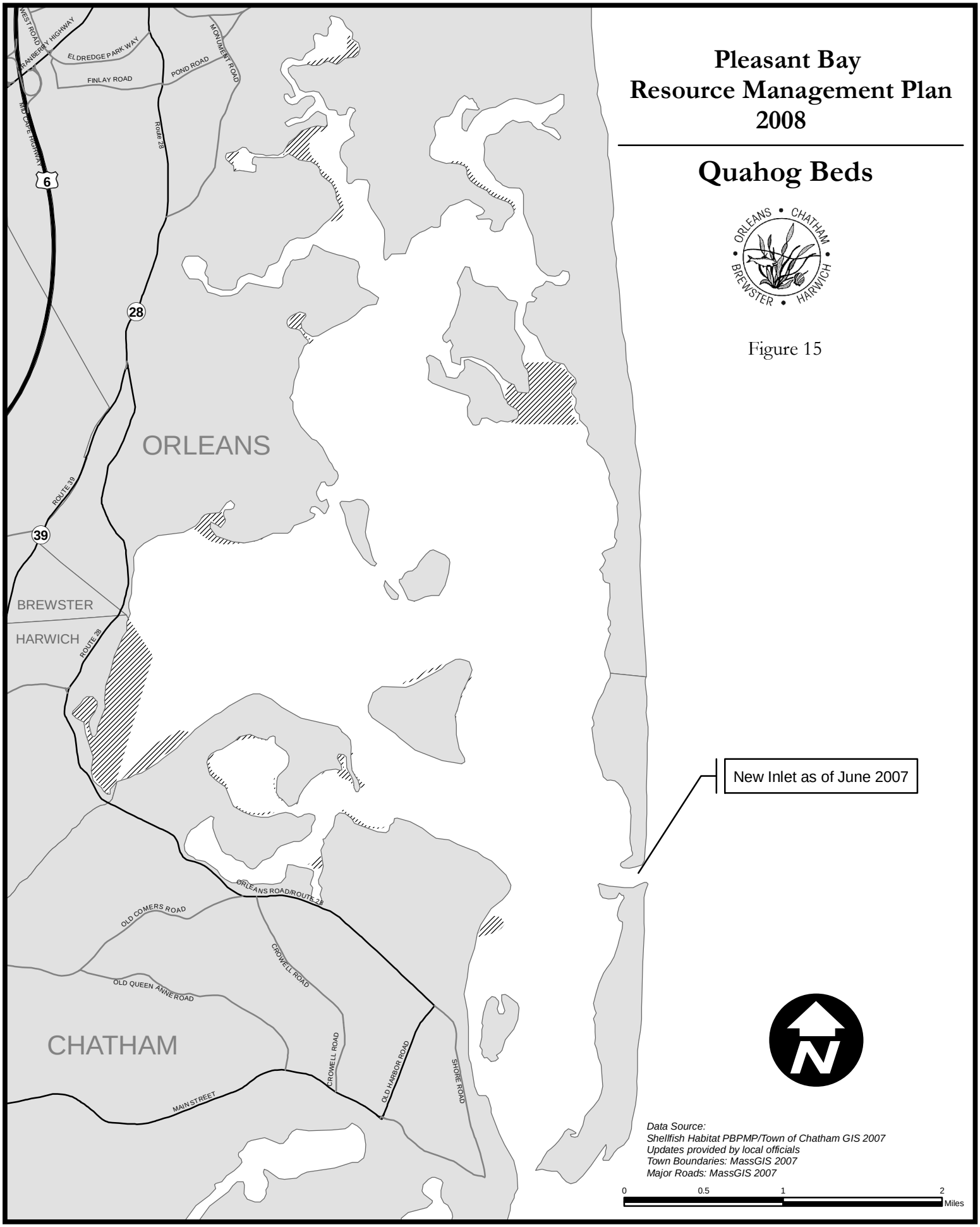
Figure 14



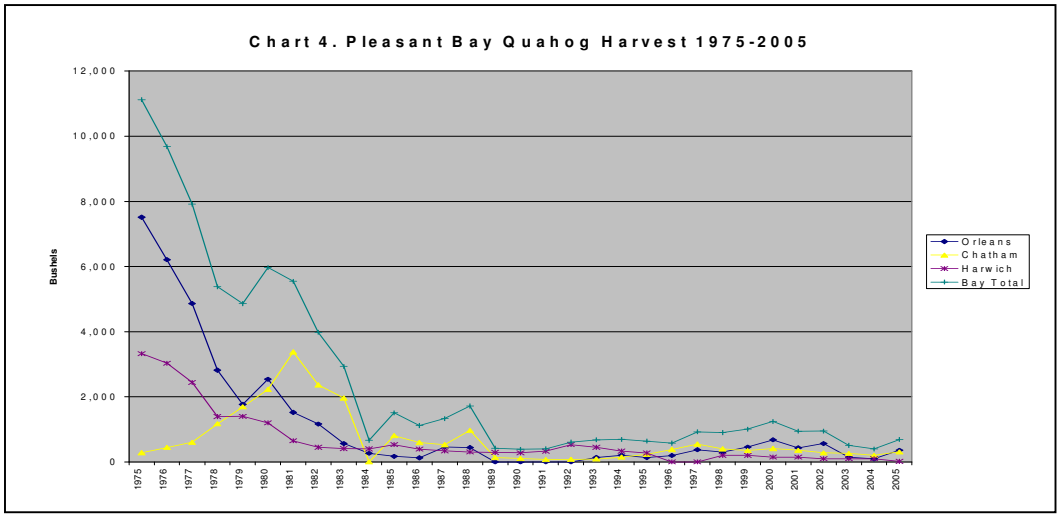
Pleasant Bay Resource Management Plan 2008

Quahog Beds

Figure 15



Rapid increases in harvests have raised concerns about possible overfishing of razor clams. Field observations conducted through the Barnstable County Cooperative Extension Service indicate a regular supply of larvae for razor clams and softshell clams in Pleasant Bay waters, based on observed settlement of both species in areas protected from predation[2]. This abundance of larvae suggests that fishing large populations of these species is sustainable. However, there are currently no size limits or catch limits for razor clam harvesting, although a permit is required.

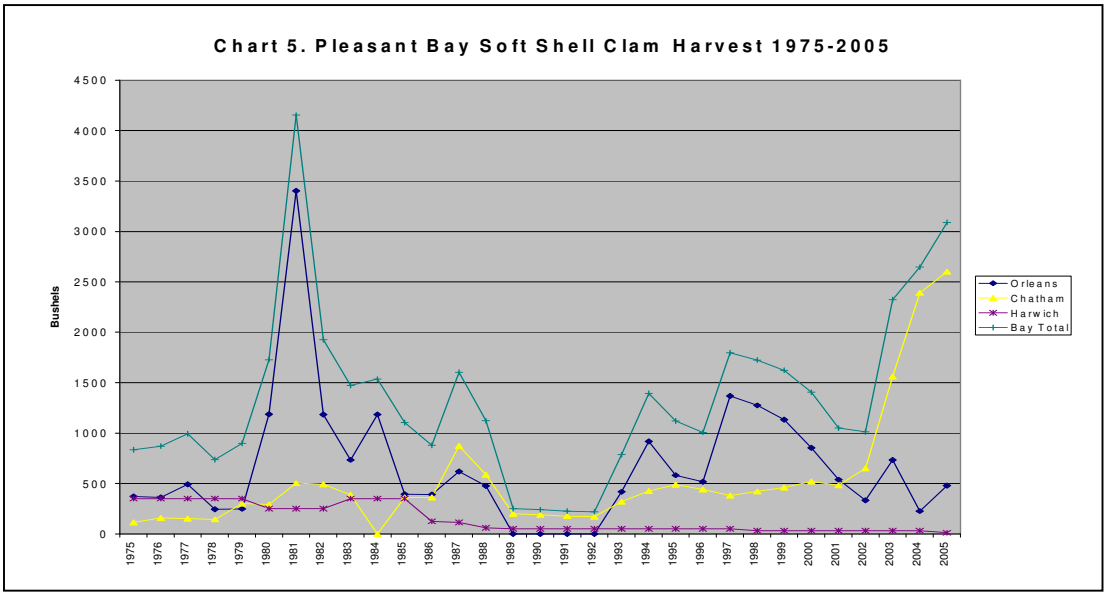


Quahogs

Catch report data compiled in the 1998 plan show a continuous bottoming out of quahog harvests since the mid-1980's. This trend is continued in more recent catch data. The last significant harvests of quahogs were two and three decades ago. At that time Pleasant Bay, particularly in the center of Big Bay, was one of the most productive quahog fisheries on the East Cost. Several factors have been linked to the decline in quahog harvests, although none are confirmed. One theory is that an increase in salinity after the 1987 break, coupled with reduced freshwater inflows from upland areas, created a less hospitable environment for these freshwater loving animals. In addition, a change in the state regulation of gauge size resulted in animals being harvested at a smaller size, before they reach prime reproductive age.

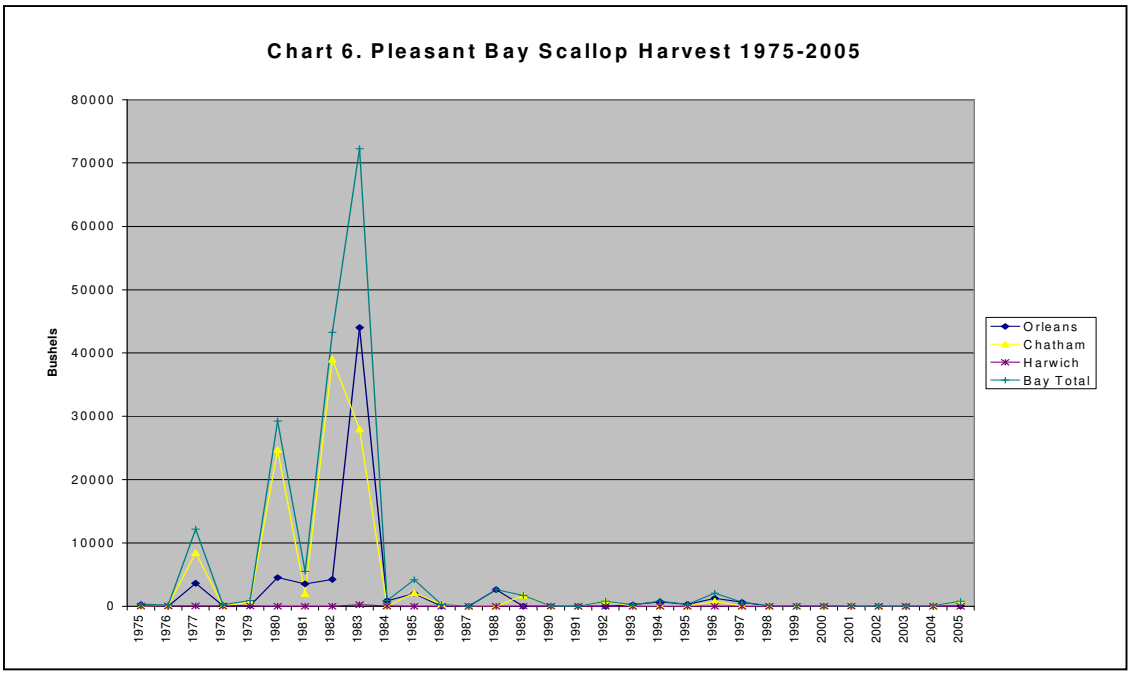
Currently most quahog larval productivity in Pleasant Bay is generated by the standing natural population. Private aquaculture grants are another source of larvae, but the tendency to harvest farmed quahogs at as early a stage as possible due to higher market value tends to limit larval production. An increase in predator and pest populations such as green crabs, sulfur sponge, and spider crabs is also noted as a possible cause for the decline in quahogs. Figure 16 shows the location of quahog beds in Pleasant Bay.

[2] Comment by William Walton, Barnstable County Cooperative Extension Service and WHOI Sea Grant, at a public forum on Pleasant Bay Fisheries held June 28, 2007, Orleans Town Hall.



Soft Shell Clams

Bay-wide harvests of soft shell clams have been rising since 2002, driven by a spike in Chatham waters (Chart 5.) Like razor clams, soft shell clams appear to be generating large amounts of larvae, which enhance the wild population. Figure 16 shows soft shell

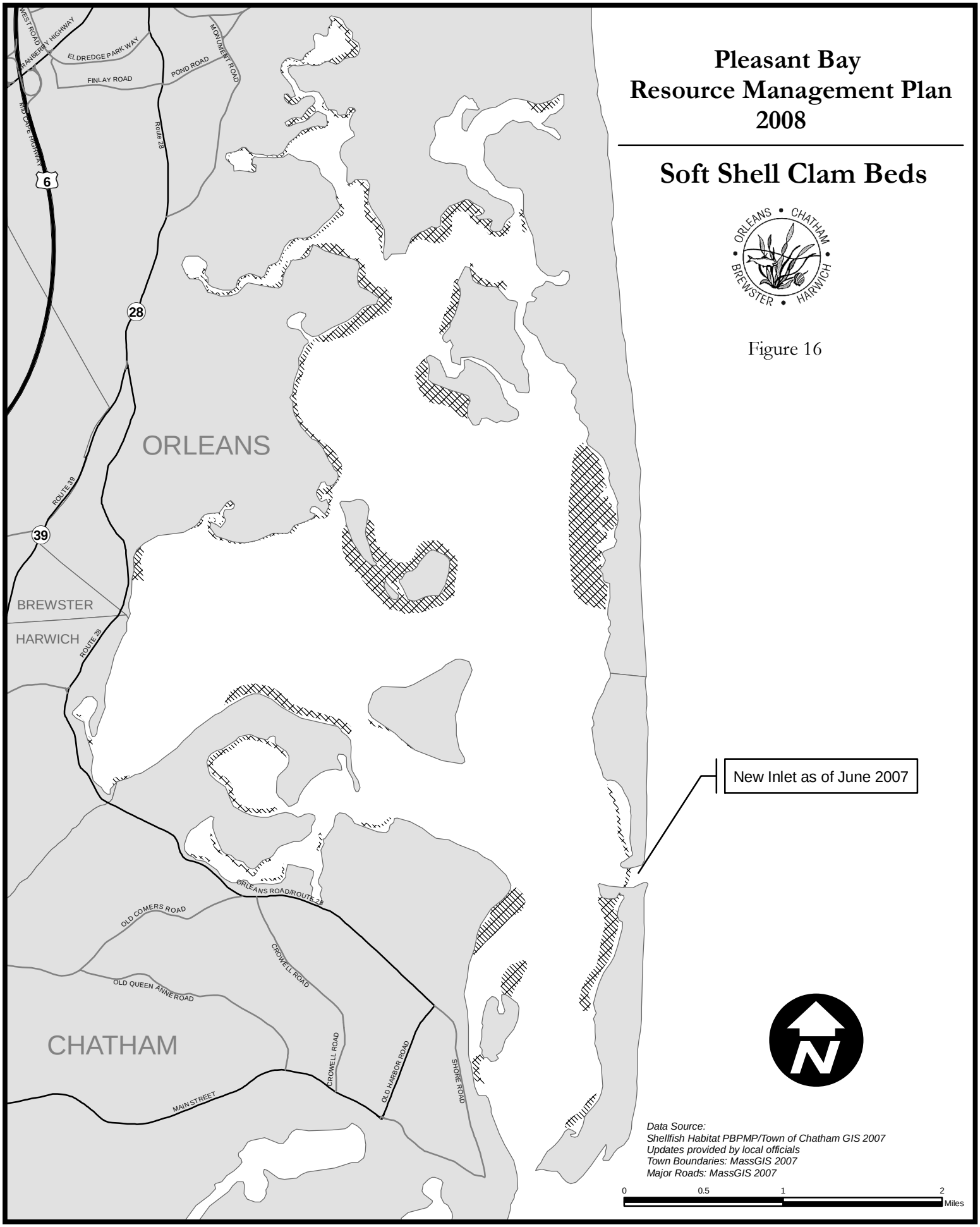


clam beds in Pleasant Bay.

Pleasant Bay Resource Management Plan 2008

Soft Shell Clam Beds

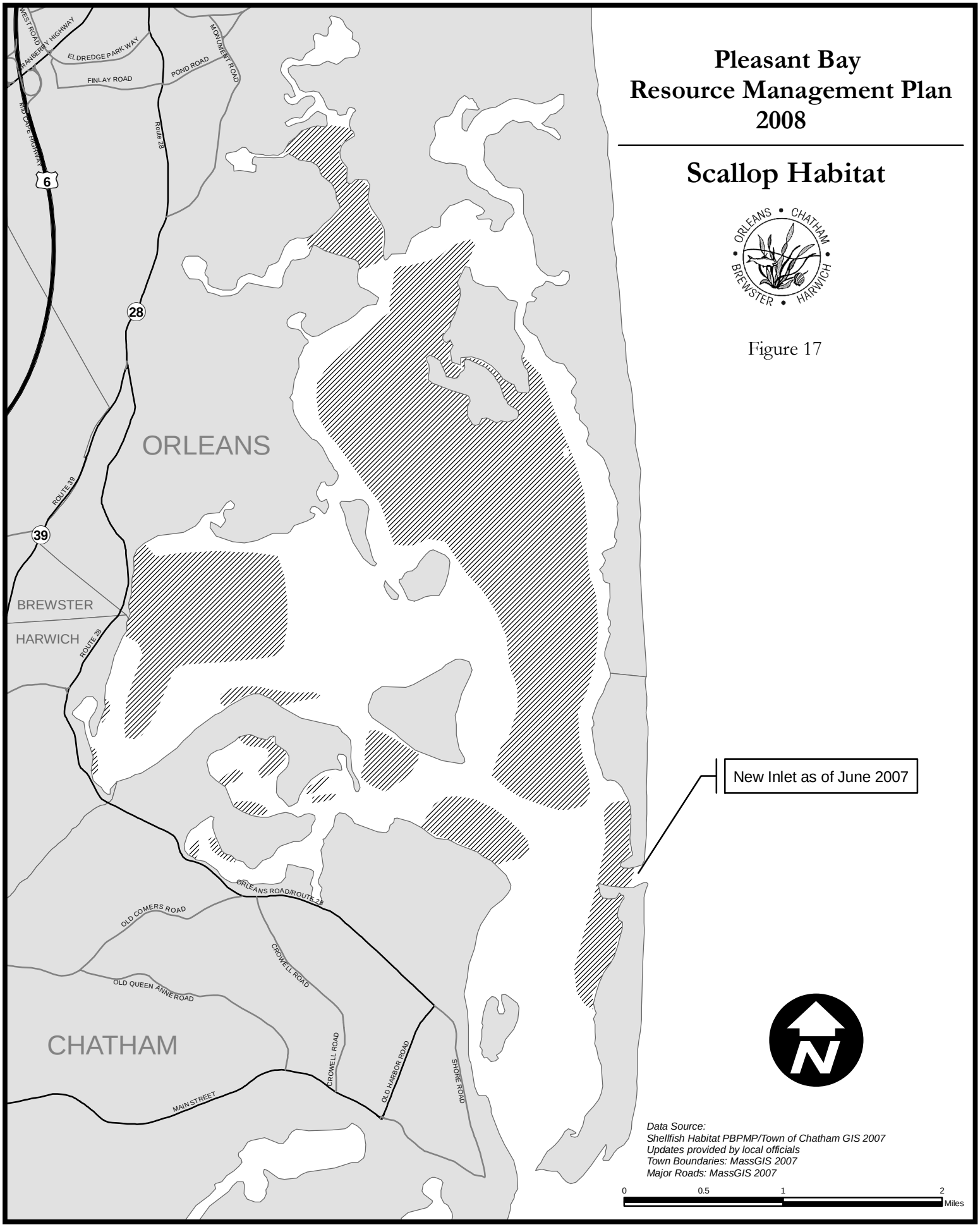
Figure 16



Pleasant Bay Resource Management Plan 2008

Scallop Habitat

Figure 17



Data Source:
Shellfish Habitat PBPMP/Town of Chatham GIS 2007
Updates provided by local officials
Town Boundaries: MassGIS 2007
Major Roads: MassGIS 2007

Scallops

Scallop harvests have been nearly non-existent in Pleasant Bay for nearly two decades (see Chart 6 above.) As with other species, the causes of the decline are unclear. Loss of eelgrass habitat has been cited as a possible influence on populations of this highly mobile species. Eelgrass coverage in Pleasant Bay declined 24 percent from the 1950's to the 1990's, according to the MEP. The complex predator community may also play an important role in the decline of this species. Field observations from the Barnstable County Cooperative Extension Service have noted the presence of seed scallops in some areas, but fewer adults.[3] The reason could be lack of eelgrass to provide a nursery for juveniles. Figure 17 shows scallop habitat in Pleasant Bay.

Finfish

The Bay's thirty-six finfish species are also a highly valued and ecologically significant resource. Pleasant Bay is well known as one of the most popular sport fishing areas in the state. Flounder, eel, and lobster are among the Bay's commercial fisheries. Several offshore commercial species -- American eel, winter flounder, white hake, pollock, and menhaden -- rely on the Bay's warm waters and extensive marsh areas to provide nursery areas. Numerous conditions influence the productivity of the Bay's finfish species. Significant trends include the virtual disappearance of winter flounder, and the resurgence of bass and blue fish stocks. Also, there are two active alewife fish runs, and four historic, but inactive, runs.

In summary, Pleasant Bay continues to support a vibrant recreational fishery for several species. Commercial shellfishing of quahogs and scallops has diminished over the past decade, while other species such as razor clams and soft shell clams have provided new opportunities. Within the Bay, finfishing is almost entirely a recreational activity, featuring bass and bluefish.

The exact causes for the decline in harvests are unknown, but it is widely believed that dwindling harvests reflect diminished populations of most of these species. Possible causes for the apparent declines in shellfish and finfish populations include:

- Fishing pressure, caused by over-fishing in certain areas, or use of poor techniques;
- Juvenile mortality;
- Loss of predatory equilibrium;
- Environmental stress resulting from the formation of the Chatham breakthrough;
- Presence of non-point source pollutants in the water column and bottom;
- Natural species growth cycles;
- Emergence of alternative species; and
- Loss of habitat, primarily eelgrass.

In response, the 1998 plan called for enhanced fisheries management, more active propagation, and further study on the status of shellfish and finfish populations. As described below, the Alliance and the towns individually have made progress in

[3] Comment by Diane Murphy, Barnstable County Cooperative Extension Service at a public forum on Pleasant Bay Fisheries held June 28, 2007 at Orleans Town Hall.

implementing the plan's earlier recommendations, and in identifying and addressing emergent issues, such as disease and invasive species.

6.2 Resource Management Issue: Shellfish Management and Propagation

Shellfish populations live in a dynamic environment that is subject to constant change. One change on a grand-scale is the formation of the new inlet following the 2007 Patriot's Day storm. More information is needed to determine how this physical change may have altered habitat conditions for many species. On another front, significant efforts are underway to reduce the negative effects that sustained nitrogen loading may have had on shellfish and finfish habitats in the Bay. These efforts should result in improved water quality and more vibrant eelgrass growth throughout the Bay, but may occur slowly over a period of several years. It remains to be seen how shellfish and finfish populations will respond to changing conditions and whether species such as quahogs and scallops will ever regain populations needed to support commercial fishing. Nevertheless, recreational shellfishing is an important part of the Pleasant Bay experience, and is an important form of stewardship. The thrust of shellfish management recommendations over the next five years will continue to be on increasing the productivity of the wild shellfisheries for recreational or commercial harvesting, through strengthened shellfish management and enhanced propagation efforts.

6.3 Recommendations to Enhance Shellfish Management and Propagation

6.3.1 *Enhance wild fisheries*. Evaluate the potential for enhancing the wild quahog fishery through the following measures:

- Establishing a spawning sanctuary centrally located in the Bay, which would help sustain an adult population capable of generating sufficient amounts of larvae. This would also protect razor and soft shell clams, as well as birds, horseshoe crabs, and other species;
- Rotating heavily used shellfishing areas for closure, to allow time for stocks to replenish;
- Establishing one or more private aquaculture grants that are not harvested or are minimally harvested for the purpose of generating quahog larvae.

6.3.2 *Support local propagation efforts*. Continue to support the towns' efforts to increase the effectiveness of propagation, and strengthen enforcement of shellfishing regulations.

6.3.3 *Mark town boundaries*. Pursue the re-establishment of a series of buoys to demarcate town boundaries, particularly at Strong Island, North Beach and Big Bay. On-going monitoring of boundary markers will be required.

6.4 Management Issue: Disease, Pest and Invasive Species

The massive New England Red Tide[4] Bloom of 2005 was a sober reminder of the uncontrollable factors that influence the viability of Pleasant Bay's fisheries. An all time record of 1,351,265 acres or 77.4% of Massachusetts's marine waters in forty-two communities were closed to shellfishing, including all of Pleasant Bay. Fortunately, the closure was precautionary and Pleasant Bay was not contaminated by this red tide outbreak.

Another disease management issue concerns Quahog Parasite Unknown (QPX). It is fortunate that to date, QPX has not yet been identified in any public shellfishing areas in Pleasant Bay. QPX has only been observed in selected private grant areas in the northern portion of Pleasant Bay. However, Orleans shellfish managers are concerned about the incidence of QPX and continue to work with the Division of Marine Fisheries, the County, and regional scientific institutions to understand the causes of QPX and develop a management response.

Another management issue is the emergence of invasive species, which pose threats to the viability of shellfish. One long-established invasive species is the green crab. It is believed that the green crab was unintentionally transported to the US East Coast from Europe in the early 1800s. The crabs are voracious consumers of all varieties of shellfish as well as eelgrass. Another invasive species, Codium, is an aquatic plant that attaches to objects on the bottom. A characteristic of Codium is its ability to reproduce an entire plant from a tiny fragment. As a result, the algae is rapidly overtaking sections of bottom in parts of Pleasant Bay. More recently the Japanese shore crab has become established in the waters of the Bay, and its effects are not yet known.

The Massachusetts Coastal Zone Management has developed the *Massachusetts Aquatic Invasive Species Management Plan,* which should be consulted in the development of strategies for managing invasive species in Pleasant Bay.

6.5 Recommendations to Address Disease, Pest and Invasive Species

6.5.1 *Develop management responses to invasive species and diseases*. The Alliance should continue to work with the towns, Massachusetts Division of Marine Fisheries, the County Extension Service, Massachusetts Coastal Zone Management and regional scientific institutions to study and develop effective management response to QPX, red tide and invasive species. Best management practices and possibly predator control measures should be evaluated for their effectiveness, including impacts on shellfish and other aspects of the Bay's ecology.

6.6 Management Issue: Monitoring Fisheries

Questions about the reliability of shellfish harvest data as an indicator of species decline prompted a recommendation to conduct a shellfish and finfish assessment. The

[4] Alexandrium fundyense is the scientific name for the toxic strain.

assessment was intended to update a 1967 survey conducted by the Massachusetts Division of Marine Fisheries. While it was felt that such a study could produce interesting data on shellfish densities, greater long-term benefit would result from a greater understanding of the types and quantities of, and the natural and man-made influences on, shellfish and finfish habitat. A deeper understanding of habitat conditions would enable shellfish managers to focus on promoting conditions under which shellfish and finfish thrive.

6.7 Recommendation to Monitor Fisheries Habitat

6.7.1 *Conduct research on the status of Pleasant Bay's fisheries habitat*. The Alliance should work with the Division of Marine Fisheries, Barnstable County and regional scientific institutions to determine the best approach to long term monitoring of the Bay's finfish and shellfish habitat. The recommended approach should encompass:

- Inventory of shellfish and finfish species in the Bay, and assess density and productivity of various species;
- Develop a framework for long-term habitat monitoring;
- Evaluation of impacts on wild shellfish and finfish, including those related to water quality or from the construction, maintenance, or presence of shoreline structures; sustained fishing of marginal stocks; loss of predatory equilibrium; cyclical abundance phenomenon; non-point source pollutants in the water column and sediments; juvenile mortality; environmental stresses; and the productivity of alternative species;
- Potential for restoration of habitat for finfish species such as white perch, yellow tail flounder;
- Seal habitat and population trends, including potential impacts on fisheries; and
- Cormorant population trends and their impact on fisheries.

6.7.2 *Study Intertidal Habitats*. The Alliance will work with ecologists and scientists from the Cape Cod National Seashore to develop a GIS mapping project of intertidal areas categorized by tidal regime, sediment type, and vegetative cover. This information should provide valuable information the conditions and dynamics affecting shellfish habitat areas (See also recommendation 3.8.3.)

6.8 Management Issue: Managing Private Aquaculture

Private aquaculture remains only within the areas specified in the plan. Since the plan was adopted, no new grants have been permitted, but several existing grants have expanded contiguous to existing licensed areas. Currently there is a total of twenty-eight acres of private grant area with the potential for an additional twelve acres. The entire forty acres of current and potential grant area is located in Orleans (see Figure 18.)

Since the adoption of the plan the Town of Orleans has been working with the Massachusetts Division of Marine Fisheries, the Barnstable County Cooperative

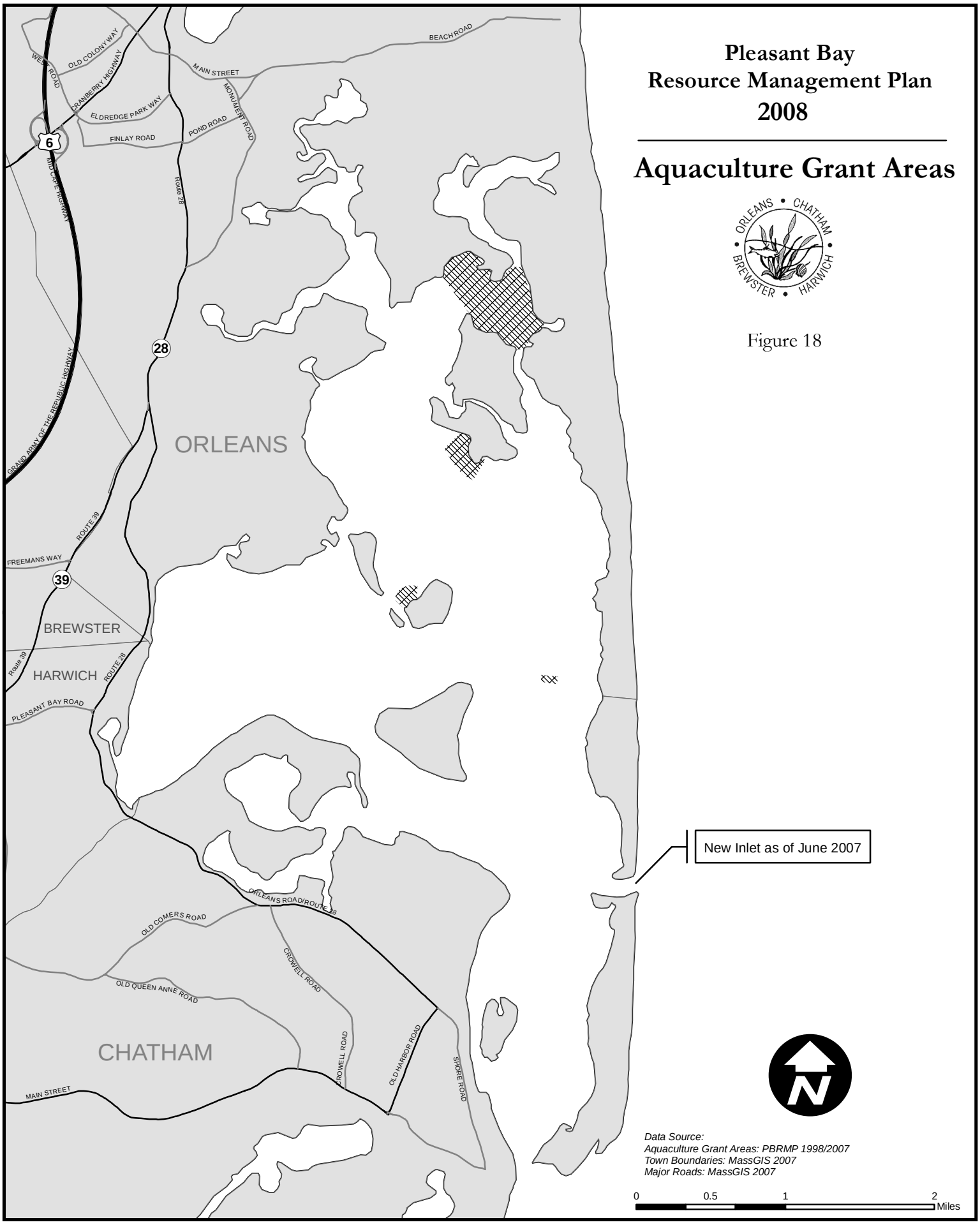
Extension Service, and regional scientific institutions to develop best management practices for grant holders, as recommended in the plan.

6.9 Recommendation to Manage Private Aquaculture

6.9.1 *Encourage adherence to aquaculture best management practices developed by the Massachusetts Division of Fisheries.*

6.9.2 *Guidelines for aquaculture expansion.* Develop guidelines for evaluating proposals for expanded or new aquaculture grants within ACMH (see recommendations 3.8.1-3.8.3.) The guidelines would ensure that alteration of a grant within an ACMH would only be allowed if:

- Compliance with all applicable local, state and regional regulations, policies and best management practices can be demonstrated;
- It can be documented and demonstrated that there will be no negative impact on other marine invertebrates, shorebirds, migratory birds, or other rare or endangered species; and
- Based on historical harvest data and an objective site investigation there is no likelihood of a natural recurrence of a wild shellfish population.



Pleasant Bay Resource Management Plan 2008

Aquaculture Grant Areas

Figure 18

Data Source:
Aquaculture Grant Areas: PBRMP 1998/2007
Town Boundaries: MassGIS 2007
Major Roads: MassGIS 2007

Chapter 7.
Coastal Processes and Coastal Structures

7.0 Overview

The outer barrier beach and inlet system that divides Pleasant Bay from the Atlantic Ocean continues to be the most significant physical feature in determining the health of the estuary. The barrier beach protects the Bay from the harsh impact of ocean waves, while the inlets control the ebb and flow of ocean waters. The beach and inlet configurations influences the flow, current strength and tidal range of water flushing in and out of the Bay and thereby affects the Bay's water quality, eelgrass, salt marshes and other natural resource conditions. It also influences shoaling patterns that affect navigation, and the deposition and erosion of sediments along the shoreline.

Awareness of the close link between the barrier beach and inlet system and the overall health of the estuary grew dramatically in the two decades following the formation of the 1987 Chatham break. In recent years, the observed thinning of portions of the barrier beach and periodic small scale overwash events sparked new speculation about the fragility of the barrier beach and the possibility and implications of changes in the inlet configuration. In 2006 the Alliance hosted the *Pleasant Bay Symposium: Managing a Dynamic System*, where regional specialists explained the dynamics of the inlet and beach system and its influence on resource conditions throughout the Bay. The MEP Technical Report for Pleasant Bay released that same year underscored the importance of the inlet and its influence on tidal flushing as it relates to measuring and addressing nitrogen overloading from watershed land uses.

Almost a year to the day following the symposium, an extended storm system settled off the coast of the Northeast, delivering storm surges fueled by astronomically high tides. The so-called *Patriot's Day Storm* caused an over-wash in a narrow area of the barrier beach across from Minister's Point in North Chatham, approximately 1.8 miles north of the existing Chatham Inlet. Initially it was felt that the new breach would quickly fill in with the southerly littoral drift of sediment. However, it quickly became apparent that the new inlet was, in fact, widening and deepening[1].

Presently both the 1987 and 2007 inlets are allowing tidal waters to flow in and out of the Pleasant Bay system. While many questions remain concerning the implications of the new inlet, there seems to be growing consensus on a number of important points:

- The new inlet is not likely to fill in naturally and can be reasonably expected to continue to grow.

- The new inlet and the 1987 inlet are likely to co-exist for a period of time, and ultimately the new inlet is expected to become the more dominant of the two.

[1] Chatham Breach closure briefing document, Chatham Coastal Resources Department, June 11, 2007

- The new inlet is exposing portions of the interior shoreline to higher energy waves and may result in increased water levels, flooding and erosion.

- With the new inlet in place, there is a potential shift in the dominant sediment transport patterns. The portion of North Beach now isolated by the new and existing inlets would be expected to erode over time as the northerly flow of sediment from Nauset Beach will be interrupted by the new inlet. Eroding sediment from this isolated portion of beach may cause westward shoaling over time.

- The new inlet is expected to result in improved water quality in the Bay, particularly in the upper reaches of the Bay. Further study is needed to determine the extent and duration of this improvement.

- While the inlet has resulted in the "shoaling in" and the potential for rolling over of the barrier beach onto some eelgrass and shellfish beds, these impacts have been localized to date and the improvement in water quality and increased tide range are expected to result in a net improvement in resource conditions throughout the Bay.

In the coming five years the Alliance will focus on deepening our understanding of the management implications of the new beach and inlet configuration, and using that information to support system-wide management. As described in more detail in the remainder of this chapter, on-going resource management activities will fall into three areas:

- Sediment Management;
- Permitting Guidelines and Best Management Practices for Coastal Structures; and
- On-going study and research.

7.1 Resource Management Issue: Sediment Management throughout the Bay

A likely impact of the new inlet formation is increased shoaling, particularly in the triangular area formed by the new inlet to the east, Minister's Point to the west and Strong Island to the north. The 2003 plan update noted that waterways managers had noticed an increase in shoaling in channels not previously dredged. One such example is the channel located roughly between Minister's Point and the entrance to Bassing Harbor. This shoaling trend may continue as existing and new sand washing into the Bay continues to be moved by currents in this area.

Similarly, shoaling is likely to continue to occur in Chatham Harbor as the isolated portion of barrier beach located between the southern and northern inlets begins to erode and sediment is moved by tidal action toward the mainland shore.

While shoaling is occurring in the eastern part of the system, many sections of the mainland shoreline are experiencing a diminished sediment supply. This is believed to be partly the result of increased coastal armoring of the mainland shoreline, which prevents erosion and littoral flow of sediments from coastal banks. Under normal

circumstances, winds, currents and tides hit a coastal bank and, depending on the profile of the bank and its vegetation, erode the bank's sediments. Eroded sediments are transported by winds and currents to the beach at the base of the bank, to elsewhere along the adjacent shoreline, or back out to sea. This natural action ensures that beaches are replenished with sand, which is continually removed by tides and storms, and adds nutrients to intertidal and fringe marsh vegetation. Without the erosion of coastal banks - the primary source of sand - nearby beaches, dunes and barrier beaches would rapidly disappear, jeopardizing landward salt marshes, tidal flats and the extensive plant and animal life they support.

The main impacts of hard structures include a diminished supply of sediments available for natural beach nourishment, and increased turbulence associated with breaking waves. Both of these impacts may contribute to lowering the profile of beach fronting the structure. Within Pleasant Bay there is indication of beach loss from erosion control structures. Regular beach nourishment is occasionally a mitigation requirement for the licensing of hard structures. In practice, however, beach nourishment is often unfeasible, neglected, or poorly executed, resulting in expenses for owners without the intended mitigation effects.

Shoaling from an influx of sediment in the eastern portion of the system, and erosion from the loss of sediment on the western shore present distinct management challenges. However, both are best addressed on a system-wide basis. Historically, dredging, dredged material disposal and beach nourishment are managed by individual towns. As pointed out in the 2003 update, a system wide approach is needed to prioritize areas for dredging and material disposal in order to protect habitat and allow for continued safe navigation.

7.2 Recommendations to Address Sediment Management throughout the Bay

7.2.1 *Develop a Bay-wide Sediment Management Plan*. The plan would provide a comprehensive assessment of sediment dynamics in the Pleasant Bay system, including future trends, and would be intended to guide local policies and projects for dredging, disposal of dredge material, and review and permitting of erosion control structures and beach nourishment projects. The plan would recognize the unique sediment management challenges of an estuarine system, which often include shallow depths, limited access, narrow beach widths and awkward shoreline angles for pumping dredged material. Elements of the plan would include, but not be limited to:

- Assessing the potential needs, benefits and detriments of maintenance and improvement dredging in specific locations throughout the Bay and prioritize areas where it is determined dredging may be needed or desirable;
- Identifying and prioritize areas for accepting dredged material for purposes of shoreline stabilization, habitat restoration and protection of public access, consistent with Chapter 91 regulations;
- Identifying priority areas for proactive beach nourishment;
- Identifying strategies for disposing of fine grained or other material not compatible for beach nourishment;

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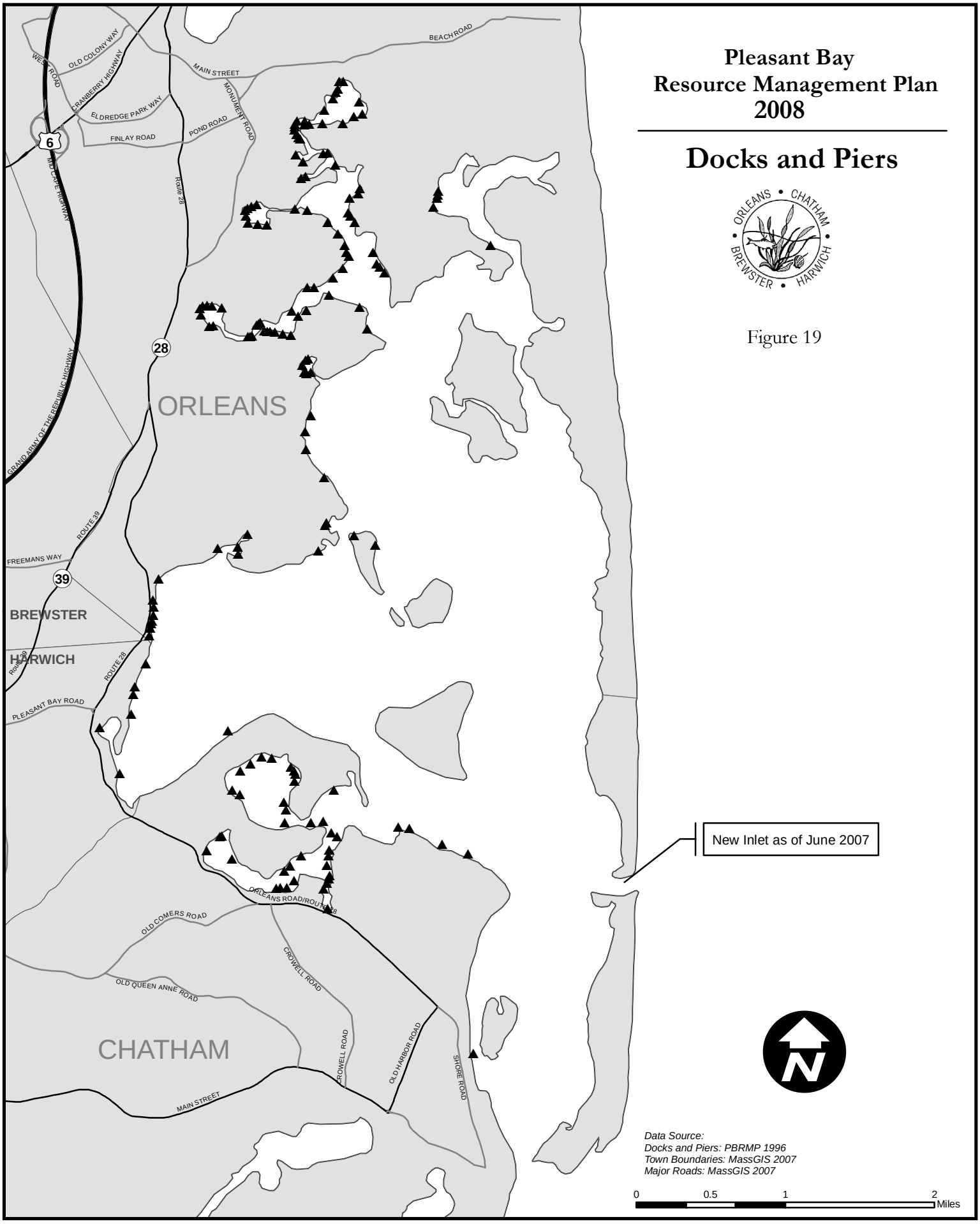
Docks and Piers

Figure 19



- Providing a starting point for permitting for dredging and material disposal on a system wide or intermunicipal basis.

7.2.2 *The Alliance should work with local Conservation Commissions to develop and promote adherence to best management practices for beach nourishment projects. The best management practices would be based on MassDEP's Guide to Best Management Practices for Beach Nourishment Projects in Massachusetts, but would be tailored to specific conditions in Pleasant Bay.*

7.3 Environmental Impacts of Coastal Structures

The 1998 plan documented the direct and indirect environmental impacts of structures on the Bay's resources. The harmful effects of docks and piers cited in the plan include blocking wind and tidal flow, shading of vegetation, chemical leaching from materials, and impacts from construction and removal. Impacts from erosion control structures stemmed from the concern that hard structures interfere with the natural erosion and re-nourishment processes in the Bay. The need for clear guidelines to assist towns with reviewing applications for marsh walkways is also recommended.

The priority status given to the regulation of docks and piers in the 1998 plan was based on the fact that a categorical restriction on the issuance of new Chapter 91 licenses for private piers had been placed in effect within the ACEC until such time as guidelines for permitting new structures was put into place. The 1998 plan provided a detailed resource assessment of the Bay's shoreline area that was used to identify areas where new piers would continue to be prohibited, and areas where piers could be permitted provided they met certain performance criteria and design standards. The plan also called for the categorical restriction to be extended until such time as the towns adopted new or revised policies and regulations consistent with the framework outlined in the plan. Figure 19 shows where existing docks and piers are located in Pleasant Bay.

The framework for permitting new docks and piers was subsequently developed into a comprehensive set of permitting guidelines (1999). Local Conservation Commissions and Planning Boards relied upon the guidelines to develop specific regulatory or bylaw changes necessary to bring local regulations into compliance with the resource management plan. The guidelines allowed the towns to achieve consistency in their treatment of docks and piers while working within the existing structure of local regulations. Although the guidelines were developed for Pleasant Bay, each town opted to apply many of the performance standards town-wide, resulting in a significant increase in the protection of coastal resources beyond the ACEC boundary. The Guidelines were approved by the Secretary of the Executive Office of Environmental Affairs, and are now relied upon in determinations of Chapter 91 license applications within the ACEC.

The Alliance undertook a similar approach in developing *Guidelines for Private Walkways and Stairways in Fresh and Marine Resource Areas In Pleasant Bay* (2002), and *Guidelines for Permitting Shoreline Structures on Freshwater Lakes and Ponds in*

the Pleasant Bay Area of Critical Environmental Concern (2007). The respective guidelines were submitted to the towns for implementation and to the state for approval.

Some areas of the Bay and types of structures are not specifically addressed in any of the guidelines noted above. These areas include:

- Erosion control structures
- Docks or piers along the shoreline of the Bay Islands and Muddy Creek
- Other types of structures that could be placed along any shoreline areas including, but not limited to, anchored floats, outhauls, and ramps.

7.4 Resource Management Issue: Environmental Impacts from Erosion Control Structures

When the 1998 resource management plan was written, approximately 22,627 feet of Pleasant Bay's shoreline was protected by erosion control structures. There were 103 revetments, 25 bulkheads, and only five soft solutions in the study area. As can be seen in Table 4, there has been some change in these numbers.

Table 4: Erosion Control Structures on Pleasant Bay

	Orleans	Brewster	Chatham	Harwich	2007 Total	1998 Total
Bulkheads	10	--	14	3	27	25
Revetments	25	1	64	15	105	103
Soft Solutions	8	--	20	--	28	5
Total Number	43	1	98	23	165	133

A proliferation of hard structures could diminish the Bay's natural erosion and nourishment processes, resulting in the loss of beach height and vitality, and vegetated marsh. While use of hard structures may be called for in certain cases, there is continuing concern that use of hard structures may be installed in situations where soft solutions could work be effective with fewer negative impacts on surrounding resources. Figure 20 shows hard structures located in Pleasant Bay, and Figure 21 shows the location of soft structures and beach nourishment areas.

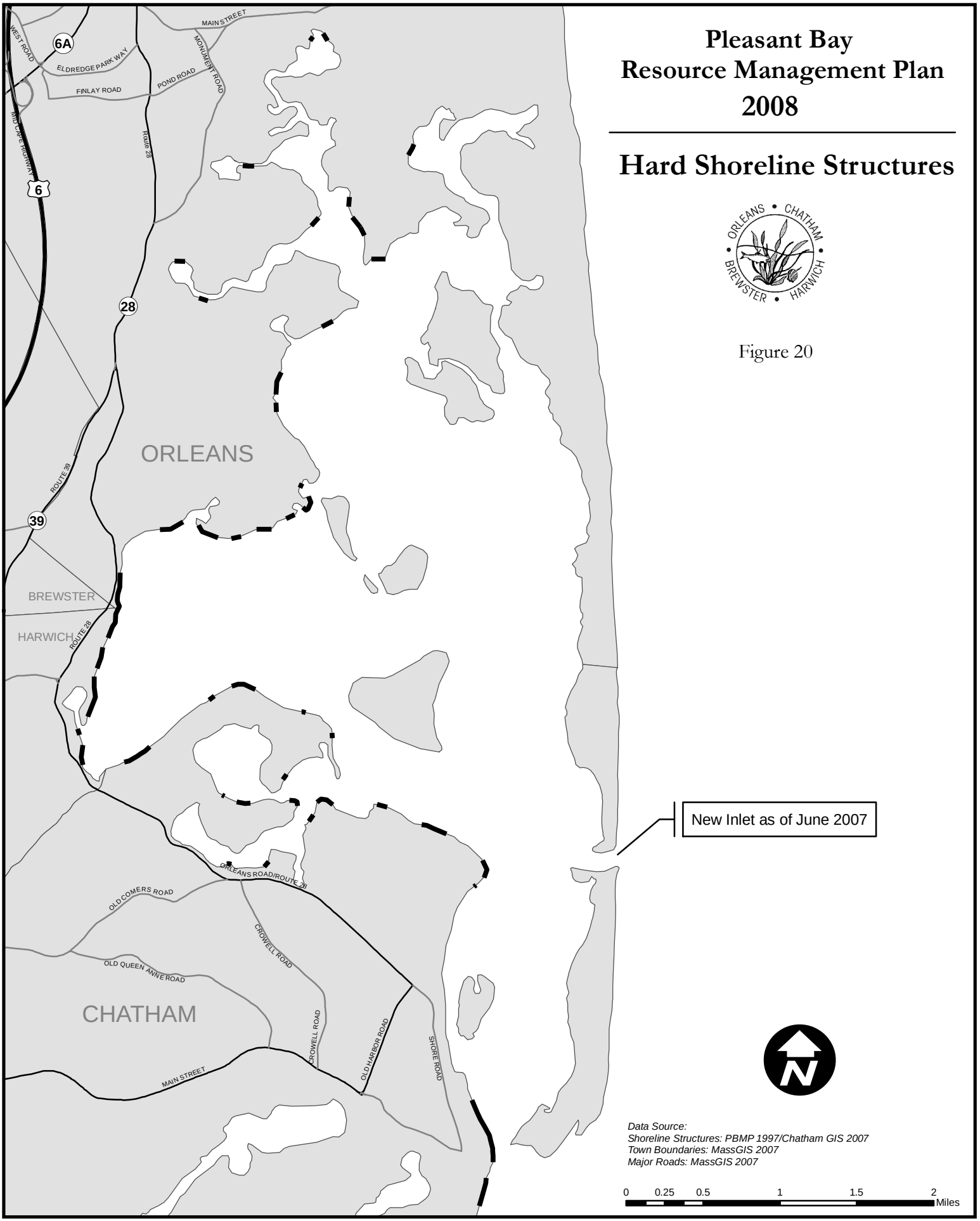
Among the areas experiencing a loss of sand and a change to a stony shoreline is the southern portion of shoreline around "Big" Pleasant Bay. This is occurring because the erosion of the protected bluffs no longer provides fresh sediment. This area includes Jackknife Harbor in Chatham, Bay Road Beach in Harwich, and the Route 28 beach area and town landing in Orleans, which constitutes the only public beachfront on the Bay, as well as a number of private properties. Protection against the loss of these beach areas is warranted. By comparison, the southeast shore, where there are few erosion control structures, remains sandy or covered with beach grass.

Hard structures can have impacts on other resources and public access, as well. Use of heavy equipment in the construction of erosion control structures or for gathering nourishment sand from down-drift areas can crush near-shore shellfish and vegetation.

Pleasant Bay Resource Management Plan 2008

Hard Shoreline Structures

Figure 20



Data Source:
Shoreline Structures: PBMP 1997/Chatham GIS 2007
Town Boundaries: MassGIS 2007
Major Roads: MassGIS 2007

0 0.25 0.5 1 1.5 2 Miles

Local shellfishermen have noted that shellfish beds in areas traversed by heavy equipment can be destroyed and may require several years to revive, if ever.

Revetments, sea walls and other hard structures are also notorious for impeding lateral access along the shoreline. This effect is exacerbated as beaches at the base of the structure are washed away and not effectively re-nourished. Structures seeking a Chapter 91 license are supposed to provide access for fishing, fowling and navigation by doing such things as installing signs stating that persons with legal public access may traverse the structure. Stairs and platform walkways should also be required to provide safe passage for fishers, fowlers, and navigators. Some erosion control structures on the Bay were built before the Chapter 91 public access requirements were in effect, and are not designed to allow for safe passage. Also, it is believed that some newly licensed structures are not in compliance with licensing requirements for public access. Structures built above mean high water are not held by such requirements, even though those structures may end up below mean high water due to erosion or sea level rise

The observed cumulative effects of hard structures on natural resources and public access in Pleasant Bay are significant. As a result, there is continuing concern that the number of hard structures should be limited in number and size, and that alternatives to hard structures should be utilized whenever they can be shown to provide ample protection of shoreline properties. Soft structures are already preferred by state and local permitting agencies because they provide substantial protection with minimum interruptions to beach nourishment and natural habitats. While soft structures may require frequent maintenance to remain effective, they may be less costly than hard structures in the long run.

7.5 Recommendations to Address Environmental Impacts of Erosion Control Structures

7.5.1 *Develop Performance Standards and Design Criteria for Erosion Control Structures*. Performance standards and design criteria should be developed for erosion control structures. Local and state permitting authorities would use the performance standards to assess situations where the use of hard structures is the only feasible alternative for erosion control. In such cases, the design criteria would be used to minimize negative environmental impacts from such structures. The design criteria for hard structures should address:

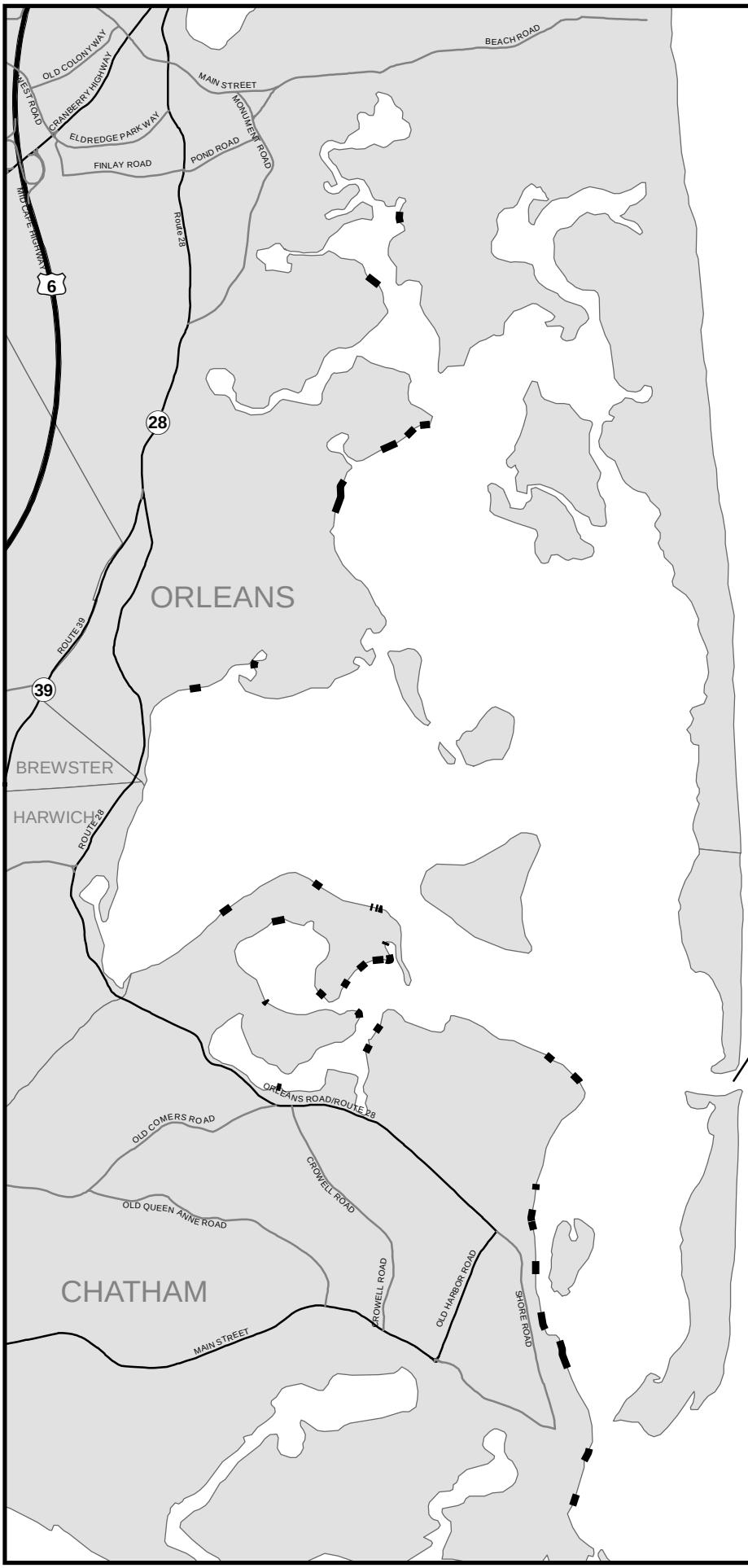
- Designing the height of the structure to allow sediment release during extreme storm events;
- Requiring “rough face” surfaces with the shallowest possible slope to displace wave energy and cut down on “end effect” erosion without resulting in a footprint that encroaches on resource areas;
- Constructing hard structures as far landward of mean high water as possible;
- Requiring 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;

Pleasant Bay Resource Management Plan

2008

"Soft" Shoreline Structures

Figure 21



Data Source:
Shoreline Structures: Town of Orleans/Town of Chatham
Town Boundaries: MassGIS 2007
Major Roads: MassGIS 2007

0 0.25 0.5 1 1.5 2 Miles

- Requiring vegetative covering and beach nourishment, either immediately following construction or when conditions allow; and
- Requiring 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;
- Requiring compliance with beach re-nourishment guidelines see 7.2.2.

Design criteria would also be developed for soft structures.

7.5.2 *Treatment of Erosion Control Structures Subject to Categorical Restriction.* Erosion control structures located within the boundaries of the ACEC below mean high water may be subject to the existing categorical restriction on new Chapter 91 licenses issued by MassDEP (310 CMR 9.32 (1)(e).) In such cases, state waterways regulations also allow for granting a license for purposes of shoreline stabilization, provided that reasonable measures are taken to avoid, minimize, and mitigate any encroachment in a waterway (310 CMR 9.3.2 (2).) Until such time as *Performance Standards and Design Criteria for Erosion Control Structures* as outlined in 7.5.1 above are adopted by the Alliance towns and the state, it is recommended that DEP apply regulatory discretion provided for in 310 CMR 9.3.2 (2) in its review of applications for Chapter 91 licenses for erosion control structures in the ACEC, and that in its review DEP give due consideration to the issues enumerated in 7.5.1 above and 7.5.3 below. Once guidelines and performance standards are completed in accordance with 7.5.1, adopted into regulation by the respective towns and approved by the state, they will replace the categorical restriction and provide guidance to DEP in issuing Chapter 91 licenses for such structures. Conservation Commissions are encouraged to adopt and apply the same performance standards and design criteria for erosion control structures that do not require a Chapter 91 license.

7.5.3 *Encourage Alternatives to Hard Structures.* Local and state permitting agencies should be urged to ensure that alternative measures to hard structures are utilized wherever possible to mitigate the effects of coastal bank loss. Areas of special concern include the southern shore of "Big" Pleasant Bay. These areas, which include public beaches and other access points, are experiencing a transition from sandy to stony beaches and loss of vegetation due to erosion and lack of sediment input. Use of hard structures in these areas could further decrease the sediment supply. It is important to note that some techniques that are considered soft solutions are becoming increasingly fortified in their application. One such example is the practice of wrapping fiber roles in wire and anchoring them. Fortified "soft" solutions function similarly to traditional hard structures and may generate similar impacts. These impacts should be carefully monitored, and mitigation methods outlined above under 7.5.1 should be applied as appropriate.

The selection of erosion control measures should be made with an understanding of all reasonable alternatives including the landward relocation of the structure and taking into account the entire profile of the resource area. For example, fortification or

restoration of fringe marsh could provide significant storm damage prevention and minimize the need for extensive fortification. The following is a partial list of alternatives to hard structures that should be considered:

- Bank restoration;
- Marsh restoration;
- Relocation of buildings away from the eroding edge;
- Designing the structure appropriate to the rate and cause of erosion;
- Re-contouring of existing bank elevations;
- Vegetative plantings such as dune grass and other types of compatible vegetation;
- Proactive and maintenance beach nourishment;
- Soft structures such as fiber rolls.

7.5.4 *Study Building Relocation for Erosion Management*. A cost benefit analysis of building relocation as an alternative to installing erosion controls structures should be undertaken. The study should consider the financial and resource costs and benefits of building relocation in comparison with other alternatives, and should also look at the other regulatory issues that would associated with relocating structures, such as zoning, health and conservation requirements.

7.6 Resource Management Issue: Permitting Docks on Bay Islands and Backside

The Pleasant Bay study area contains eight small islands that constitute 13 miles of shoreline and the bulk of undeveloped open space in the ACEC and, indeed, the watershed.[2] In Orleans, Pochet, Little Pochet, Hog, and Sampson's Islands are owned by a private conservation trust and, with the exception of fifty acres on Pochet Island reserved for existing homes, are subject to a conservation restriction. Sipson's Island is privately owned and contains some residences. Little Sipson's is owned by the Orleans Conservation Trust. Strong Island in Chatham is owned by the Town of Chatham and the Chatham Conservation Foundation, with a long term lease for a private residence. Tern Island is owned by the Massachusetts Audubon Society.

When the resource assessment of shoreline areas was developed for the 1998 resource management plan, little attention was given to these island and barrier beach shoreline areas because it was believed that shoreline structures were precluded by their respective conservation status. Similarly, the backside of the barrier beach was not included in the analysis because it was within the boundary of the Cape Cod National Seashore. The extent of private interests in these areas was not fully recognized. As a result, the "Resource Assessment for Dock and Pier Impacts in Pleasant Bay" developed for the *Pleasant Bay Resource Management Plan* treated a combination of North Beach to the Pochet Bridge; and Strong, Little Sipson's, Sipson's, Sampson's and Hog Islands as a single area for the purposes of the assessment. The "Guidelines for Permitting Docks and Piers in Pleasant Bay", which is based on the assessment, did not make clear reference to these areas individually. In light of this, the Alliance's coastal processes

[2] Pleasant Bay RMP 1998, p.60.

work group considered whether further impact assessment of these areas was warranted, and whether the guidelines should be amplified or new guidelines should be developed and recommended to the towns to guide the review of permits for structures in these areas. With no further action by the Alliance, these areas would continue to be regulated by the existing conservation regulations and/or zoning bylaws applicable in each town, which reflect the Alliance's guidelines.

The work group concluded that the shoreline areas of the Bay islands and "backside" have a unique character and exemplary habitat value because they provide large, contiguous areas of open space, proximity to tidal flats which serve as feeding areas for migratory birds, relative isolation from Bay's mainland shoreline as well as significant scenic and aesthetic value. As such, these shoreline areas require application of the highest standards of protection.

7.7 Recommendation for Regulating Docks on Bay Islands and Backside

7.7.1 *Limit structures on Bay islands and Nauset Beach.* The shoreline areas of the Bay islands and backside of Nauset Beach are not suited to placement of new structures due to their unique habitat value. Structures in these areas should only be considered where they are necessary to provide safe and reasonable access, and only when it has been demonstrated that all alternative forms of access are impractical. In such cases where a structure is deemed necessary to provide reasonable access, it should be the minimal size necessary and must meet all applicable performance standards and design criteria as defined in the Alliance dock and pier guidelines and local and state regulations. Multiple structures on a single island or otherwise within 1,000 feet of another structure are strongly discouraged, and steps to promote sharing of structures among multiple user groups should be a condition of approval.

7.8 Resource Management Issue: Permitting Docks on Muddy Creek

Currently the categorical restriction on Chapter 91 licenses for new private structures remains in effect for Muddy Creek. Muddy Creek is not conducive to boating other than kayaking or canoeing, and there is no visible demand for shoreline structures. Route 28 blocks access to larger Pleasant Bay, and at this time there is no public access for boat launching. Steep slopes on either side of the Creek limit access by nearby private property owners.

Hydrodynamic and water quality analyses undertaken as part of the Massachusetts Estuaries Project evaluated the flushing and water quality improvements that could be obtained by re-installing an historic dike part way up Muddy Creek, causing the headwaters to become a freshwater system. The freshwater would provide natural attenuation of nitrogen. Currently the Alliance is working with the Town of Chatham and Harwich, which share Muddy Creek and its subwatersheds, to study the implications of this proposal.

7.9 Recommendation: Permitting Docks on Muddy Creek

7.9.1 *Continue Categorical Restriction in Muddy Creek pending study.* The Alliance has obtained a grant from the Cape Cod Water Protection Collaborative to study the wetland resource impacts, permitting requirements and cost allocation strategies for the dike re-installation. This information is critical to weight the costs and benefits of moving forward with this project. The categorical restriction on new Chapter 91 licenses for structures in Muddy Creek should be continued pending evaluation of the dike re-installation project. Reconsideration of the categorical restriction should occur once a determination is made on the feasibility and potential impacts of the dike re-installation.

7.10 Resource Management Issue: Permitting for Other Coastal Structures

Local conservation Commissions are seeing an increased number of applications for other types of coastal structures, such as outhauls, anchored floats, boat ramps, boat houses, decks and racks. Many of these structures are subject to the categorical restriction on new Chapter 91 licenses until such time as local regulations are brought into compliance with an approved resource management plan. These types of structures are not addressed in any of the guidelines previously developed by the Alliance and adopted by the towns or the state. The structures themselves, as well as the use of the structures, may have direct or secondary impacts on resources in the area, and may interfere with other waterways users.

7.11 Recommendation: Permitting for Other Coastal Structures

7.11.1 The Alliance should develop permitting guidelines for ancillary coastal structures not addressed by any existing permitting guidelines. These types of structures include but are not limited to: outhauls, anchored floats, boat ramps, boathouses, decks and racks. The guideline should consider direct and secondary impacts from the structures and use of them.

7.12 Management Issue: Continued Study of Coastal Processes and Shoreline Dynamics

The creation of a new inlet resulting from the Patriot's Day Storm has raised new questions regarding implications of the barrier beach/inlet system for resource conditions, public access, navigation, and shoreline alteration in Pleasant Bay and Chatham Harbor.

In reviewing potential management responses to the new inlet formation and current dynamics of the barrier beach system, the need for additional information has become more acute. The Alliance is working with a number of other partners to study trends and impacts associated with the new breach conditions and other coastal dynamics:

- Working with Dr. Graham Giese, the Cape Cod National Seashore and the Town of Chatham to collect and analyze tide gage data at Meetinghouse Pond and Chatham Fish Pier;
- Working with the Town of Chatham, U.S. Army Corps of Engineers and Friends of Pleasant Bay to update the hydrodynamic modeling of the Bay under the new dual inlet configuration;
- Working with MassDEP and the MEP to assess water quality implications of the new inlet configuration and alternate configurations; and
- Working with University of Rhode Island Coastal Geologist Mark Borrelli to track inner shoreline and marshline change.

7.13 Recommendations: Continued Study of Coastal Processes and Shoreline Dynamics

7.13.1 *Participate in developing and implementing a comprehensive approach to monitoring the barrier beach and inlet system.*

The comprehensive monitoring approach should encompasses:

- Sediment transport and erosion/deposition,
- Protection of shoreline resources, properties and public access points,
- Hydrodynamics of the two inlet system
- Assessment of water quality
- Barrier beach access,
- Barrier beach habitat and impacts to estuarine habitat from change in the barrier beach configuration, and
- Navigation.

7.13.2 *Continue support for tide gage monitoring.* In 2007 the Alliance began working with Dr. Graham Giese to expand the collection and analysis of tide gauge data in Pleasant Bay. The project looks at both the spectral components and harmonic constituents of the tides: spectral components to quantify the energy peaks within tidal frequencies; harmonic constituents to characterize the amplitudes and phases of the major constituents and the ratios between them. Changes in tide range and phase, as well as changes in tide distortion, can give valuable information about Pleasant Bay hydrodynamics and, in so doing, give indications of conditions that could lead to future changes in the barrier beach and inlet system. Currently tide gages are deployed at the Fish Pier (by Town of Chatham) and Meetinghouse Pond (by Cape Cod National Seashore.) Additional tide gage monitoring locations should be considered if indicated by the data analysis.

7.13.3 *Continue to monitor shoreline and marshline Change.* Shoreline Change Maps generated by Massachusetts Coastal Zone Management did not include information on erosion rates for the shoreline of Pleasant Bay. Information on historic erosion rates is necessary for evaluating coastal wetlands resources in terms of their value for storm

protection, and sediment supply. A primary reason for monitoring erosion rates is to determine or document the need for a shoreline structure.

The Alliance sponsored a study of shoreline based on maps and aerial photography from 1868 to 2005. The study found that, although there was little change in the shoreline of Pleasant Bay measured from the High Water Line over the137 year period, there were areas of both marsh growth and depletion during this same time period.

7.13.4 *Continue to Build an Archive of Aerial Image*ry**.** As part of the shoreline marsh line changes study, Mark Borrelli compiled aerial photography dating back to 1938. The imagery was identified and digitally archived for historical reference. The new and historical aerial photography provide an indispensable resource for monitoring shoreline dynamics, changes in aquatic vegetation and shoaling patterns.

Included in the archive are the aerial images generated from the comprehensive aerial flyovers of Pleasant Bay in 2000 and 2005. These flyovers should be continued every five years, or more frequently if circumstances warrant. The high-resolution digital aerial images provide an invaluable tool for resource managers involved with wetlands protection, erosion management, and navigation.

Chapter 8
Waterways Safety and Navigation

8.0 Overview

Boating for recreational and commercial purposes continues to be one of the most popular uses of Pleasant Bay. Both the 1998 plan and 2003 update noted an increase in the intensity of boating activity in the Bay. The plans also cite a number of management issues related to boating:

- Environmental impacts from motorized vessels, which will increase as boating activity intensifies;
- Boating congestion, and conflicts between different types of vessels;
- Growing demand for moorings, and the associated impacts on resources and boating congestion; and
- Anticipated needs for dredging projects to maintain existing channels, or to restore or create channels for navigation or Bay flushing.

In response to these concerns, the 1998 plan and 2003 update call for stronger and more coordinated management of the Bay's waterways, and other measures to balance boating with natural resource protection. A direct outgrowth of the plan was the formation of a coordinated bay-wide patrol. The coordinated patrol was established in 1997 and has been operational every boating season since that time. Features of the bay-wide patrol include:

- Each town added patrol staff time to the Bay;
- Patrol schedules are coordinated to ensure adequate patrol coverage at all times;
- Patrol staff are cross deputized to facilitate quick response to transgressions regardless of town boundaries; and
- Radio and telecommunications have been improved to facilitate direct communication between the different town patrols in the Bay to report situations and request support.

In the five years ahead, the Alliance will continue to support coordinated management of the Bay's waterways, as outlined in the original plan and 2003 update, and address emerging concerns described below.

8.1 Resource Management Issue: Safety and Navigation

Back in 1998, strong public concern about the environmental and safety impacts of personal watercraft (PWC) prompted the Alliance to work with the towns, the Cape Cod National Seashore and the Massachusetts Environmental Police, to adopt and implement a bay-wide ban on PWC operation in Pleasant Bay. The elimination of PWC is believed to have reduced confusion on the water concerning the *Rules of the Road.* However, it is acknowledged that an unseasoned boater can still create a lot of chaos. Too often problems occur because boaters fail to exercise common sense and common courtesy. At

a recent forum on boating issues in Pleasant Bay attended by harbormasters and members of the public, a list of remaining issues of concern regarding boating safety were discussed. These included:

- Boating activity has intensified during the boating season, especially on the weekends. It is believed that there are more boats on the water during these times, and many of these boats are larger and more powerful than a decade ago. This increases the potential for boating conflicts, and heightens potential environmental effects from waking and mooring.
- The boating season has become longer. Whereas the season used to last from Memorial Day to Labor Day, it now extends well into October. This increased boating activity extends the need for harbor patrols.
- Public education is needed to re-enforce the existing regulation that "no wake speed" is required within 150 feet of a mooring field or swimming area or the shore, and that "headway speed" is required within 150 ft to 300 ft of a swimming area.
- There is a noticeable increase in kayaking on the Bay, with added confusion regarding powerboats and sailboats. Kite sailing and tubing are also more prevalent, increasing the potential for conflicts with other vessels.

The following recommendations are provided in response to these concerns.

8.2 Recommendations to Address Safety and Navigation

8.2.1 *Continue the coordinated bay-wide patrol*. The Towns of Orleans, Chatham and Harwich should continue to coordinate harbor patrols and should fund additional patrol personnel hours if harbormasters find such an increase necessary to maintain adequate patrol coverage.

8.2.2 *Deploy navigational aids and designate speed controls as needed*. Navigational aids and speed controls should be used, as needed, in congested areas or where necessary to protect resources or guard against excessive speeds. Figure 23 shows Existing No Wake Zone in Pleasant Bay. Other areas that have been identified as having the potential need for additional aids or speed controls and should be carefully monitored include the area around Minister's Point (due to shoaling) and The River.

8.2.3 *Evaluate opportunities for potential changes in waterways regulation or policies to promote safe and appropriate use of recreational equipment and activities*:

- Kayaks, canoes, kite-boards, towed tubes, water skis, and swimmers should be prohibited from operating in marked navigational channels unless crossing at a safe location;
- Marker buoys should be placed to delineate swimming public swimming areas; and
- Relocation of lobster pots should be undertaken by appropriate town officials as necessary if pots are located in areas where channels are narrow.

8.12.1 *Undertake a public education campaign.* A public education campaign targeted to local and transient boaters should be undertaken to reinforce the recommendations of the resource management plan. The campaign should encompass informational brochures, signs at public landings, seminars, media, advertising, and public forums, and should address:

- Waterways regulations, and penalties for non-compliance;
- Environmental benefits of newer two- and four-stroke engines in terms of fuel efficiency and lower emissions;
- Operating and maintenance procedures designed to reduce impacts on natural resources;
- Unregulated boating protocols;
- Procedures concerning aquaculture grant areas;
- Appropriate use of town landings; and
- Resource sensitive areas.

8.3 Resource Management Issue: Managing Use of Town Landings and Other Access Points

Because so little of Pleasant Bay's shoreline is publicly owned, the number and variety of public access points are vitally important. Recent trends suggest that demand for access to the shoreline for boating, beach activities, shoreline walking, and other uses is on the rise. As demand for access continues to grow, additional stresses will be placed on the limited number of existing access points. This trend has heightened concerns about whether existing access points are adequate to accommodate current and future demand while preserving fragile resources.

Most public access points on the Bay do not provide facilities or services for public support such as public transportation, restrooms, picnic tables, and benches are limited. Signs and historic markers pointing out the Bay's maritime history, or examples of natural phenomena such as barrier beach evolution, and biology, are extremely limited.

Of the thirty open public access points located along the Bay, of which twenty-six are town landings (See Table 7, Chapter 9.) Of these, nine have boat ramps, and an additional four are suitable for small boat launching. The observed increase in boating activity in the Bay is coupled with more intensive use of boat ramps. When the plan was developed in 1998, River Road, Ryder's Cove and Round Cove were the most heavily used boat ramps. While that is still true today, use of other boat ramps and launch areas has on the Bay has intensified, notably at Quanset Pond, Meetinghouse Pond, and Paw Wah Pond. One result of heavy use at town landings is an increased number of dinghies left on shore. The placement of the dinghies, as well as the dragging of them back and forth to the water, can cause erosion and damage to shoreline vegetation. Where most landings are very limited in size, placement of dinghies can also encroach on neighboring property.

8.4 Recommendations to Manage Use of Town Landings and other Access Points

8.4.1 *Promote a high level of public maintenance and investment at all town landings and public access points, especially the heavily used boat ramps at River Road, Round Cove and Ryder's Cove.* Town landings and ramps provide critical access to Pleasant Bay waterways and support a wide variety of recreational and commercial activities. Heavy use of landings and ramps may require more frequent investments in maintenance and improvements. Adequate signage should be provided to mark the limit of the landings and other relevant regulations and policies.

8.4.2 *Promote steps to reduce impacts of dinghy storage at town landings.* Towns are encouraged to provide one or more courtesy dinghies at town landings where there are mooring fields with heavy access demands, to cut down on the need for storage at the landing. In locations where dinghies are causing excessive erosion, damage to vegetation or encroachment on private property, other efforts to limit dinghy storage should be considered. These could include public education efforts aimed at encouraging boaters to bring dinghies back and forth rather than leaving them at the landing or, alternatively, issuing permits for dinghy storage.

8.4.3 *Monitor commercial activity occurring at town landings*. Unless special permission is granted, commercial activity at town landings is limited to transactions for the sale of shellfish or finfish. However, there is increasing interest in using for kayak, seal, small tackle fishing or other commercial tours or launches. While these activities are not currently observed as causing undue pressure, they should be monitored and, if warranted, steps to regulate such activities should be considered. A model for the regulation of commercial activities at landings is Chatham's Policy for Town Landings and Water Dependent Properties. The policy establishes a special permit process to manage private activities at town landings.

8.5 Resource Management Issue: Dredging and Material Disposal

Maintenance dredging is allowed within ACECs. The plan recommended that maintenance dredging be allowed to continue provided that it met all local, state, regional and federal permitting requirements and is consistent with the plan. Figure 22 shows locations of maintenance dredging and material disposal in Pleasant Bay. Since the plan was adopted in 1998, maintenance dredging within the ACEC has occurred only at the Round Cove entrance channel and Ryder's cove bulkhead. Dredged material from Round Cove was used to re-nourish the Bay Road Beach and Round Cove Barrier Beach in Harwich. Within the Pleasant Bay study area since 1998 dredging has occurred in Chatham Harbor to allow access to Aunt Lydia's Cove. Some dredged material from those projects has been used for beach and shoreline stabilization within the ACEC.

Local waterways managers in the Alliance towns have identified areas that have traditionally been navigated that are experiencing shoaling. However, there is no record of these areas ever having been dredged. Dredging of these channels would be

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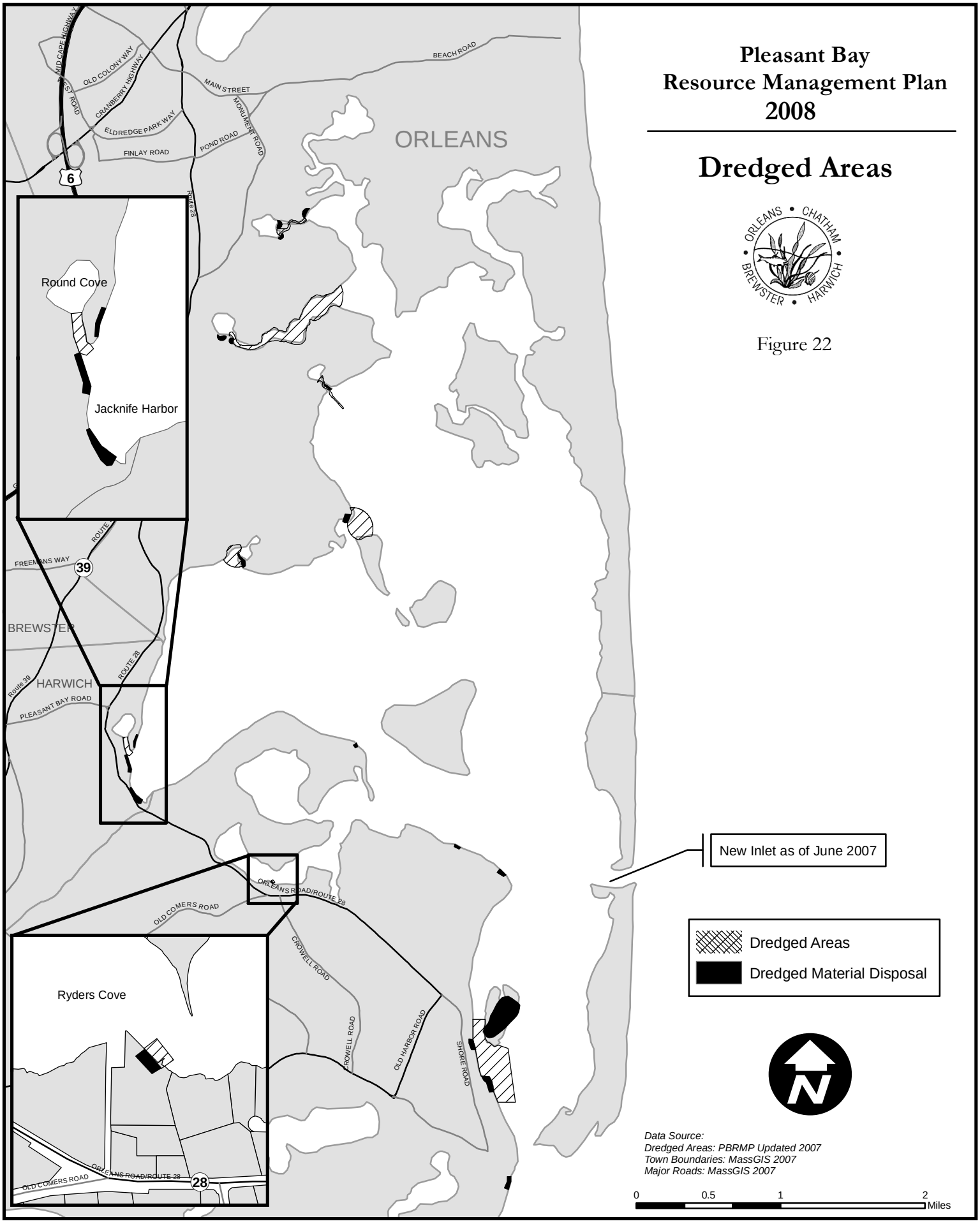
Dredged Areas

Figure 22



considered improvement dredging. The state Waterways Regulations (Chapter 91) prohibits improvement dredging within ACECs except for the purposes of fisheries or wildlife enhancement.

The state's Waterways (Chapter 91) Regulations prohibit the disposal of dredged materials within an ACEC, except for the purposes of beach nourishment; or stabilization with proper vegetative cover; or the enhancement of fishery or wildlife resources. (310 CMR 9.40 (1)(b)). Any proposals to dispose of materials from dredging projects within the study area should be required to demonstrate consistency with the resource management plan, and to meet all local, state and federal environmental permitting requirements.

Currently, material from dredging is disposed of within the town undertaking the dredging. Greater system-wide benefits could be achieved by locating the material where it could provide the maximum benefit for beach nourishment; or stabilization with proper vegetative cover; or the enhancement of fishery or wildlife resources, regardless of town boundary.

8.6 Recommendations to Address Dredging and Material Disposal

8.6.1 *Continue maintenance dredging as needed*. Maintenance dredging should be allowed to continue provided it meets all applicable permitting requirements and is consistent with the resource management plan and updates.

8.6.2 *Evaluate implications of improvement dredging*. As part of the sediment management study outlined in Chapter 7, the Alliance will conduct a study of the potential need for, impacts from, and feasibility of improvement dredging in areas where shoaling is limiting access in areas that traditionally have served as important public navigable waterways. An analysis of the regulatory implications and issues associated with improvement dredging would be included in the study.

8.6.3 *Prioritize locations for dredged material disposal.* Also as part of the sediment management study (recommendation 7.2.1) the Alliance will identify and prioritize locations for the disposal of dredge material in the ACEC consistent with Chapter 91 regulations. Towns will be encouraged to explore the feasibility of locating dredge materials in one of the prioritized ACEC locations, even if it is located outside of the town's boundary.

8.7 Resource Management Issue: Environmental Impacts from Boating

The 1998 plan and 2003 update cite numerous direct and secondary environmental impacts from boating, and motorized vessels in particular. These impacts include bank erosion, turbidity, loss of vegetation, and affects on water quality from hydrocarbon emissions and marine sanitary waste. The documents also point out that dredging to create or maintain navigational channels can destroy shellfish and vegetation, and that traditional moorings and tackle can scour bottom vegetation.

As noted above, there has been an observed increase in the intensity of boating activity in the Bay. All other things being equal, the negative environmental impacts of boating would be expected to increase as the number and size of vessels increases. However, some trends may help to offset the negative effects of that increase. It is widely held that a number of older more heavily polluting two-stroke engines are being phased out and replaced with newer and cleaner two- and four-stroke engines, which are quieter and more fuel-efficient. Also, there is growing interest in exploring alternative mooring technologies that minimize or eliminate bottom scouring. While these emerging trends are promising, it is unlikely that the negative environmental impacts of boating can be eliminated. Over the coming five years the Alliance will work with the Harbormasters and related boating groups to promote the following measures aimed at managing and further reducing the environmental impacts of boating.

8.8 Resource Management Recommendations: Environmental Impacts from Boating

8.8.1 *Seek Designation of Pleasant Bay as a No Discharge Area* The plan recommends that an application be made to the U.S. Environmental Protection Agency (EPA) to designate Pleasant Bay as a No Discharge Area (NDA). The designation results in a prohibition of discharge of treated (macerated or chlorinated) boat sewage. The disposal of untreated sewage is already prohibited within three miles of the shoreline. As reported in the 2003 update, the Alliance, with support from the Massachusetts Coastal Management Regional Office, began developing an application for NDA designation. However, Alliance Harbormasters at that time felt that the application should not be pursued until more pump out capacity is added in the Bay. At this time it is believed that adequate pump out capacity is available, and that the application should proceed. Until such time as the Bay is designated as a NDA, disposal of treated (macerated or chlorinated) wastes is strongly discouraged by the Alliance.

8.8.2 *Develop and distribute a pamphlet on best management practices for boat maintenance geared to individual boat owners*. Desirable practices include:

- Only products scientifically proven to be environmentally benign, should be used for hull painting;
- A drop cloth, vacuum sander or other form of recovery system should be in place for hull scraping, and all dust and scraps generated should be disposed of in accordance with all applicable laws;
- Only biodegradable, non-toxic boat cleaners should be used. To avoid spills, use of any chemical products should be restricted while a vessel is on the water;
- Boat chemicals, and cleaning materials should be disposed of in accordance with all applicable laws;
- Steam cleaning methods should be used to clean outboard motors, and use of toxic chemical cleaners should be avoided;

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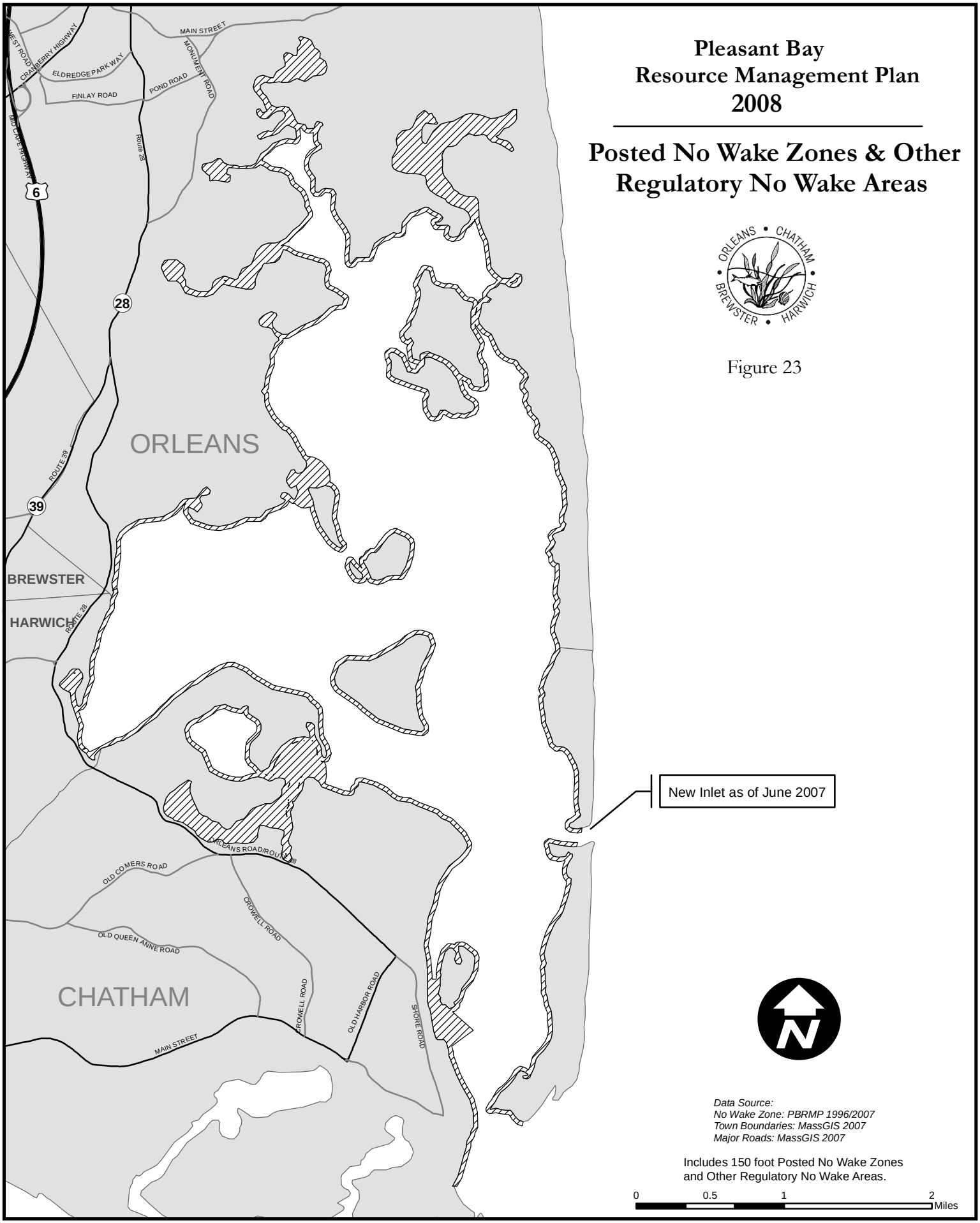
Posted No Wake Zones & Other Regulatory No Wake Areas



ORLEANS • CHATHAM • BREWSTER • HARWICH

Figure 23

Data Source:
No Wake Zone: PBRMP 1996/2007
Town Boundaries: MassGIS 2007
Major Roads: MassGIS 2007

Includes 150 foot Posted No Wake Zones and Other Regulatory No Wake Areas.

0 0.5 1 2 Miles

- Premium oil should be used in outboards. All used motor oil from oil changes should be disposed of in accordance with all applicable laws;
- Propylene glycol mixtures should be used for anti-freeze rather than ethylene glycol mixtures. All used anti-freeze from changes should be disposed of in accordance with all applicable laws;
- A funnel should be used when filling an outboard motor with gas or oil;
- A bilge "pillow" should be used to absorb oil from bilge water before it is pumped overboard.

8.8.3 *Continue to promote adherence to the MCZM Marina Best Management Practices*, including relocation of certain activities to inland areas where they can be contained. Private boat yards are relying more and more on the CZM BMPs—they have relocated some activities off site.

8.8.4 *Address the need for environmentally safe haul out facilities for commercial vessels.* The need for additional haul out facilities for commercial vessels has been identified. The potential options for meeting this need should be developed and evaluated.

8.8.5 *Sponsor further research to characterize and quantify the impacts of boating on water quality, habitats, and other aspects of the marine environment in Pleasant Bay.* This research should assess:

- Extent of loss of vegetation;
- Extent of bank erosion;
- Loss of habitat due to noise or loss of vegetation;
- Impacts of chemical leaching from anti-fouling paints, and from treated lumber used for shoreline structures; and
- Impacts from moorings on bottom vegetation and shellfish.

The research would be available to the towns to use as a basis for reformulating guidelines or regulations to minimize any negative impacts of boating on the natural resources of the Bay.

8.9 Resource Management Issue: Mooring Management

Since the adoption of the Plan Harbormasters in the Alliance towns have maintained an upper limit on the number of mooring permits at all existing town mooring fields in Pleasant Bay. However, Table 5 shows there has been an increase in recorded permits in some areas. The increase is due in part to enhanced record keeping capabilities within the towns, as well as fuller utilization of moorings by boat yards and, to a lesser extent, an increase in mooring permits to waterfront homeowners (Orleans' policy only.) Table 6 shows that the vast majority of boats moored in the Bay are between 16 and 25 feet, with only 5% greater than 25 feet. Figure 24 shows Existing

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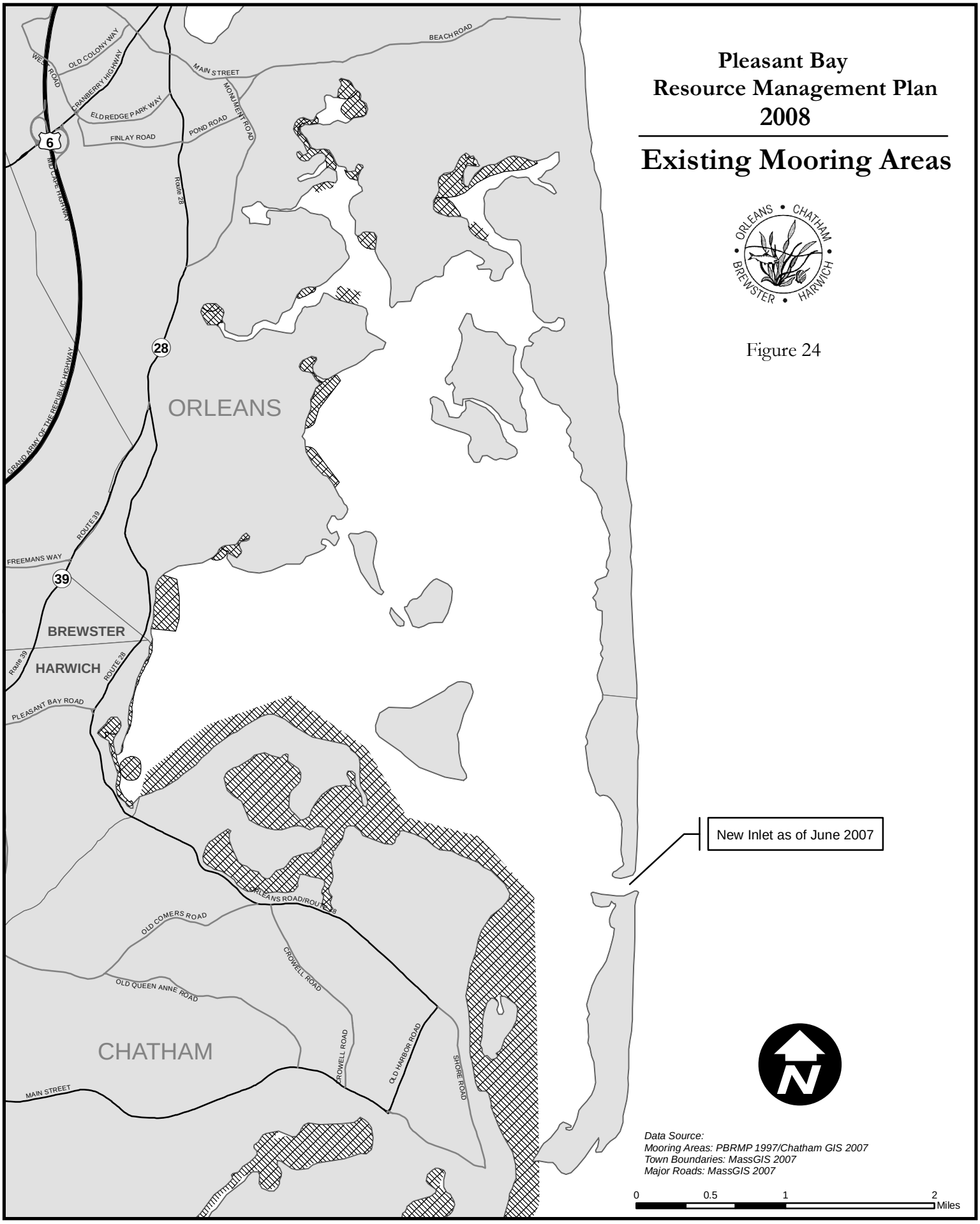
Existing Mooring Areas

Figure 24



Mooring Areas in the Bay. A mooring free area continues to be in effect within Big Pleasant Bay, as outlined in the 1998 plan.

Table 5. Moorings in Pleasant Bay, 1996, 2001, 2007

Town	1996	2001	**2007**
Orleans	634	740	**820**
Chatham	616	960*	**840**
Harwich	133	165	**160**
Total	1,383	1,865	**1,820**

*Additional 78 permits are issued with no current boat
Source: Harbormasters of Orleans, Chatham, Harwich

Table 6. Moored Vessels in Pleasant Bay by Size, 2007

Boat Size in Feet	<16	16-25	>25-40	>40	Total Moorings (% Increase since 1996)
Orleans	234	549	37	0	820 (29%)
Chatham	184	604	52	0	840 (36%)
Harwich	29	123	7	1	160 (20%)
Bay Total (% Total Moorings)	447 (25%)	1,276 (70%)	96 (5%)	1 (0%)	1,820

Source: Harbormasters of Orleans, Chatham, Harwich, 2007

Use of alternate mooring technologies such as helical screws that have the potential to reduce scouring are used on a very limited basis in the Bay. This is primarily because of the increased costs associated with this type of mooring technology. However, Harbormasters have begun to experiment on a small scale with different strategies for attaching the chain to the ball, using less chain and more line to maintain the scope of the mooring in areas where there is less exposure, and use of floats to suspend the line and limit scouring.

8.10 Recommendations for Mooring Management

8.10.1 *Maintain mooring intensity at public mooring fields at current levels.* Harbormasters are urged to continue to limit the number of mooring permits at current levels in order to prevent overcrowding of the waterways and at town landings, and to minimize other boating impacts on resources.

8.10.2 *Promote selected use of alternative mooring technologies.* Use of alternative mooring technologies that limit scouring are encouraged, but not as a means of increasing mooring capacity in the Bay. Use of alternate tackle or mooring techniques are encouraged if they can reduce environmental impacts as compared with traditional mooring technologies. The Alliance encourages local Harbormasters to explore the potential of one or more demonstration projects to test the long-term benefits of alternative technologies or mooring techniques.

Chapter 9:
Public Access and Historic Resources

9.0 Overview

Perhaps the single most obvious and widely cherished resource in Pleasant Bay is its beauty. To say that Pleasant Bay has a unique sense of place tells only part of the story. In fact, the many embayments, rivers, ponds, marshes, beaches and islands found in or along Pleasant Bay each have their own character and natural beauty.

The abundant resources and scenic attractiveness of Pleasant Bay are important economic and environmental assets to the surrounding towns. People use and enjoy the Bay in many diverse ways, including boating, fishing, shellfishing, bird watching, swimming, and simply enjoying the view. The fact that many of these activities build a sense of appreciation and stewardship of the Bay is evidenced by the fact that many volunteers who collect water quality samples are avid boaters, fishermen, or birders who want to do what they can to protect and preserve the beauty and uniqueness of Pleasant Bay.

All of this suggests that managing the Bay's resources should encompass strategies to ensure that the many ways people enjoy the Bay are preserved in harmony with resource protection. It is easy to imagine the impacts of loving a place too much, but continued access to and enjoyment of the Bay is critical to support public stewardship and proactive, coordinated management of its resources.

The analysis and recommendations found in the 1998 plan and 2003 update sought to promote:

- Reasonable public access to and along the shore;
- Protection of the sights and sounds of the Bay; and
- Appreciation for the Bay's historic and archaeological resources.

These three themes are carried forward in the work of the Alliance in the coming five years.

9.1 Management Issue: Public Access to and Along the Shore

Given the largely residential nature of surrounding land uses, the Pleasant Bay shoreline is largely privately owned. Public access to shore and water is concentrated at the 30 town owned landings, beaches and conservation areas along the shoreline (see Table 7 and Figure 25. As noted in Chapter 8, use of public landings is on the rise, particularly for those landings that offer access for transient boaters. Landings are typically small, narrow properties with limited parking. There are three public access points that also serve as bathing beaches. Each of these three areas have limited parking and no facilities or on duty lifeguard. One of these, Route 28 in Orleans, is a town

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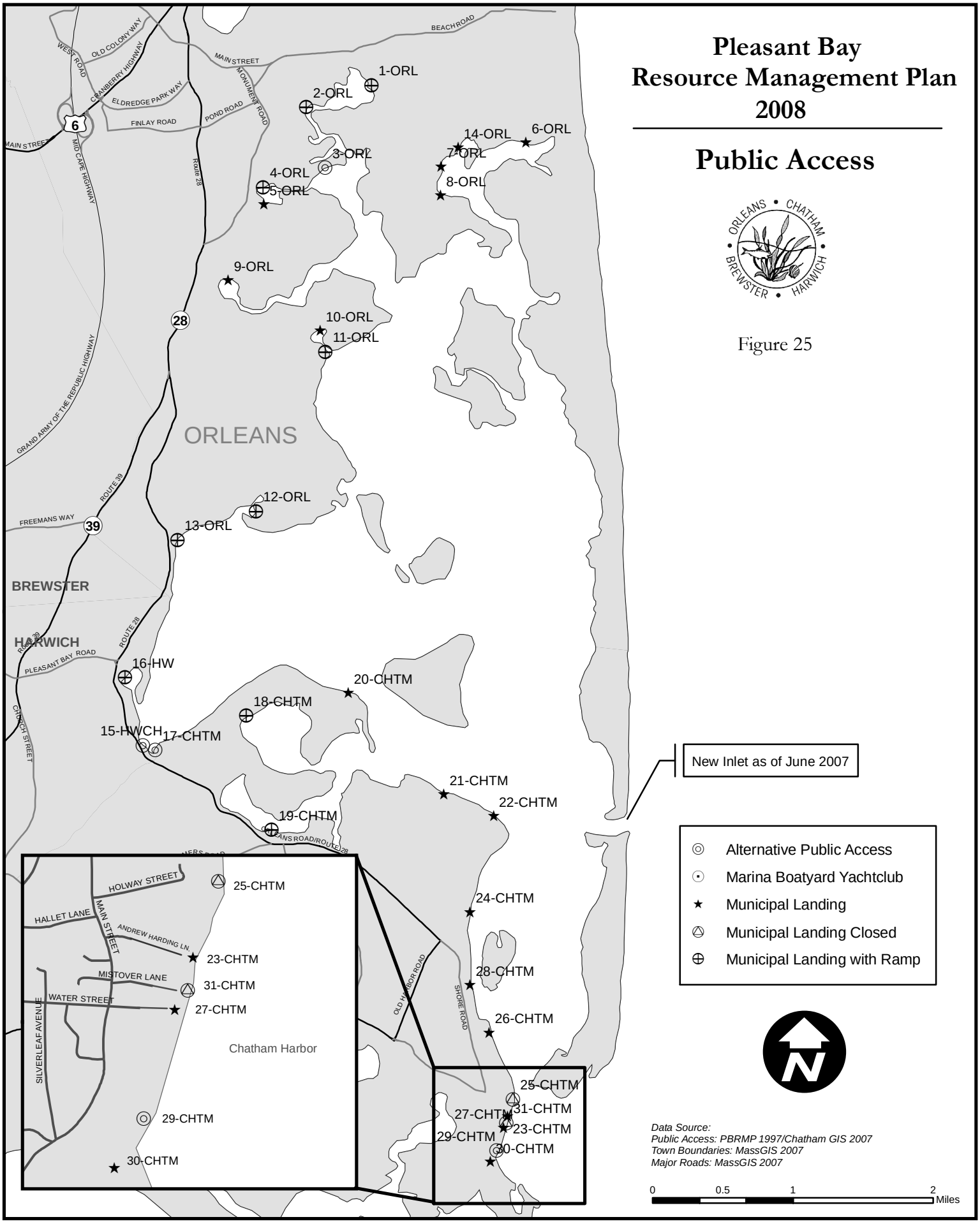
Public Access

Figure 25



landing. Jackknife was a landing and is now considered a rural beach, although it does support dry sailing and a mooring field.

Table 7. Town Landings and Other Public Access Points

Number/Town	Name	Parking	Ramp	Launch	Beach^
1-Orleans	Meetinghouse Pond	30	Yes	Yes	Yes
2-Orleans	River Road	25	Yes	Yes	No
3-Orleans	Kent's Point*	10	No	No	No
4-Orleans	Kescayogansett Pond	8	Yes	Yes	No
5-Orleans	Kescayogansett Pond	3	No	No	No
6-Orleans	Pochet-Sparrowhawk	8	No	Yes	No
7-Orleans	Pochet-Gilman	3	No	No	No
8-Orleans	Pochet-Barley Neck	8	No	No	No
9-Orleans	Arey's Pond	2	No	No	No
10-Orleans	Namequoit Road	4	No	No	No
11-Orleans	Portanimicut	18	Yes	Yes	Yes
12-Orleans	Quanset Pond	12	Yes	Yes	No
13-Orleans	Route 28	30	Yes	Yes	Yes
14-Orleans	Briar Springs Road	0	No	No	No
15-Harwich	Bay Road Beach*	12	No	No	Yes
16-Harwich	Round Cove	15	Yes	Yes	No
17-Chatham	Jackknife Harbor	20	No	Yes	Yes
18-Chatham	Crows Pond	10	Yes	Yes	No
19-Chatham	Ryder's Cove	20	Yes	Yes	No
20-Chatham	Strong Island	20	No	No	Yes
21-Chatham	Cotchpinicut	4	No	Yes	Yes
22-Chatham	Scatteree	10	No	No	Yes
23-Chatham	Andrew Hardings Lane	Closed	No	No	Yes
24-Chatham	Cow Yard	4	No	Yes	No
25-Chatham	Holway Street	Closed	No	No	No
26-Chatham	Claflin landing	Closed	No	No	Yes
27-Chatham	Water Street	Closed	No	No	No
28-Chatham	Fish Pier*	53	No	No	No
29-Chatham	Lighthouse*	57	No	No	Yes
30-Chatham	Bearses Lane	0	No	No	Yes
31-Chatham	Mistover Lane	Closed	No	No	No

*Alternative public access point; not a town landing
^Connotes small beach area; not a guarded beach

A major impediment to public access to and along the Bay's inner shoreline is the low proportion of publicly-owned shoreline property. This observation, which appeared in the plan, was confirmed by the Alliance's Shoreline Access Inventory Project. The project showed that of more than 3,000 acres of parcels located on the shoreline of the Bay, only 13% are owned by the towns. Of the 65.7 total miles of the Bay's shoreline, 10.36 miles, or roughly 16 %, belong to the towns, and only 3.4 miles is accessible by car. An additional 600 linear feet of shoreline became publicly accessible through the terms of a recently purchased conservation restriction on the 9-acre Eelman's Point property located on the Narrows in South Orleans.

The Alliance's efforts to sustain public access to and along the shoreline focuses on:

- Support for maintenance of existing landings, beach areas and other public access points, including efforts to prevent erosion;
- Support for land purchases and conservation restrictions that limit development and provide or protect access; and
- Efforts to protect public access through provisions in local and state permits for shoreline structures.

Table 8. Shorefront Parcels on Pleasant Bay (By Ownership)

OWNERSHIP	ACRES (%)
Municipal	384.46 (13)
Federal – CCNS	910.33 (30)
Private Conservation Trust	505.90 (17)
Private – Undeveloped	275.53 (9)
Private – Developed	945.55 (31)
TOTAL	3030.77 (100)

9.2 Recommendations to Protect Public Access to and Along the Shore

9.2.1 *Promote enhanced access to and along the shoreline*:

- Requirements for human lateral passage should be incorporated in permitting guidelines to be developed by the Alliance for new or rebuilt shoreline protection structures, and these should be relied upon by local and state permitting authorities. Local and state permits for such structures should require mitigation for the loss of lateral passage at any stage of the tide and at any future date. These might include, but are not limited to, beach replenishment and the construction of flat walking surfaces in the wall. The discussion of how lateral access will be accommodated should be addressed in the design stage and be presented with plans filed for conservation commission review.
- Instances where the public access provisions of state Waterways Regulations (Chapter 91) are not being enforced should be brought to the attention of the MassDEP, which administers and enforces Chapter 91 regulations.
- Pre-existing erosion control structures, which, due to loss of slope on the fronting beach, now sit on state tidelands (i.e., are wet at high tides) are subject to Chapter 91 regulations. The MassDEP should incorporate special conditions to mitigate loss of shoreline lateral passage in any Chapter 91 licenses issued. These should include, but not be limited to, deed restrictions requiring signage stating that the public has the right to traverse over and to fish from protective shoreline structures, in accordance with the Colonial Ordinance.

9.2.2 *Undertake actions to reduce existing shoreline obstructions, and to prevent future*

obstructions:

- Encourage MassDEP and the Massachusetts Attorney General to include "through-walking" in addition to "fishing, fowling (now interpreted to include bird-watching), and navigating" as a permissible activity over the passage provided.
- Initiate discussions with owners of existing structures that impede public passage to encourage voluntary measures to facilitate public passage. Impeded areas identified in the shoreline accessibility survey conducted by the Public Access Work Group provide a starting point for pursuing voluntary improvements.
- Research existing permits for requirements regarding public passage and enforcing such requirements where they are not being met.

9.2.3 *Support efforts to establish additional access points for low impact uses such as scenic viewing, walking, beach activities, and use of small, non-motorized vessels.*

9.2.4 *Develop a comprehensive public information program concerning public access points, support facilities and services, use guidelines, and public access rules and responsibilities*. Elements of the program should include:

- *User Guidelines and Information*. Information on the use and availability of access points would include: a map and list of public access areas; facilities and services provided at each access point such as walking trails, picnic areas, and parking; transportation options; and appropriate uses and activities. Such information should be provided through signs, brochures and displays, and should be distributed through chambers of commerce, retail outlets, public libraries, realtors' offices, and hotels/inns.

- *Interpretative Education Program*. An interpretative educational program would be designed to address the area's Native American history, history of settlement, maritime history, natural development, ecology and natural resources. The educational program should include information on programs and policies which are in place to protect the Bay's resources. Interpretative services from the National Park Service should be requested to participate in the development of public education displays and materials.

- *Public Access Rights and Responsibilities in the Intertidal Zone*. Realtors, chambers of commerce and other outlets would be requested to participate in efforts to communicate the public's rights of passage to prospective shoreline property owners. The public would be advised of property owners' rights, and that littering, unleashed pets, loitering, and other abuses of public access rights would not be tolerated. Information about liability laws would be provided to private property owners and the public.

9.5 Management Issue: Preserving Visual Access and Moderate Noise Levels on the Bay

The scenic qualities of the Bay and the surrounding area, as well as its sense of tranquility, are both important resources that need protection. Maintaining the unique

sights and sounds that contribute to the character and natural resources of the Bay is a significant challenge in light of the constant changes in land development, and use of the Bay's shoreline and waterways.

9.5.1 Erosion of Public Views

The ability to glimpse the waters of the Bay from public ways has been incrementally reduced by private development and fencing and the growth of vegetation on both private and public properties. Even the spectacular views along Route 28 are limited to short stretches and in some areas, such as Ryder's Cove, are obscured by overgrown vegetation. The public's ability to see the Bay and enjoy its resources and panorama has been drastically eroded from early years of this century when the vast majority of the land bordering the Bay as well as its shoreline was undeveloped, supported low vegetation, and was freely open for public use. Significant public views are depicted on Figure 26.

The meandering, rural qualities of the portions of Route 28 must also be counted as a scenic asset of the Bay. Improvements to this roadway in the future must be designed carefully to preserve its character as well as the opportunities it provides for public viewing and access to the Bay.

9.5.2 Moderating Noise Levels on the Bay

As with visual access, the tranquility of the Bay is also threatened by encroaching land uses, and increased use of the shoreline and waterways. Noise emanates from motorized vessels operating at high speeds. These noises are a nuisance to shoreline property owners and other Bay users. Over the past few years, there have been an increased number of fireworks displays that result in a short period of intense noise. Short term or persistent intense noise levels from these and other sources can disturb habitat areas, and disrupt the balance of wildlife in the region.

9.6 Recommendations to Preserve Visual Access and Moderate Noise Levels on the Bay

9.6.1 *Protect existing views of the Bay and encourage the opening of new vistas.*
The following actions should be undertaken to protect and enhance public views of the Bay:

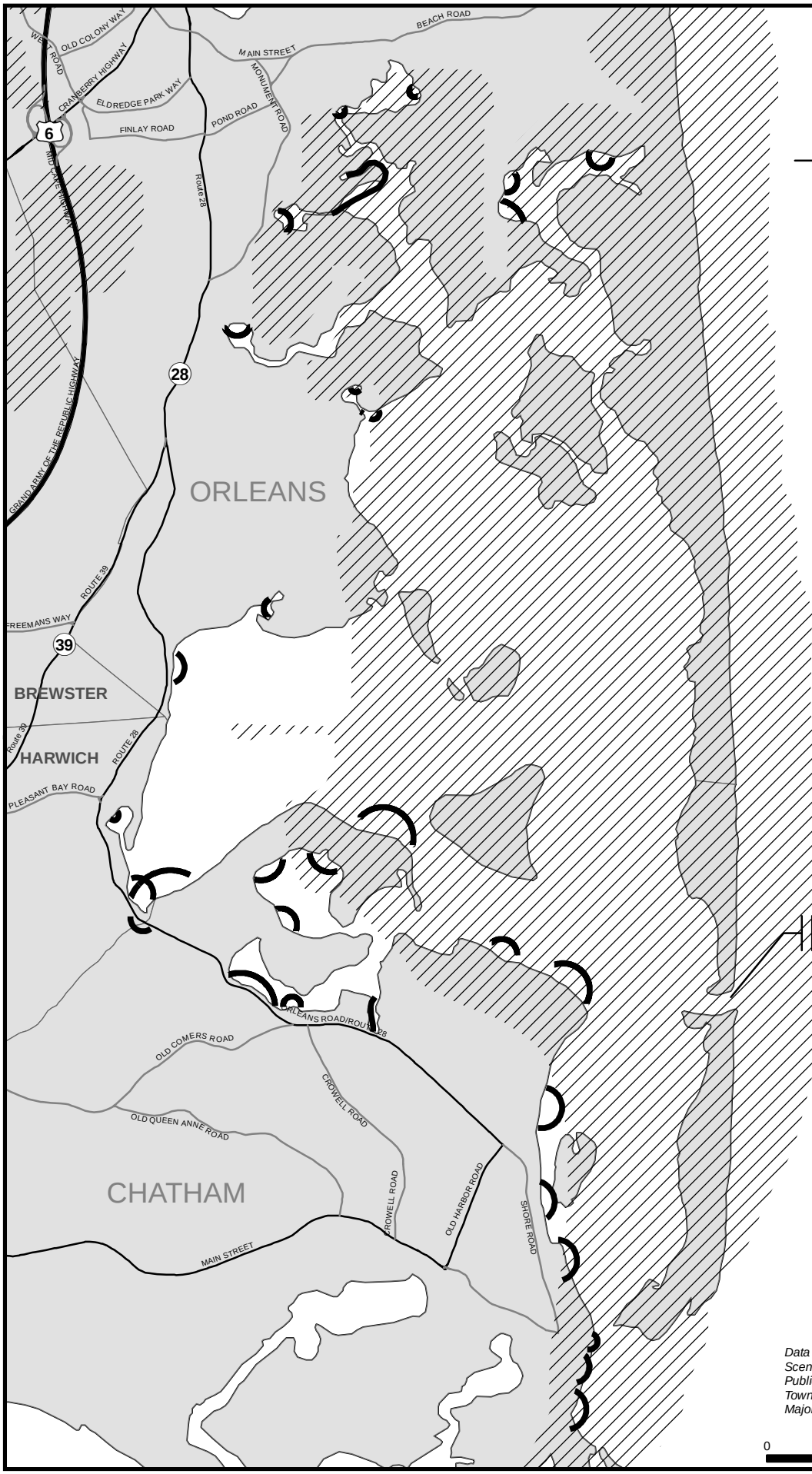
- Coordinating with the towns' conservation commissions, and public works departments to develop guidelines for maintaining vegetation on public lands along the shoreline so that invasive species and rampant vegetative growth do not block scenic vistas. Guidelines will need to be compliant with state and local wetlands regulations.

- Identifying incentives to encourage private property owners to manage vegetation so as to allow views from public roadways.

Pleasant Bay Resource Management Plan 2008

Public Scenic Views and Landscapes

Figure 26



Public Scenic View

Scenic Landscape

Data Source:
Scenic Landscapes: MassGIS 1999
Public Scenic View: PBRMP 1997
Town Boundaries: MassGIS 2007
Major Roads: MassGIS 2007

0 0.5 1 2 Miles

- Coordinating with the towns' planning boards to include in development reviews consideration how developments alter water views from public ways, and to encourage owners and developers to modify site plans to enhance and protect views.

- Coordinating with the state Highway Department to ensure that improvements to Route 28 maintain the road's scenic qualities and to maintain and enhance its public access areas. Future improvements to Route 28 should include provisions to allow parking for overlook-type sight seeing. Use of opaque barriers in scenic areas should be strongly discouraged.

9.6.2 *Explore ways to moderate noise on the Bay.* The following recommended actions are intended to help moderate noise levels on the Bay:

- Permits for all fireworks displays proposed within the study area should be reviewed by the applicable local Conservation Commissions, Natural Resource Departments and Harbormasters to ensure adequate protection is provided for natural resources and habitats.

- Speed controls should be enforced and transition to use of newer and quieter outboard motors encouraged as means of minimizing noise impacts.

- Commercial operations located on the shoreline should adopt noise mitigation measures such as restricting hours of noise generating operations, and installing sound proofing technologies.

9.7 Management Issue: Appreciation for the Bay's Historic and Archaeological Resources

At the Pleasant Bay Symposium in 2006, archaeologist Fred Dunford remarked that many of the management challenges that face us today—managing access to the water, providing ways for people to continue to make a living off the bay, and managing how land is used around the bay—may have changed in some respects but are essentially the same challenges that faced earlier inhabitants. Learning how to live in harmony with the Bay is a challenge of generations.

The 1998 plan contains a description of some of the cultural and historical resources found within the study area. However, it stops short of providing specific measures aimed at protecting those resources. In its review of the plan in 1999, the Massachusetts Historical Commission noted that while many of the plan's recommendations to protect natural resources would also help to protect archaeological resources, establishing the protection of fragile historical resources as an explicit goal would strengthen the plan.

A report commissioned by the Friends of Pleasant Bay, Inc. in 1987 provides an important context for developing management actions protect historic resources. Approximately 10 % of all pre-historic and historic archaeological sites recorded for Barnstable County fall with in the greater Pleasant Bay study area, what may prove to be the highest site density for any single locale on Cape Cod.[1] These resources may provide key insights into the political, religious, cultural, economic and adaptive processes of the Cape's indigenous peoples.[2]

9.8 Recommendation to Promote Appreciation for the Bay's Historic and Archaeological Resources

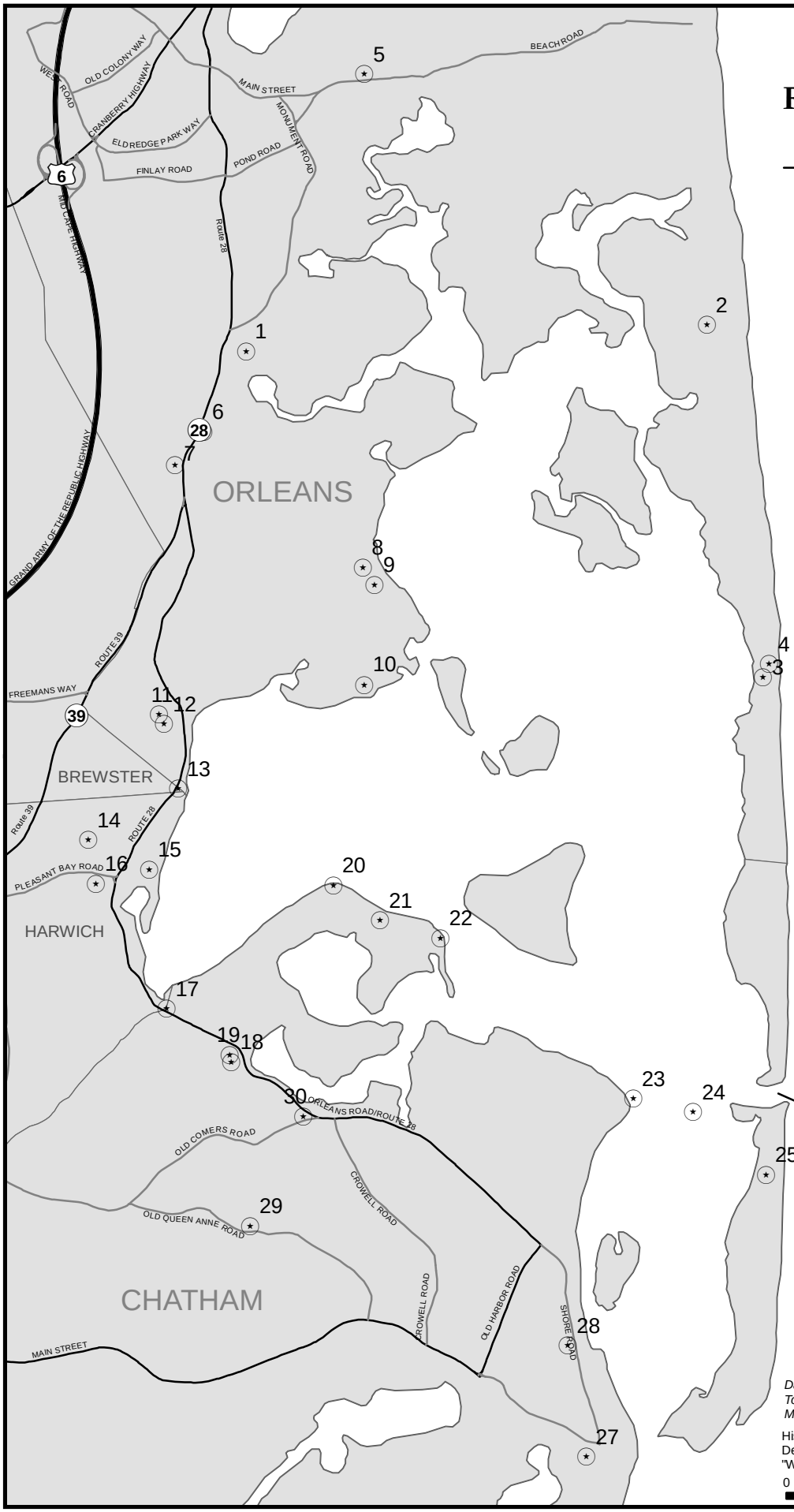
9.8.1 *The Alliance should work with local historians, archaeologists and historical commissions to develop an inventory of sites and resources of historic, archaeological and cultural interest within the study area. The effort should include appropriate recommendations to protect and interpret these important community resources.*

[1] Frederick J. Dunford, An Archaeological Reconnaissance Survey of Pleasant Bay, Massachusetts, 1987, p 21
[2] Dunford p.48

Pleasant Bay Resource Management Plan 2008

Historic Sites

Figure 27



1. Indian Meeting House Site
2. Old Coast Guard Station
3. Entrance 1619-1626
4. Remains of Sparrow Hawk
5. Early Meeting House
6. Old South Orleans Post office
7. Captain Kendrick House
8. First Boys Camp
9. First Girls Camp
10. First Drummer Cottage 1887
11. Tar Kilns Baker 1665
12. Tar Kiln Creek
13. Uncle Kiah's Spring
14. Warren Jensen Nickerson House
15. Elnathan Eldredge Mill
16. Indian Praying Stone
17. The Wading Place
18. William Nickerson House
19. William Nickerson Burial Monument
20. Great Point
21. Hotel Chatham
22. Jesse's Folly
23. Pull and Be Damned
24. Old Harbor Late 1900's
25. Old Harbor Coast Guard Station
26. Chatham Light
27. Old Village 1800's - Present
28. Chatham Bars Inn 1913
29. First Chatham Church
30. Marconi - RCA Wireless Receiving Station

Data Source:
Town Boundaries: MassGIS 2007
Major Roads: MassGIS 2007

Historic sites were chosen by Pleasant Bay Resource Management Project December 1997 as compiled from local historians and the map "W. Sears Nickerson's Pleasant Bay", 1995

0 0.5 1 2 Miles

SECTION III. IMPLEMENTATION

Chapter 10.
Implementation

10.0 Overview

When the initial resource management plan was developed a decade ago considerable attention was paid to how the plan would be implemented and monitored over time. Consensus quickly grew around three organizational principles:

1. A specific, multi-town entity was needed to ensure that the plan's many recommendations would be implemented and that progress would be monitored
2. The implementing structure would need to augment, and not duplicate, existing local and regional resources and activities; and
3. Regulatory authority and decision-making would remain within the member towns, but would be guided by the entity in matters regarding Pleasant Bay.

Accordingly, the resource management plan called for the formation of a four-town Alliance to implement the plan and to have overall responsibility and accountability for on-going stewardship of the Bay. The Alliance would develop policy recommendations, undertake scientific research, and promote public education and awareness. The make-up of the Alliance would include:

- A Steering Committee to govern the Alliance;
- A Technical Resource Committee to assist the Steering Committee;
- A Coordinator to manage day-to-day activities; and
- On-going community involvement through project issue specific work groups.

A decade later the Alliance is respected for its leadership and advocacy in the protection of the natural resource and public enjoyment of Pleasant Bay. In 2003, the state EOEA referred to the Alliance as "a model of coordinated municipal and regional planning and management of sensitive resources that other ACECs and communities across the Commonwealth can use as an example." In the five years ahead the Alliance will continue to build on this record of accomplishment, and strengthen its effectiveness in promoting the goals and objectives of the resource management plan.

10.1 Local Adoption and Authorization

In 1998, Town Meetings in Orleans, Chatham, and Harwich adopted the Pleasant Bay Resource Management Plan and authorized their respective Boards of Selectmen to enter into a Memorandum of Agreement (MoA) with the other communities to form the Pleasant Bay Resource Management Alliance to implement the plan. In 2003 the Town Meetings adopted the first five-year update and authorized their respective Boards to renew the five-year MoA. In 2007, Town Meeting in Brewster voted to adopt the plan and 2003 update, and to authorize the Board of Selectmen to sign the MoA.

The MoA sets forth the purposes of the Alliance, and its organizational structures and reporting and accounting responsibilities. The purpose of the Alliance is to

implement the recommendations of the approved plan and subsequent updates, and to oversee the process of revising the plan upon the five-year anniversary of its approval. The renewal provision was incorporated to enable the towns to reassess the need and effectiveness of the Alliance, and to renew their commitment to its purposes. The current MoA expires in December 2008.

10.2 Alliance Governance and Administration

The organizational structure of the Alliance builds upon the high degree of public involvement and intergovernmental cooperation initiated with the development of the resource management plan and updates.

A Steering Committee is the policy setting body for the Alliance and has overall accountability and responsibility for coordinating implementation activities, including the authority to contract for services. As outlined in the memorandum of agreement, the Steering Committee consists of one representative and one alternate appointed by the Board of Selectmen in each Alliance town.[1] Each Board of Selectmen has also appointed from among its members a liaison to meet with the Steering Committee from time to time. The Steering Committee meets monthly and as a municipally sponsored committee is subject to Massachusetts open meeting laws.

A Technical Resource Committee (TRC) consisting of four resource management professionals from each town provides technical assistance to the Steering Committee. TRC members are appointed by their respective Board of Selectmen and consist of harbormasters, coastal resource managers, conservation agents, planners, and water quality scientists with professional responsibility for managing the Bays resources. To facilitate cooperation among other agencies involved in managing the Bay's resources, the TRC has as ex officio members representatives from the Cape Cod Commission, Cape Cod National Seashore, Department of Environmental Management and Massachusetts Coastal Zone Management. The TRC meets quarterly or more frequently as needed and all meetings are open to the public.

A professional coordinator for the Alliance is responsible for developing and managing implementation projects, coordinating activities with local and state officials, grant writing, media management, and public outreach and involvement.

Pursuant to the intermunicipal agreement, the Director of Finance for the Town of Chatham acts as fiscal agent for the Alliance. The Town of Chatham manages a separate account for the Alliance for the receipt and disbursement of funds associated with the Alliance's implementation activities.

[1] The original MoA was amended twice. In 2001, the MOA was amended to authorizing each Board to appoint one alternate member to the Steering Committee. This was to enable the Committee to act with a full complement of voting members despite individuals' travel plans and other scheduling conflicts. In 2007 the MoA was amended to include Brewster as a participating member in the Alliance.

10.3 Project Management and Work Groups

The Coordinator works closely with the Steering Committee and TRC to manage individual projects. Work Groups have been formed for specific implementation projects as a way to increase technical expertise and provide a forum for substantive community involvement. In addition to TRC and Steering Committee members, work groups involve researchers from the National Park Service/Cape Cod National Seashore, Provincetown Center for Coastal Studies, Woods Hole Oceanographic Institute Sea Grant Program, Cape Cod Cooperative Extension Service, and Cape Cod Commission, as well as local officials, members of local boards and commissions, interested citizens, and representatives of conservation organizations and state environmental agencies.

Membership in work groups may change depending on the focus of the group at a given time. The following is a list of work groups that have completed or are now working on Alliance projects:

Citizen Water Quality Monitoring Program Work Group,
Coastal Processes Work Group (Formerly Shoreline Structures),
Freshwater Resource Assessment Work Group,
Waterways Work Group,
Intertidal Habitat Work Group,
Public Access Work Group,
Wetlands Work Group, and
Watershed Planning Work Group.

10.4 Budgeting and Grantwriting

The Steering Committee, TRC and Coordinator developed a program budget and work plan for each fiscal year which identifies priority implementation projects and activities. Each action item or project in the work plan relates to a recommendation of the RMP. Funding for Alliance activities comes from annual appropriations from the towns and a combination of public and private grants.

Municipal funds cover the cost of the Alliance's administration and laboratory expenses for the water quality monitoring program. All other projects are funded through non-town sources. The Alliance has been successful in obtaining $86,000 in grants from non-town sources over the past five years. In addition, the Alliance has received more than 5,000 in technical assistance and analysis from the Cape Cod Commission. The Alliance greatly appreciates the financial and technical support of the following agencies, foundations and organizations:

Executive Office of Energy and Environmental Affairs.
Friends of Pleasant Bay, Inc.,
Cape Cod Commission,
Cape Cod National Seashore,
Cape Cod Water Protection Collaborative,

WHOI/ Sea Grant Program,
Provincetown Center for Coastal Studies, and
Cape Cod Cooperative Extension Service.

10.5 Public Outreach and Education

Public outreach and education was integral to the development and approval of the original resource management plan, and continues to be through the plan's implementation. Over the past five years the Alliance has undertaken the following implementation activities:

- Forums and Workshops. The Alliance convened the Pleasant Bay Symposim in 2006, where speakers addressed the dynamic coastal system and how it affects habitat conditions in the Bay. More than 200 people attended the event, which was hosted by the Chatham Bars Inn. Co-sponsors of the symposium included the Cape Cod National Seashore, and WHOI Sea Grant. Also in 2006 the Alliance coordinated two regional public meetings to review the Massachusetts Estuaries Project Technical Report and a public hearing on the Draft Total Nitrogen Daily Load (TMDL) report issued by MassDEP. In 2007 the Alliance convened a public forum to discuss the new inlet formation and management responses.

- Outreach and Involvement of Local and Regional Organizations. The Alliance coordinator and other members of the Steering and Technical Resource Committees frequently make presentations to local and regional organizations explaining the Alliance's programs and activities. As an outgrowth of these efforts, numerous towns on the Cape and throughout Southeastern Massachusetts have requested information about the Alliance and its programs to assist in their coastal resource protection efforts. In addition, the Alliance encourages the participation of representatives of a variety of local and regional agencies, environmental groups and citizen-based organizations in the discussion of issues, review of reports and documents, and the identification of technical resources.

- Media Outreach. The Alliance issues media releases on the occasion of noteworthy events, such as receipt of grants, and the launching or completion of studies or projects. Media outlets that frequently carry news about the Alliance and its activities include: the *Cape Cod Times*, *Cape Codder*, *Harwich Oracle*, *Cape Cod Chronicle*, *Cape Cod Voice*, and *WQRC*.

- Website. The Alliance established www.pleasantbay.org, through which visitors can:

    - View a description of the Alliance and its programs and activities;
    - Download the resource management plan and other documents and reports prepared by the Alliance;
    - View media releases; and
    - View the schedule of upcoming meetings.

- Annual Reports. The Alliance submits an annual report to the Town Clerk of each community for inclusion in the annual Town Reports

10.6 Implementation Recommendations

10.6.1 *Adopt the Plan Update and Renew the MoA*. It is recommended that Town Meeting in each of the four Towns adopt the Resource Management Plan 2008 Update and authorize their respective Board of Selectmen to renew the five-year memorandum of agreement forming the Alliance.

10.6.2 *Review and modify Organizational Structure as Needed*.

10.6.3 *Continue to seek non-town sources of funding for its studies and programs*.

10.6.4 *Continue public outreach and education activities*. Outreach activities should include:

- The Alliance is proposing to sponsor issue forums and symposia focused on specific topics relevant to the resource management plan. The forums and symposia would provide opportunities to review issues in-depth, and invite outside experts.

- The Alliance will continue to issue publications reporting on research and project findings. The Alliance routinely makes its publications available through direct distribution, public presentations, and by making copies available for review at town halls, libraries and electronically on the Alliance's website

- Continue to promote public information and education on issues and initiatives through enhancements to the Pleasant Bay Alliance website, www.pleasantbay.org.

Biodiversity & Habitat Protection		
1998,2003 Recommendations	**1998-2007 Accomplishments**	**2008-2013 Recommendations**
Water Quality Monitoring & Analysis	*Designed program; obtained approval of QAPP; equipted and trained 150+ volunteers; completed 8 monitoring seasons at 16-25 locations; 90%+ recovery rate for samples each year. *Calcualted eutrophication indices & issued interim data reports in 2000, 2001 and 2002. *Data provided foundation for MA Estuaries Project & TMDL development	*Continue monitoring in concert w/ TMDL compliance protocols being developed by DEP/MEP/Alliance. *Update MEP water quality model as needed to reflect changing conditions. Conduct 3 model runs in 2008. *Develop/disseminate periodic water quality reports and public educational brochures *Update QAPP as needed *Conduct eelgrass & benthic monitoring in concert w/ TMDL compliance w/ DEP/MEP/Alliance protocols. *Support water quality monitoring in freshwater ponds in the ACEC and watershed. *Track trends in bacterial monitoring data & support efforts to address sources in areas w/high levels *Participate in Geographic Response Plan (GRP) for oil spill preparedness.
Ecological Inventory and Monitoring	*Undertook and intertidal habitat & sediment survey *Conducted survey of rare and endangered species surrounding 11 ACEC ponds. *MEP included eelgrass and benthic monitoring and habitat assessment	*Develop a Citizen's Guide to the Ecology of Pleasant Bay *Conduct a sediment mapping project with the CCNS *Support on-going research and collaborations with scientific and advocay groups aimed at understanding species dynamics in the Pleasant Bay study area. *Continue aerial photography every 5 yrs or more frequently if necessary *Continue salt marsh monitoring at 2 sites, and evaluate expanding to more sites. *Develop best management practices to manage invasive species, and for site alteration or clearance

Biodiversity & Habitat Protection, Continued		
1998,2003 Recommendations	**1998-2007 Accomplishments**	**2008-2013 Recommendations**
Areas of Critical Marine Habitat (ACMH)	*Obtained information on ACMH through intertidal survey & evaluation of other research & monitoring *Implemented recommended restrictions on activites in ACMH	*Revise ACMH areas to remove areas that have lost habitat value due to upland development; add/combine areas backside of the barrier beach & around islands *Revise guidelines for aquaculture and docks in certain areas *Continue to study these areas through sediment mapping project with CCNS
Species Habitat Protection	*Reviewed priority habitat ranking by FOPB & Cape Cod Compact of Conservation Trusts. *Supported open space purchases in Harwich (42 ac) and Orleans (27 ac) *MEP included eelgrass & benthic monitoring and habitat assessment	*Inventory & develop management strategies for species in the ACEC and watershed. *Promote compliance with NHESP for all development projects *Support land purchases and other measures to protect open space and significant habitat.

Wetlands Protection		
1998,2003 Recommendations	**1998-2007 Accomplishments**	**2008-2013 Recommendations**
Strengthen wetlands regulations & review procedures	*Provided comment letters to state and local officials regarding projects within the ACEC *Provided comment on changes in state legislation and regulations *Developed permitting guidelines for: docks in marine resource areas; docks in freshwater resource areas, walkways/stairways in both resources areas	*Recommend modifications to strengthen local regulations & bylaws (see list in Chapter 4) *Continue to provide comment on legislation and project reviews
Study barrier beach marsh system	*Established marsh monitoring system with CCNS at two locations *Sponsored Pleassnt Bay Symposium 2006 on the dynamics of the barrier beach system.	*Continue marsh monitoring & evaluate program expansion to additional sites. *See Coastal Processes and Structures below.
Relieve restricted wetlands	*Reviewed modeling of improvements to flushing & water quality in Muddy Creek *Monitored dike re-installation concept	*Assess impacts on wetlands from dike re-installation in Muddy Creek. Assess re-installation based on findings.
Develop a public education campaign regarding activity in wetland resource areas		*Develop a public education campaign regarding work in wetland resource areas

Watershed Planning		
1998,2003 Recommendations	**1998-2007 Accomplishments**	**2008-2013 Recommendations**
Develop watershed management program; evaluate changes in land use regulations	*Watershed residential build out was calculated in 2002. *Waterhsed build out for all use categories was calculated for the MEP study *Detailed comment letters were prepared for significant development projects in the watershed.	*Support & encourage watershed towns to develop & Implement CWMPs *Promote watershed-based collaboration to achieve TMDLs through watershed work group focus on: coordinated planning, modeling, monitoring, compliance reporting, cost sharing and communication
Promote public awareness of the impacts of nitrogen in the Bay	*Two versions of the Citizen's Guide to Estuarine Protection were developed and distributed.	*Build public awareness of nitrogen loading impacts through publications, outreach and project reviews
Promote modeling of the entire bay through the Massachusetts Estuaries Project	*Obtained $120,000 in local funds to include the entire bay in MEP modeling. *Coordianted, reviewed and commented on MEP Technical Report *Extensively reviewed and commented on TMDL report and coordinated public review. *Convened regional work group to review & promote issues & studies in support of watershed collaboration. *Obtained funding to pursue a fertilizer management study and Muddy Creek dike re-installation study.	*Conduct 3 model runs in 2008-09, and more as needed to support watershed-based planning.
Undertake efforts to understand & control sources of bacterial contamination	*Purchased 19 mutt mitt dispensers, supplies and printed an educational brocure on pet waste impacts	*Continue to support 19 mutt mitt placements *Encourage towns to implement Phase II Stormwater Management Plans;promote adherence to state BMPs & evaluate benefits of adopting a stormwater management bylaw. *Encourage towns to develop long term financing methods for stormwater management

Fisheries Management		
1998,2003 Recommendations	**1998-2007 Accomplishments**	**2008-2013 Recommendations**
Refine/coordinate shellfish regulations	*Efforts to refine and strengthen shellfish mgmnt regulations are on-going locally.	*Pursue re-establishment of town boundary markers.
Conduct fisheries assessment	*Reviewed information on razor clam species & harvesting trends in the Bay *Intertidal survey and eelgrass and benthic surveys doen for MEP have provided habitat assessment	*Continue to study fisheries habitat through sediment and vegetative cover mapping project with CCNS *Eelgrass and benthic surveys will be on-going in regard to compliance with TMDL *Identify potential collaborations to study fisheries habitat and species
Enhance baywide propagation	*Efforts to enhance public shellfish propagation are on-going	*Evaluate potential for a centrally located spawning sanctuary, possible rotating closure of heavily fished areas and minimally harvested grants *Continue to support local propagation efforts.
Develop aquaculture guidelines	*MA DMF, County and Orleans developed aquaculture best management practices which are being applied by Orleans grant owners	
Monitor trends in disease and invasive species	*Sponsored a presentation by Dr. Don Anderson on the causes & impact of the 2005 New Engalnd Red Bloom	*Work with towns, DMF and insititutions to study and develop appropriate management response to disease and invasive species.

Coastal Processes and Structures		
1998,2003 Recommendations	**1998-2007 Accomplishments**	**2008-2013 Recommendations**
Revise categorical restriction on private piers;develop performance standards & design criteria	*Guidelines for Permitting Docks & Piers in Pleasant Bay issued in 1999, replacing categorical restriction.	*Continue application of the guidelines
Develop performance standards & design criteria for marsh walkways	*Guidelines for Permitting Marsh Walkways and Stiarways were issued in 2002 and revised in 2007	*Continue application of the guidelines
Conduct resource assessment of fresh-water ponds and develop permitting guidelines	*Guidelines for Permitting Docks in Freshwater Resource Areas were issued in 2007.	*Seek local adoption and state approval of the guidelines
Monitor shoreline erosion Monitor cumulative impacts of shoreline structures	*High resolution aerial photographic surveys of the entire Bay were conducted in 200 and 2005 *Aerail photography dating back to 1938 has been archived *A shoreline/marshline change study was completed. *Tide gage monitoring at two locations was initiated in 2006-07	*Conduct aerial flyovers every five years or more frequently if warranted ; continue to build archive of historical aerial photos *Continue to update the shoreline/marshline study *Develop a bay-wide sediment management plan to prioritize areas for dredging and material disposal, identify areas for proactive beach nourishment, develop strategies for disposiing of silt and non-comp-atible mateiral, evaluate an intermunicipal dredging & disposal permit, and explore improvement dredging issues.
Increase protections for barrier beach/ marsh system	*Pleasant Bay Symposium 2006 foucsed on the dynamics of the barrier beach system. *Hosted public forum on new inlet formation and management responses *Participated as funding partner in US Army Corp of Engineers project to update hydrodynamic modeling	*Participate in developing and implementing a comprehensive monitoring program for the barrier beach and inlet system. *Promote adherence to MassDEP beach nourishment guidelines
Develop resource based framework for erosion control structures; develop performance standards & design criteria; encourage alternatives to hard erosion control structures		*Develop performance standards and design criteria for erosion control structures;encourage alternatives to hard structures and study the impacts of fortified soft structures. *Limit structures on the Bay islands and backside only to instances necessary to provide safe and reasonable access & only if all other forms of access have been demonstrated to be infeasible. *Develop permitting guidelines for ancillary structures not addressed by previous guidelines.

Waterways Safety & Navigation		
1998,2003 Recommendations	**1998-2007 Accomplishments**	**2008-2013 Recommendations**
Enhance waterways regulations	*On-going locally	*Continue local regulation & enforcement efforts to increase safety & limit resource impacts
No Discharge Area designation	*Initial application was not submitted due to a perceived lack of pump out capacity	*Seek designation of the Bay as a No Discharge Area; ensure adequate pump out capbilities are available & provide public information on requirements and support facilities.
Assess boating impacts/promote environmentally safe O&M practices	*Promoted adherence to MCZM BMPs for marina practices	
Establish coordianted bay patrol Enhance navigational aids Augment boater education	*Coordianted bay patrol was initiated and continues including cross-deputizing patrol personnel *Channel markers were consecutively numbered & additional navigational aids were deployed as needed.	*Encourage towns to continue patrol and increase funds for patrol staff if warranted. *Continue to deploy aids as needed. *Undertake boater education efforts to reinforce regulations, environmentally sound practices, unregulated protocols, and safe use of access points. *Promote a high level of investment needed to maintain town landings.
Prohhibit personal watercraft operation	*Pursued state and local approvals to ban PWC in the Bay in keeping with CCNS rules	
Establish a mooring free area Reduce landside &aquatic resource resource impacts from moorings	*Mooring free area is established in Big Bay	*Continue to limit moorings to current level of intensity *Explore use of alternative mooring technolgies, but not as a means of increasing moorings.
Maintenance dredging and disposal	*Supported dredging of Round Cove channel, and advocated placement of dredged material to fortify an overwashed area of barrier beach	*Continue to support as needed
Improvement dredging and disposal		*Evaluate potential benefits and detriments in light of increased shoaling in heavily used areas.

Public Access and Historic Resources		
1998,2003 Recommendations	**1998-2007 Accomplishments**	**2008-2013 Recommendations**
Preserve endangered access points Establish new access points	*Developed the Shoreline Access Inventory Project *Addressed public access through review & comment on permit applications	*Promote enhanced access to & along the shoreline through permitting and enforcement of Ch91 public access requirements & voluntary compliance where appropriate
Public access information campaign		*Support efforts to establish new access points, such as Muddy Creek trails and Eelman Point beachfront
Town landing management & improvements	*Underway locally	*Continue to support local efforts
Protect public views; moderate noise levels	*Provided comments on proposal for private proposals *PWC operations ban addressed significant noise concern	*Support efforts to protect existing view and re-establish views that may have been lost. *Work with towns and MHD to ensure that Rt 28 improvements reflect local character *Support efforts to moderate noise levels by restricting fireworks & enforcing vessel speed controls
Protect archaeologocal resources	*Included archaeological component to Pleasant Bay Symposium 2006	*Work with local historicans, archaeologists and historical societies to catalogue historic, archaeological and cultural resources in the study area.

APPENDIX

MEMORANDUM OF AGREEMENT
Between the Towns of Orleans, Chatham, Harwich and Brewster
TO ESTABLISH THE PLEASANT BAY RESOURCE MANAGEMENT ALLIANCE

Article I. Recitals

WHEREAS, the estuary known as Pleasant Bay and its watershed lies within the municipal boundaries of Orleans, Chatham, Harwich and Brewster, and

WHEREAS, in 1995 the four towns entered into an agreement to develop a resource management plan ("plan") to protect the vast natural resources of the Bay, and

WHEREAS, the agreement established as a goal of the plan to have the towns adopt uniform polices and regulations for the management of the Bay, and

WHEREAS, the plan developed in accordance with the agreement provides management recommendations concerning the towns' policies and regulations relative to water quality, wetlands, wildlife, fisheries, boating, shorelines structures, and public access, and

WHEREAS, the Towns of Harwich, Orleans, Chatham and Brewster have approved the plan and subsequent five-year plan updates (herein collectively referred to as "the plan");

NOW THEREFORE, the undersigned towns, in consideration of the mutual covenants contained herein, hereby agree as follows:

Article II. Policy and Purpose

1. This agreement forms the Pleasant Bay Resource Management Alliance ("Alliance"). Through participation in the Alliance the undersigned towns agree to implement the plan recommendations, acting by and through their designated officers, employees or agents. The towns also agree to seek funding through Town Meeting for implementation of the plan in accordance with the terms of this agreement.
2. Each town participating in the Alliance shall retain authority over the resources and activities within its jurisdiction. The Alliance shall coordinate, and not duplicate or compete with, the functions of existing regulatory and planning organizations in each of the undersigned towns as they pertain to the Pleasant Bay Resource Management Plan.

Article III: Steering Committee

1. A Steering Committee shall be created, with one member appointed by the Board of Selectmen of each undersigned town.
2. The Board of Selectmen of each undersigned town may appoint an alternate Steering Committee member to vote in place of the appointed member when the appointed member is absent.

3. The members of the Steering Committee shall serve at the pleasure of the Board of Selectmen of the Town by whom they were appointed.
4. Provided there is a quorum of three-quarters of the members or designated alternates present, the Steering Committee shall act by majority vote.
5. The Steering Committee shall elect a Chairman, Vice-Chairman, and Treasurer annually.
6. During any fiscal year for which a Town Meeting in one or more of the undersigned towns fails to appropriate funds in accordance with the provisions of Article VI of this agreement, the Steering Committee member and alternate from such town shall serve as an ex officio member and alternate and shall not vote.
7. The Steering Committee shall be authorized to expend funds, subject to the conditions contained herein, from the Pleasant Bay Resource Management Alliance Account as described in Article V of this agreement. The Steering Committee shall have no authority to contract for services or expend funds in excess of the amount available in said account. All contracts shall be in writing and no contract shall be entered into without a certification of the Town of Chatham Finance Department in accordance with Article V of this agreement.
8. The Steering Committee shall have overall responsibility and accountability for coordinating with officers, employees or agents of the undersigned towns to implement the plan.

Article IV: Technical Resource Committee

1. A Technical Resource Committee shall be created, with four members from each of the undersigned towns. The Committee members may include the harbormaster, shellfish constable, conservation agent, health agent, town planner, or their equivalent as determined by the town's Board of Selectmen, of each undersigned town.
2. The members of the Technical Resource Committee representing each town shall be appointed by their respective Board of Selectmen.
3. The Technical Resource Committee shall provide technical assistance, advice, and recommendations to the Steering Committee in the implementation of the plan.

Article V: Alliance Account

1. An account shall be established under the jurisdiction of the Town of Chatham Finance Department to be known as the Pleasant Bay Resource Management Alliance Account ("Alliance Account").
2. The Alliance Account shall be the depository for all non-municipal funds and municipal appropriations made for the implementation of the plan.
3. Expenditures from the Alliance Account shall be authorized by a majority vote of the Steering Committee as provided herein. Any expenditure so authorized shall be subject to the customary and ordinary requirements for the expenditure of funds in the Town of Chatham.

4. The Steering Committee is authorized to release funds from the Alliance Account for consultant services, or other goods and services related to the Pleasant Bay Resource Management Plan's implementation.

Article VI: Budgeting and Reporting

1. The Steering Committee shall prepare a proposed annual budget and operating plan for the coming fiscal year.
2. The proposed annual budget and operating plan shall be presented to the Boards of Selectmen of the undersigned towns per each town annual budget schedule.
3. The proposed annual budget shall indicate the amount of funds requested from the Towns of Orleans, Chatham, Harwich and Brewster for the coming fiscal year, as well as the amount and source of all non-municipal funds. The total amount of funds requested from the Towns of Orleans, Chatham, Harwich and Brewster, shall be apportioned as follows: thirty-five (35) percent to Orleans, thirty-five (35) percent to Chatham, eighteen (18) percent to Harwich, and twelve (12) percent to Brewster. In accordance with current practice, all participating towns shall include their share of funds as a line item in their annual town budget.
4. The proposed annual budget shall present the expenditures planned for the coming year.
5. At the end of each fiscal year the Steering Committee shall submit a financial statement and a report of activities to the Boards of Selectmen of the undersigned towns to be publicized in annual town reports.
6. Funds in the Alliance Account not expended by the end of the current fiscal year shall remain in said account and applied toward approved expenditures related to the implementation of the Pleasant Bay Resource Management Plan in the following fiscal year.

Article VII: Renewal and Termination

1. The approved plan shall be reviewed and updated as necessary every five years. Any proposed amendments to the approved plan shall be submitted to the Board of Selectmen in each of the undersigned towns for review and may be submitted to Town Meetings in the undersigned towns for approval.
2. This agreement shall expire December 31, 2013 unless prior to that date the undersigned towns take action either to extend or terminate the agreement.
3. Upon termination of the Alliance, the assets remaining in the Alliance Account after all outstanding obligations have been paid shall be returned to the source of funds. If the source of funds is not discernible, then remaining funds shall be distributed among the undersigned towns in accordance with Article IV. Section 3 of this agreement.
4. This agreement shall be subject to the applicable provisions of General Laws, Chapter 40, Section 4A governing contracts between municipalities except such provisions of Chapter 40, Section 4A requiring Town Meeting approval in which case each town's process shall be governed by applicable provisions of that town's Home Rule Charter.

Executed this day of , 2008 by

_____	_____
Chatham Board of Selectmen	Harwich Board of Selectmen
_____	_____
Orleans Board of Selectmen	Brewster Board of Selectmen