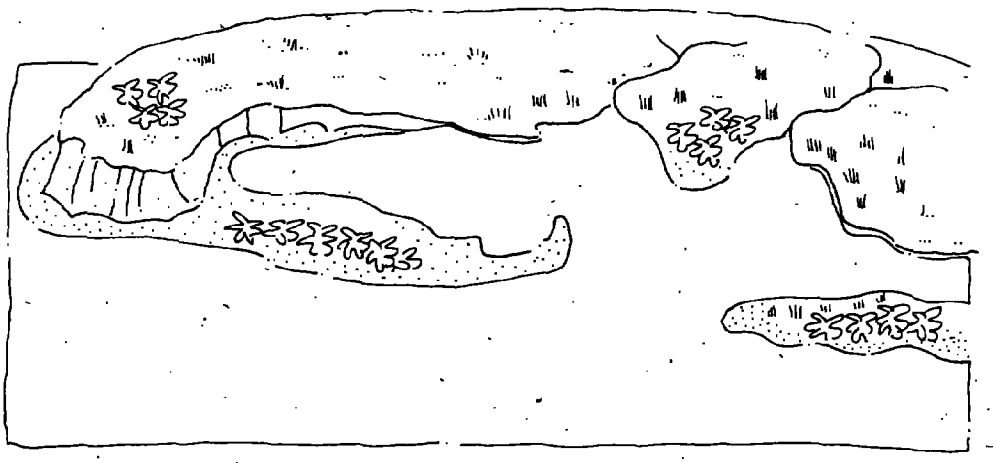
Guidelines for

Barrier Beach

Management in Massachusetts



A Report of the Massachusetts Barrier Beach Task Force

February 1994

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Guidelines
for Barrier Beach Management in Massachusetts

A Report of the Massachusetts Barrier Beach Task Force

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FOREWORD

On May 29, 1992, the Massachusetts Coastal Zone Management Office, the Massachusetts Audubon Society and the Association for the Preservation of Cape Cod co-sponsored a "Conservation of Our Barrier Beaches" Symposium in Brewster, Mass. At the conclusion of the symposium, the co-sponsors resolved to explore some of the outstanding and pressing questions and issues that had been raised and left unanswered by symposium participants. With unanimous support, the co-sponsors, along with the Massachusetts Department of Environmental Protection which had advocated for the formation of such a group with the Audubon Society since 1991, established the Massachusetts Barrier Beach Task Force. Later that summer, an agenda, schedule and membership list were drawn up by the co-sponsors and the Department.

In addition to the Symposium resolution, other forces leading to the establishment of the Task Force were:

- The federal government's addition to the U.S. Endangered Species List of the piping plover;
- The establishment of jurisdiction, under the Massachusetts Wetlands Protection Act, over the use of off-road vehicles on barrier beaches at Nauset Beach in the Town of Orleans; and
- The enactment of an Endangered Species Act by the Massachusetts Legislature.

The **Guidelines** that follow are provided as a public service to those given responsibility for implementing and complying with a myriad of federal, state, and local laws relevant to barrier beaches. They are designed to serve as a reference tool to those charged with the responsibility of preparing, reviewing, and implementing barrier beach management plans. This reference book need not be read cover to

cover in order to be understood, although that effort is certainly encouraged. A Matrix in the Appendix allows for quick and easy access to the most recent interpretation of laws and how they apply to actual and potential barrier beach uses.

For each potential barrier beach use covered in this document, the Task Force has provided a "Summary of Wetlands Protection Act Regulatory Performance Standards" and prepared a set of "Recommended Management Measures" that may be appropriate for your beach. **All recommendations may not be suitable for all areas. Each beach should be managed site-specifically! Granted, there are certain general principles that are relevant to the natural functioning and management of all barrier beaches, however, the application of a particular recommendation depends upon the individual circumstances of nature and use. Local authorities may know these issues best and should tailor their management plans accordingly. Beach managers and conservation commissions should work together in this regard.**

These **Guidelines** are intended to set barrier beach stewards headed in the direction of responsible beach management. It is recognized that many beach management issues will remain to be discussed and reviewed on a case-by-case basis with municipal conservation commissions, the Massachusetts Department of Environmental Protection, the Division of Fisheries and Wildlife, and the managers themselves in order to meet the standards of environmental law. The Task Force's intent is to equip local beach managers in order for them to be proactive, rather than reactive, in their management approach.

Beach managers should prepare barrier beach management plans and submit them to their municipal conservation commissions as a Notice of Intent for review under the Massachusetts Wetlands Protection Act and any relevant municipal wetlands protection by-law or ordinance. The conservation commission can then issue an Order of Conditions based on the elements of the plan within their jurisdiction. Therefore, each barrier beach management plan in Massachusetts will be subject to a full, legally advertised **public hearing** prior to any final approval.

We also recommend that the public be involved in each step of the planning process. The Massachusetts Coastal Zone Management Office offers a "Guide to Public Involvement" (January 1988) that may assist managers in working with the public. Management plans should also be routinely updated.

Where barrier beaches cross political and jurisdictional boundaries, it is recommended that a regional approach be used in drafting management plans.

In conjunction with the drafting of the **Guidelines**, the Task Force recommended that the Massachusetts Department of Environmental Protection independently issue a Wetlands Policy in the form of a generic Order of Conditions specific to off-road vehicle use, the building of structures, and beach nourishment and dune restoration activities on barrier beaches. This was done and appears in Appendix I.

The Task Force also recommended that the Massachusetts Division of Fisheries and Wildlife independently issue a policy on "Off-Road Vehicle Management Guidelines for Piping Plovers and Terns in Massachusetts." That policy appears in Appendix H.

Together, these two follow-up documents will help implement the Task Force's recommendations. The Department of Environmental Protection and the Division of Fisheries and Wildlife enforce the Massachusetts Wetlands Protection Act and Endangered Species Act respectively and are appropriately equipped to perform this function. The Task Force has convened varied barrier beach interests who have been able to come together in a constructive way to provide barrier beach stewards with **Guidelines** that may help them in the tough and complex task of barrier beach management.

Users of the **Guidelines** should be aware that the document is equally applicable to barrier beaches under Commonwealth stewardship as they are to those under the ownership of Massachusetts' cities and towns. Federal agencies and private individuals and organizations are also encouraged to apply the **Guidelines**, where appropriate, to barrier beaches under their jurisdiction. The result can be a consistent and uniform method of managing the 681 barrier beaches throughout the Bay State. In addition, these **Guidelines** advance the goals and objectives of the Secretary of Environmental Affairs' "Environmental Agenda," and Massachusetts Executive Orders, Number 181 and Number 190, while also serving as policy for the Secretary's Coastal Zone Management Program.

The **Guidelines** provide for an ecosystems-based management approach designed to foster responsible use and protection of the Commonwealth's barrier beaches. Implementation of the **Guidelines** can be considered application of Best Management Practices.

The Task Force's guiding principles regarding the incorporation of text into the **Guidelines** were that: 1) the information be readable; and 2) the information be relevant to barrier beach management today. The sounding board for all information included in the **Guidelines** came from representatives of the Beach Managers Association of Massachusetts. The Association's members are charged with the day-to-day responsibility of managing most of the 18,750 acres of barrier beaches throughout the Commonwealth.

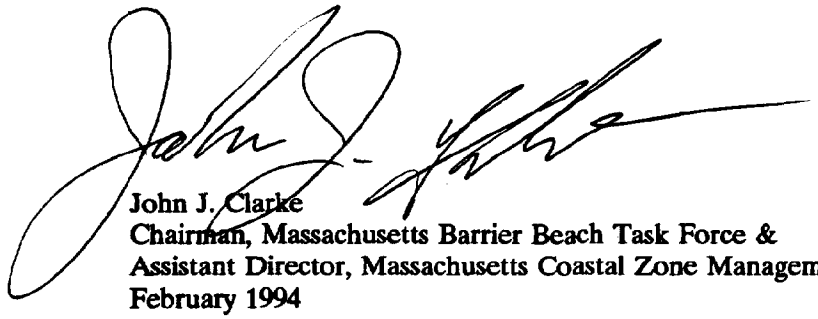
Since establishment of the Task Force, many individuals, environmental groups, federal, state, and local government agencies, advocacy, special interest, and user groups have expressed a desire to participate in the Task Force's deliberations. The Task Force has welcomed their participation and in many instances has charged a particular group with the responsibility for drafting a section of the **Guidelines** where that group had expertise. No individual, agency, or group has been denied an opportunity to participate in the Task Force's deliberations.

In drafting these **Guidelines,** the Task Force employed a consensus approach in arriving at group decisions. There were no votes taken where a majority could rule.

Alternatives were developed and explored in order to satisfy the group's interests inside of existing environmental law. Reaching consensus took more time than a centralized approach. The added time, however, was devoted to understanding people's perspectives and values. The results, I believe, were more creative and effective, as expressed in the **Guidelines'** "Recommended Management Measures."

Some members of the Task Force have had differences in the past, continue to have differences, and will inevitably express differences in the future. However, the Task Force members have worked from a shared sense of common ground -- that is, the protection and responsible use of the Commonwealth's barrier beaches.

The Massachusetts Executive Office of Environmental Affairs and its agencies remain available to provide technical assistance to barrier beach stewards on interpretation and application of the **Guidelines**.



John J. Clarke
Chairman, Massachusetts Barrier Beach Task Force &
Assistant Director, Massachusetts Coastal Zone Management Office
February 1994

The Massachusetts Barrier Beach Task Force

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INTRODUCTION

Goals

The Massachusetts Barrier Beach Task Force set three primary goals in the development of these **Guidelines:**

- To draft guidelines for barrier beach management in Massachusetts that will serve as policy and planning guidance for those with stewardship responsibilities over barrier beach ecosystems in Massachusetts;

- To include the most relevant and useful information regarding the protection and responsible use of barrier beaches; and

- To have state, federal, local and regional/county governments and private entities consider the recommendations in the guidelines and adapt them to their particular circumstances as policy.

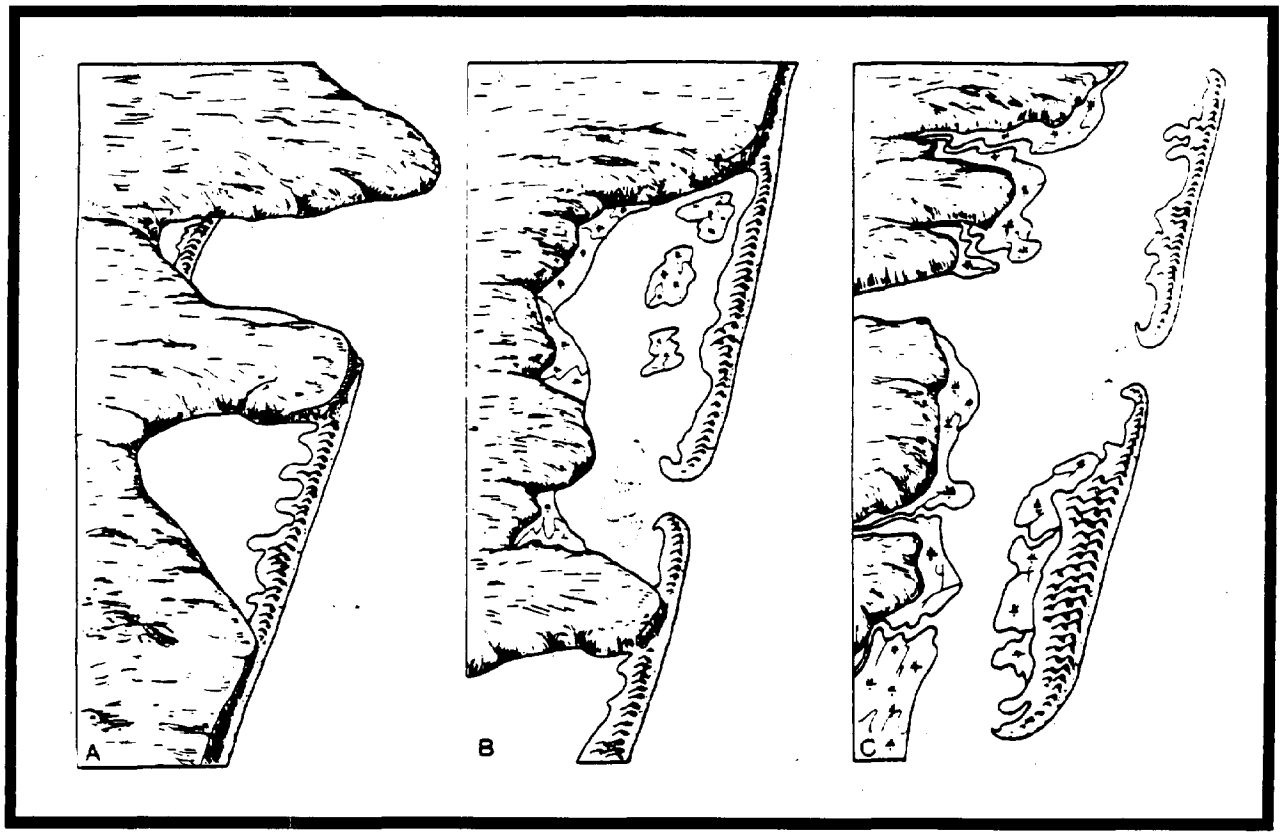


Figure 1. Types of barrier beaches: (A) Bay Barriers, (B) Barrier Spits, and (C) Barrier Islands.

Understanding Barrier Beaches

There are several basic questions that are often raised about barrier beaches, their ecology, and their importance in the ecosystem. The Task Force has attempted to answer some of the most common questions and provide an overall understanding about the role barrier beaches play in the coastal environment.

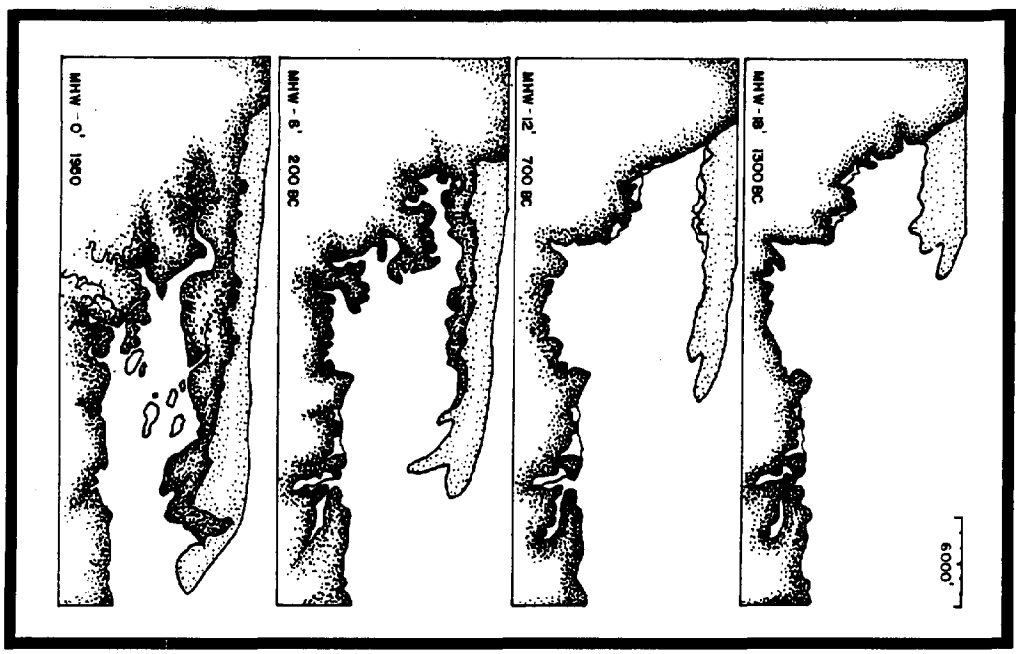
What Is A Barrier Beach?

A barrier beach is a narrow strip of beach and dunes separated from the mainland by a marsh, bay, river, or any other water body. The gently sloping beach extends from the frontal dune line to the offshore sand bar where waves first normally break. Dunes are hills or ridges of sand deposited by the wind and/or wave action, or can be artificially deposited, and are often covered with beachgrass. All dunes extending from the beach to the marsh, bay or river are part of the barrier beach. Together the beach, dunes, tidal flats and associated water bodies comprise the dynamic barrier beach ecosystem. Barrier beaches provide storm buffers for both humans and wildlife in harbors and upland areas behind the barrier. They also serve as habitat for a variety of plant and animal life, several of which are endangered in Massachusetts and throughout the nation.

In the Bay State, there are three basic types of barrier beaches: bay barrier, barrier spit, and barrier island. A bay barrier is connected to the mainland at both ends. A barrier spit is only connected at one end, and a barrier island is not connected to the mainland at all.

Why and How Do Barrier Beaches Change?

Barrier beaches are always changing. In just a year's time these changes become clearly evident. In the summer, when waves are generally less steep, the beach builds up becoming higher and wider. Large, steeper waves that occur in the fall, winter and early spring, cut into the beach and cause it to narrow and flatten. Over a longer period of time, many barrier beaches throughout the Commonwealth tend to migrate landward. This occurs when waves break and carry sand from the ocean side over the beach and dunes, to the landward side. This movement also occurs when sand is swept through tidal inlets into the bays and rivers behind barrier beaches. The landward movement of the barrier beach is caused by storm overwash, as well as the gradual rise in sea level which Massachusetts and other areas of the East Coast have been experiencing for thousands of years. In some areas of the coast, the rate of landward movement is as much as several feet per year. Its most dramatic effects are felt during storm events.



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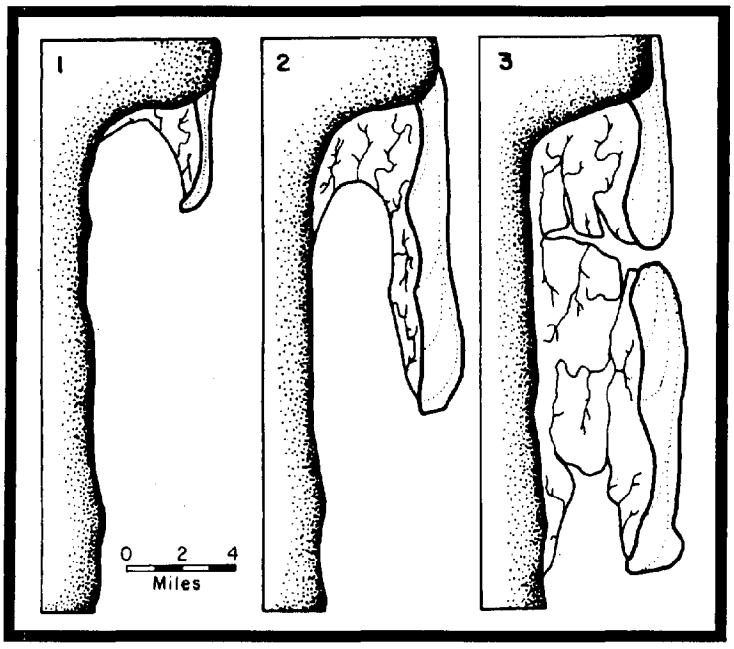

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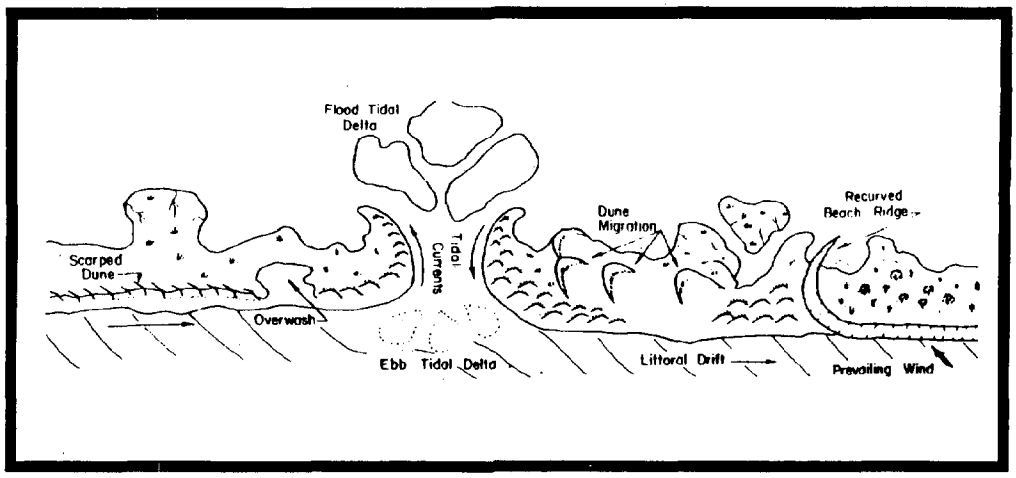
Figure 2. Reconstruction of the growth of Sandy Neck and development of Barnstable Marsh, Cape Cod, Massachusetts (Redfield 1972).

Figure 3. Barrier island formation by spit accretion and inlet breaching (from Hoyt 1967).

The strength of the barrier beach system lies in its natural dynamic character. This character is most clearly represented by the beach's and dune's abilities to respond (move and reshape) to storm winds and waves as a complete ecological unit. When left unaltered, barrier beaches respond to storm overwash quite well by building up again. The overwash provides the substrate for re-establishment of landward saltmarsh and/or dunes, as well as, in some cases, allowing landward migration. Aerial photographs of barrier beaches often show the re-establishment of saltmarsh or dunes on overwash fans. Beachgrass grows on overwash fans and traps windblown sand to begin the formation of new dunes. Eventually, the barrier beach will look much as it did before the storm, although it may now be slightly closer to the mainland. The barrier is not "breaking down" during overwash episodes, it is simply responding to the natural cycles upon which it depends.

As part of the barrier beach system, overwash plays an important role in wave energy dissipation. While the overwash fan itself is important in dissipating storm wave energy, the active process of overwash is critical. The process of overwash acts as an energy release mechanism preventing numerous other overwashes from forming by redirecting wave energy through itself. The overwash is important to the continued existence of the barrier. It allows the barrier beach to migrate landward in response to storms and relative sea level rise. When considering the importance of overwash episodes, the entire barrier profile, including its readjustment, must be considered. A barrier beach profile includes not only the portion of the barrier which can be seen, but also the seaward area out to the wave base or closure point. Wave base is the seawardmost depth where sediment movement occurs under normal day-to-day or storm wave action. Along the eastern seaboard, the 27 foot bathymetric contour is a representative wave base under severe storm conditions. Therefore, under severe storm conditions, the barrier beach profile extends to that bathymetric contour. The active profile changes under varying storm intensities. Consequently, the alteration of a portion of the profile can result in the interruption of the barrier's equilibrium and may result in additional, unnecessary damage during a subsequent severe storm. For example, bulldozing overwash material onto the seaward side of the barrier from an overwash area, will result in a changed barrier profile. The placement of material on top of the established natural equilibrium profile can result in the unnecessary loss of barrier material during the next storm through an artificial lowering and thinning of the barrier.

Many times, the usual human response to overwashes and the resultant shoreline retreat and flooding is to build seawalls, groins or other hard structures in an attempt to "protect the beach." Unfortunately, these alterations, along with paving and bulldozing, interfere with the natural processes of the barrier beach. They prevent overwash and interfere with beachgrass and dune growth, contributing to erosion in surrounding areas. These disturbances are damaging to the system as a whole. Once the natural beach and dune rebuilding processes are interrupted, the barrier beach defenses against future storms are diminished. In an attempt to "stabilize" the barrier beach through armoring, such as building a seawall or revetment, the beach areas adjacent to and in front of the armoring erode or scour at an accelerated rate and may entirely disappear over time.



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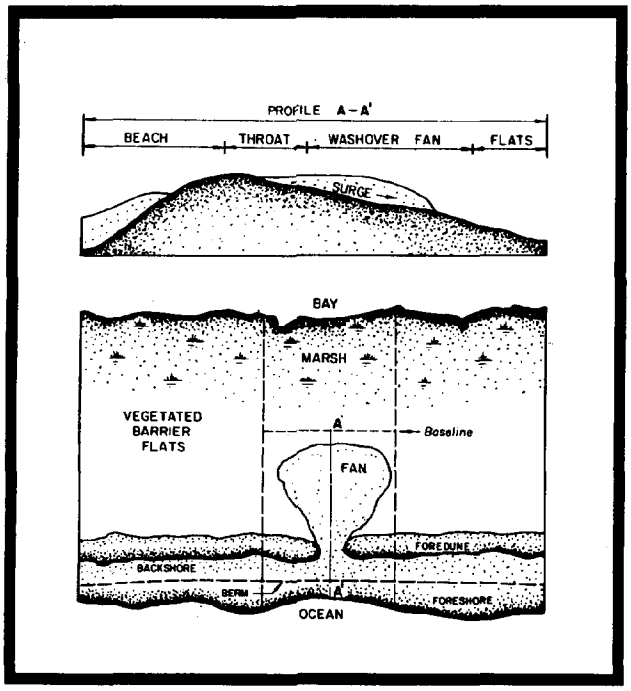

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Figure 4. Mechanisms of sand transport on barrier beaches (modified from Godfrey 1976).

Figure 5. Overwash surges during storm conditions (above) and resulting washover fans (below).

In many instances, coastal banks adjacent to barrier beaches serve as the principal sediment source for the barrier. It is therefore advised that, wherever and whenever possible, coastal banks serving as sediment sources for adjacent barrier beaches, remain or be returned to an undeveloped, unarmored state in order to allow for healthy coastal beaches and dunes. It is recommended that, in a proactive approach, barrier beach managers identify the major sediment sources for their barriers and participate, if necessary, in proceedings of the Massachusetts Wetlands Protection Act and the Massachusetts Environmental Policy Act in order to protect the future supply of that source.

Why Should Citizens Be Concerned About Barrier Beaches?

Development on barrier beaches can pose significant hazards to the public's health and safety. In 1900, over six-thousand people lost their lives when a hurricane caused flooding and overwash of the barrier beach in Galveston, Texas. While storm warning systems have improved greatly since that tragedy, the number of people living on these hazard prone areas has also increased dramatically. According to the U.S. Department of Commerce, 45% of the total land area in Massachusetts is coastal while over 75% of the population lives in coastal areas. In addition, 50% of all construction occurs in the same communities.

There are other reasons why citizens should be interested in barrier beaches. Tax money is used to indirectly promote development in barrier beach areas. Citizens are currently helping to pay for subsidized loans, disaster assistance, and the development of infrastructure, including roads, sewers, and water lines, for these beaches. One estimate indicates that it could cost the nation approximately $112 billion in the next 20 years should the government continue to invest in barrier development.

According to State-Federal Hazard Mitigation Team reports, "Hurricane Bob" (August, 1991), the "Halloween Northeaster" (October 1991), and the "December '92 Northeaster" cost taxpayers **over $50 million** (over and above monies paid from the Federal Flood Insurance Program) to repair public roads, seawalls, sewer and water lines, buildings, and other public facilities in the Bay State. The 1991/1992 storm season also caused billions of dollars in damages to private property -- much of this on barrier beaches. Approximately two thirds of the homes destroyed by those storms were located on barrier beaches. Many of these homes were behind seawalls and other erosion control structures which gave homeowners a false sense of security. Those same seawalls also contributed to beach erosion thereby reducing the natural storm defenses of the barrier beach. Most of these seawalls were reconstructed at public expense in much the same way as they had existed prior to the storm season. The large seawall and stone mound structure on Minot Beach in Scituate has been reconstructed nineteen times. It was reconstructed after the "Blizzard of '78" with a cost to the taxpayers of over $700,000. Despite the immense size of this structure many of the homes behind it continue to be heavily damaged by coastal storms.

How Should Barrier Beaches Be Managed?

Barrier beaches are managed for a variety of reasons, including recreation, tourism, ecosystem protection, conservation, and residential usage. There are many considerations to address. Federal, state, and local agencies have a variety of jurisdictional interests in the barriers. Bringing all these issues together in a management plan should help to codify management goals and initiatives. There are many resources to use in development of a plan.

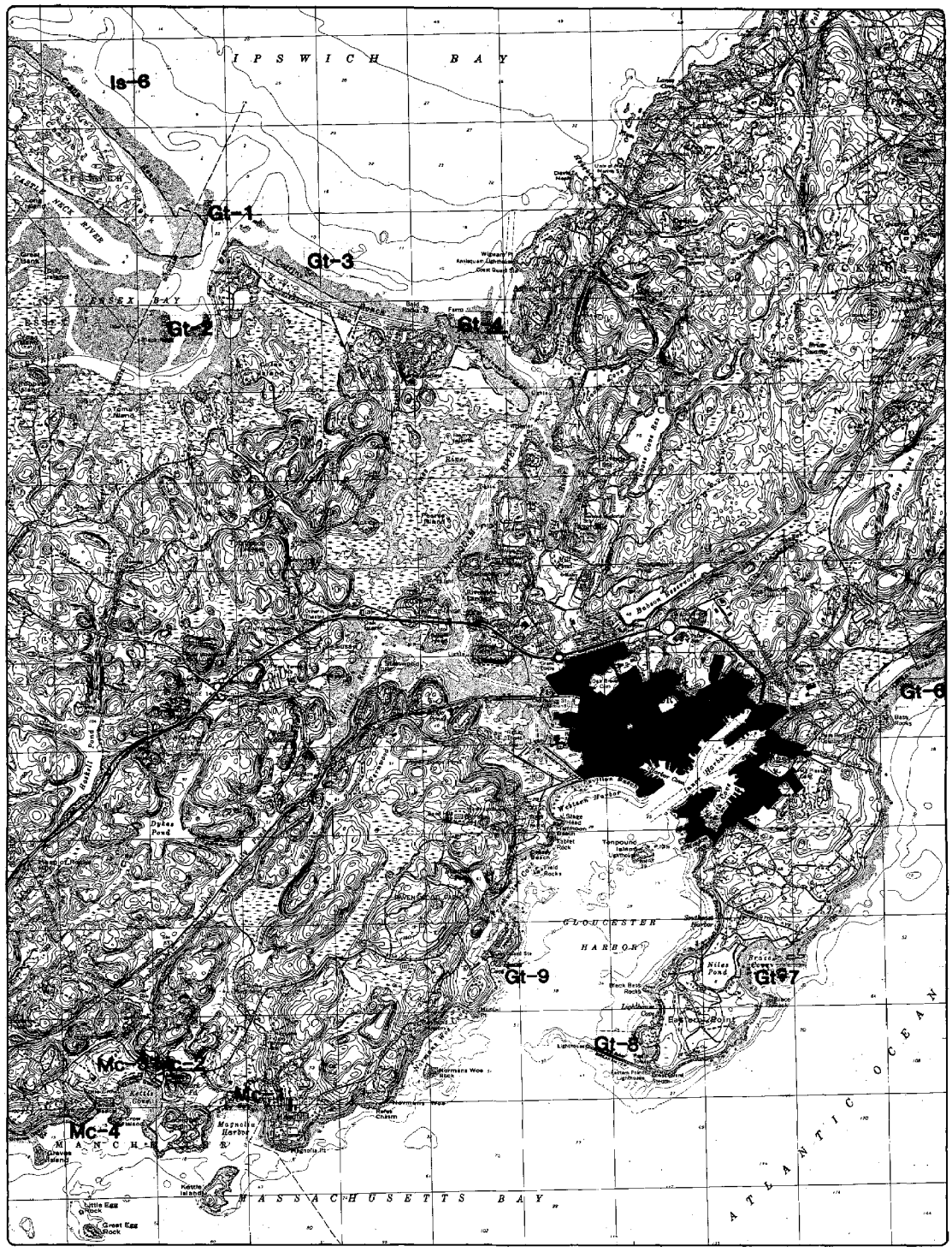
Executive Order Number 181 (1980), established a framework for the management of barrier beaches in Massachusetts. The Order directs that state acquisition of barrier beaches be made a priority. This Order assigns the highest priority for use of disaster assistance funds to relocate willing sellers from storm damaged barrier beach areas. Also, state and federal monies for construction projects will not be used to encourage new growth and development on barrier beaches. These economic policies recognize barrier beaches as hazard-prone areas where future storm damage will inevitably occur.

Local governments play an important role in barrier beach management. Since municipal commissions, committees and boards review proposals for construction activities on barrier beaches, a large responsibility resides with local officials to ensure that proposed activities reflect both the natural and economic hazards and the environmental sensitivity characteristic of barrier beaches. The Massachusetts Barrier Beach Task Force strongly encourages municipalities to develop management plans for locally owned barrier beach areas to promote appropriate use.

The Massachusetts Coastal Zone Management Office has readily available maps which identify and delineate each barrier for each coastal city and town in the Commonwealth ("Coastal Zone Management Barrier Beach Inventory Project," December 1982). [See Appendix C for the complete list and municipal location of each barrier beach.] Coastal Zone Management also has available data indicating the rate of shoreline erosion and accretion through its "Massachusetts Shoreline Change Project" (January, 1989). Other excellent references are the "Barrier Beach Management Sourcebook," developed by Coastal Zone Management (1983) and the "Barrier Island Sourcebook" (Leatherman, 1979). Appendix K is a bibliography that highlights these and other publications that will be useful to supplement these **Guidelines.**

With the addition of "Wildlife Habitat" to the list of interests protected under the Massachusetts Wetlands Protection Act and the passage of a state Endangered Species Act (1990), barrier beach management has moved to a new level of importance -- beyond flood control and storm damage protection -- to the protection of wildlife habitats and rare species on barrier beaches.

With all that has been learned since promulgation of the Massachusetts Wetlands Protection Act's Coastal Regulations in 1978, the addition of new statutes protecting wildlife habitat and endangered species, and our on-site experiences regarding the



Barrier Beach Inventory Project

Executive Office of Environmental Affairs
Massachusetts Coastal Zone Management
Richard F. Delaney, Director

Project Coordinator: Gary Clayton
Geologic Advisor: Jeffrey Benoit

Maps depict Barrier Beaches subject to Executive Order No. 181.

Barrier Beach Unit Code System

Gt - 9
Town Barrier unit

Barrier Beach Margins
The seaward and landward margins of all barrier beach units extend to mean low water and include contiguous marsh and/or tidal flats.

- no contiguous marsh and/or tidal flats are present
- contiguous marsh and/or tidal flats are part of the barrier beach unit

North

Scale in Feet 1:40,000
1000 0 1000 2000 3000 4000 5000

Mass. Quadrangle Location

Gloucester Quadrangle
Massachusetts - Essex County

The geological field research and mapping was compiled and produced under contract with **The Provincetown Center for Coastal Studies**

Principal Investigator: Lester B. Smith, Jr.
Date of completion: April 1982

Base maps are U.S. Geological Survey Quadrangles - 7.5 Minute Series (Topographic)
Department of Public Works, Massachusetts

The preparation of this publication was funded by the Office of Coastal Zone Management, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, under a program implementation grant to the Commonwealth of Massachusetts.

Figure 6. Barrier Beach Inventory Project map of Gloucester.

dynamics of barrier beach ecology, the Task Force hopes that these **Guidelines** will serve to help better understand barrier beach processes in order that ecosystems-based management of these fragile coastal resources can be improved.

Barrier Beach Economics, including Fees and Financing

The coast and coastal zone of Massachusetts is the most significant economic natural resource in the state. According to data from "Valuing Coastal Zone Management," a March 1990 report prepared for the National Coastal Resources Research and Development Institute by the University of North Carolina/Chapel Hill's Center for Urban and Regional Studies, the Coastal Gross National Product has been growing faster than the overall Gross National Product. The Massachusetts Coastal Zone Management Program has determined that over half of the Commonwealth's share ($70.7 billion in 1985) of the Gross National Product originates from coast-related activities. Included among these activities are the third largest fisheries industry in the United States and an important tourism industry that centers around bathing beaches and tourist attractions. These businesses are strongly dependent on healthy coastal ecosystems.

VALUING THE COAST

Barrier beaches comprise approximately 222 miles (or a little more than 21%) of the state's 1,500-mile beach shoreline (as determined by the Army Corps of Engineers). The 681 barrier beaches along the Massachusetts coast provide a wealth of resources that contribute greatly to the economic health of the Commonwealth. According to the Massachusetts Audubon Society's white paper "Turning the Tide: Toward a Liveable Coast" (1992), measuring the value of barrier beaches is difficult, both because of a lack of availability of basic data and because the very nature of some of the resources make assigning a dollar value a difficult task. Estimating the aesthetic value or desirability and attractiveness of coastal resources is an even more imprecise process. Nevertheless, the following information will provide some insight into the magnitude of economic contributions that barrier beach resources provide in Massachusetts.

Storm and Erosion Control

The value of storm and erosion protection capabilities of barrier beaches is enormous and well documented. Barrier beaches deflect the force of onshore waves, and function as wave energy absorbers during coastal storms.

While there are no definitive numbers for the storm protective value of barrier beaches, the flood control and erosion control benefits of wetlands have been documented by the Environmental Law Institute in "Our National Wetland Heritage" and the United Nations Conference on Environment and Development's "United States of America National Report." As discussed earlier, coastal wetlands reduce the impact of storm tides and waves before they reach upland areas. The mats of wetland vegetation, with their complicated root systems, bind and protect soil against erosion. While an exact correlation may not be possible, using an annual protection value of $2,020 per acre of wetland as determined by the federal government, the 49,000 acres of saltmarsh wetland behind Massachusetts' barrier beaches provide as much as $600 million in storm and erosion protection every year.

Fisheries

The waters of the Commonwealth are rich in finfish and shellfish, including lobsters. Saltmarsh areas protected by barrier beaches are important to fisheries for two reasons: they are a major source of nutrients for shellfish and finfish; and they provide protected spawning and feeding grounds for many of the most economically significant commercial fisheries. According to "Our National Wetland Heritage," it has been estimated that 90 percent of the species of commercial importance either pass their entire lives in estuarine environments that are protected by barrier beaches or require estuaries as nursery grounds. From information provided in the Massachusetts Audubon Society's white paper, a conservative estimate of the cumulative value of all Massachusetts commercial fisheries, including nearshore and offshore waters, was $1 billion for 1984.

Using figures from "The Massachusetts Marine Economy" (April 1991) prepared by the Massachusetts Centers of Excellence Corporation, an estimated 1.1 million recreational fishermen made 4 million fishing trips in 1986. They caught about 26 million fish, with over 19.5 million coming from Massachusetts' coastal waters. Sixty percent of the recreational catch came from enclosed coastal waters (river mouths, bays, sounds), many of which are protected by barrier beaches. While it is hard to isolate the economic impact of barrier beaches on recreational fishing, it has been estimated that recreational finfishing contributed $638 million to the state economy in 1988. Over 24,000 people took part in recreational shellfishing in Massachusetts in 1987 and harvested food items valued at $4.4 million.

From this data, it is clear that commercial and recreational fisheries provide significant contributions to the state's economy. It is also clear that the role barrier beaches play in the creation and protection of saltmarsh habitat for fisheries is important in maintaining the economic and ecological health of those fisheries.

Tourism and Recreation

Massachusetts' coastline lies within a day's drive of one-quarter of the nation's population. As the state has moved away from a manufacturing economy, the tourism industry has become the largest single component of the state's economy. According to U.S. Travel Data Center figures, residents of the U.S. made an estimated 17 million trips to Massachusetts in 1990 (an average 1.9 people per trip party, or 32.2 million person-trips). For 70 percent of these visitors, the primary purpose of traveling was for pleasure. Fifty-four percent of the visits occur in summer, the most popular season to visit Massachusetts. Thirty-six percent of the tourists visited the beach or seashore (11.6 million visits), showing that the coast of Massachusetts has a strong influence on its tourism value. The Massachusetts Office of Travel and Tourism reports that seaside areas are the fastest growing tourist areas in the state, with tourism in coastal counties growing at a rate of 13% in 1988, compared to a rate of less than 9% for the rest of the state.

In 1990, expenditures by domestic visitors (not including international tourists) to the coastal counties of Massachusetts totaled over $5.8 billion. Not all of this can be attributed directly to the use and enjoyment of coastal resources. Visits to historic sites, attendance at conventions, and other attractions unrelated to proximity to the coast probably accounted for the majority of tourism in the metropolitan Boston area. Nevertheless, visitors attracted to the coast do provide significant support for the economies of some regions, particularly the Cape and Islands. It is estimated by the

U.S. Travel Data Center that over 80,000 jobs can be attributed to tourism in the state's coastal counties.

Spending a day at the beach is probably the most typical coastal recreation activity. Quantifying the direct economic value of beach use is difficult because many beaches are free. Indirect economic benefits, such as income to area motels and restaurants, are also hard to quantify because no comprehensive data is kept on beach attendance. Research by the State of Florida and the U.S. Fish and Wildlife Service indicates that recreational users of the coast spend $45 to $55 per day on beach-related expenditures. The State of Florida has also determined that each dollar spent by tourists has a multiplier effect on the state's economy of 5.18. Research has yet to be undertaken in Massachusetts to determine the multiplier effect here. In 1987, the state's parks attracted 11.9 million visitors, 1.7 million of whom visited state beaches. Based on a 1992 Massachusetts Department of Environmental Management survey, half of all state park users also spent money in local restaurants and bought gifts during their trip. Attendance at the state and federally owned beaches, including Cape Cod National Seashore, Horseneck Beach Reservation, and Salisbury Beach Reservation, was almost 10 million in 1989. Private and town beaches accounted for several million more visitors.

Boating

According to the Massachusetts Marine Trades Association, in 1987, Massachusetts ranked nineteenth nationally in terms of registered boats in the Bay State (196,541). For the same year, the Commonwealth also supported $312,435,000 worth of boat, motor, trailer, and accessory purchases.

Real Estate

The value of coastal real estate has traditionally been higher than the state average. The Massachusetts Department of Revenue has calculated that, currently, coastal real estate per acre is worth approximately two and a half times non-coastal real estate. As indicated in "Valuing Coastal Zone Management," it was determined, for instance, that people in Rhode Island are willing to pay anywhere from $4,000 to $20,000 additional for a house with a view of the coast.

Intrinsic Value of the Coast

In addition to direct economic values, the coast has intrinsic worth that is not easily translated into dollars. This worth can be termed non-market value, even though something is not bought and sold, it still may have economic value. Economists have found that many people are willing to pay for scenic vistas, proximity to the coast or the assurance that coastal resources and aesthetics will be preserved for the future. Other studies have shown that people are willing to pay as much as $5.00 for a visit to a beach that they currently enjoy for free. People may even be willing to pay for protection of resources that they may never directly use, just for the satisfaction of knowing that unspoiled panoramas, healthy ecosystems and their attendant diversity of nature exist. While the intrinsic value of Massachusetts' coastal resources, and specifically barrier beaches, has not been analyzed in detail, studies in other areas have found that the intrinsic value can be as high as 50 percent of the direct economic benefits incurred from resource use.

FINANCING

It is important that beach managers work closely with their boards of selectmen or mayor's offices in order to adequately finance the operation of barrier beaches. Based on discussions with municipal officials and the Mass. Department of Revenue, the following are provided as possible funding options.

Municipalities should anticipate certain expenses when managing their barrier beaches. Actions necessary in order to financially prepare for barrier beach management plan implementation should include the preparation of balance sheets that clearly illustrate the expenses and revenues associated with beach management. If barrier beaches are to continue to attract visitors/users and revenue, communities should realize that financial commitments to these resources, such as maintenance and management, are crucial. It is recommended that the municipality's general fund provide the primary source of revenue for beach management. **Barrier beach revenues, however, should not be used to subsidize the general fund.**

Fair and equitable fees and fines should be levied by those with stewardship responsibilities over barrier beaches to accommodate the costs to maintain the beach.

Beach permit user fees can be levied for entrance and beach-related recreational uses. The Task Force recommends that revenues generated from entrance and beach uses be dedicated to beach and facilities' maintenance and improvements. An assessment should be made in order to determine whether or not beach-generated fees are adequate enough to pay for beach-related maintenance and improvements. With minimum state and federal assistance available to maintain such public services, it is recommended that, wherever possible, barrier beach fees be used to offset the costs of providing services at barrier beaches.

Fees can be dedicated to:

- Infrastructure maintenance and improvement -- entrance stations; parking lots and roads; bath houses; utilities (electricity, water, telephone, heat); machinery, equipment and vehicles; access ramps and boardwalks; beach grass plants and planting; fencing and signs; and
- Services/Management -- lot attendants; police and fire protection; public works staff; lifeguards; conservation officers and health agents; plover/tern wardens; harbormasters and shellfish wardens; barrier beach-related municipal expenses (personnel insurance, pensions, retirement and municipal building expenses); any outstanding beach-related debt service; beach acquisition programs; and public education.

Fee <u>options</u> can be broken down to include:

- Beach Lot Permits
  - Year-round Resident
  - Rental Resident
  - Daily/Weekly Visitor
- Off-Road Vehicle Permits
  - Resident
  - Nonresident

- Horseback Riding Permits
- Pedestrian Access (walk-ins)
- Bicycle Access
- Vessel Landings

Although municipal beach and parking fees often differ for non-residents and residents, the Task Force recommends that where fees are charged to local residents, non-residents should not be charged more than twice the local amount. Although the tax burden for municipal barrier beach care and maintenance is weighted to the local resident, where the environmental integrity of a barrier beach will not be compromised, public access for all residents of the Commonwealth is encouraged at a reasonable cost.

Fines imposed against violators of barrier beach regulations can also be dedicated to barrier beach management. Further information on this subject is discussed later on.

Enterprise Fund

As an alternative to general fund appropriations, proceeds can be dedicated to a special Barrier Beach Enterprise Fund. Enterprise funds have been successfully used in harbors, for instance, to insure that the community has adequate monies, generated by the users, to maintain and improve facilities when necessary. This is an accounting procedure that requires town meeting or city council approval. In order to separately account for the revenue and expenses of providing services at barrier beaches, municipalities are urged to establish such a fund.

An enterprise fund works as follows: through municipal adoption of Mass. General Laws Chapter 44, §53F½ all monies collected for beach use are placed in the fund and all beach-related costs come out of this fund. Expenditures are itemized on an annual budget and subject to the municipal appropriations process. The account, as with all other accounts, is managed by the municipal treasurer.

By accounting for all the revenues and costs associated with barrier beaches, beach managers can:

1) Demonstrate to the public how much of the costs of providing these services are recovered through user charges and how much, if any is being subsidized through taxes;

2) Adjust user service fees to make barrier beaches self-supporting in cases where beach facilities are currently a burden on the tax base; and

3) Accrue earnings to fund long-term maintenance or facilities improvement plans without money being directed to the general operating fund.

For additional information and guidance on establishing an Enterprise Fund, contact the Massachusetts Department of Revenue/Division of Local Services/Bureau of Accounts at (617) 727-2300. A detailed "Handbook" is available.

Non-Criminal Citations Using Local Bylaws/Ordinances

If a municipality has a local barrier beach or wetland protection bylaw/ordinance, there is a recommended enforcement technique which can be used

to bring about compliance before escalating to a lawsuit. The legislature has authorized municipal governments to use a non-criminal ticketing procedure to enforce local laws.

The ticketing statute, Mass. General Laws Chapter 40, §21D, provides that any ordinance, bylaw, rule, or regulation of any municipal office, board, or department may be enforced by this method as long as the violation is subject to a specific penalty. Only a few municipalities have actually adopted this process; some have made it applicable to a few specific bylaws/ordinances while others have given it more wide-ranging applications. Typical environmental laws enforced by this method include wetland bylaws/ordinances and regulations, conservation land rules and regulations, rubbish disposal and littering regulations, shellfish regulations, and violations of zoning bylaws/ordinances.

Use of the ticketing procedure allows an enforcement official to issue a ticket which provides for a specific sum of money to be paid as a penalty for the violation of a local law. The violator must pay the ticket or request an appeal in writing to the district court. If appealed, a hearing will be held on the matter within twenty-one days following the date the ticket was written.

Advantages to use of the non-criminal ticket include:

1) The criminal stigma is taken away from enforcement efforts;
2) The need to prove a case in a trial setting is for the most part eliminated; and
3) Many local laws can be enforced by a process similar to that employed for minor traffic violations, a process with which most people are familiar.

For further information and details, refer to the Mass. Department of Environmental Protection's Division of Wetlands and Waterways manual entitled: "An Enforcement Manual For Wetlands Protection In Massachusetts" (1990).

NOTE: The procedural aspects of Mass. General Laws Chapter 40, §21D have recently been amended, and additional amendments are likely in the near future. Consult with your town counsel or city solicitor for guidance before proceeding with this enforcement method.

CHAPTER 1

A Beach Manager's Guide to the Regulations

Definitions

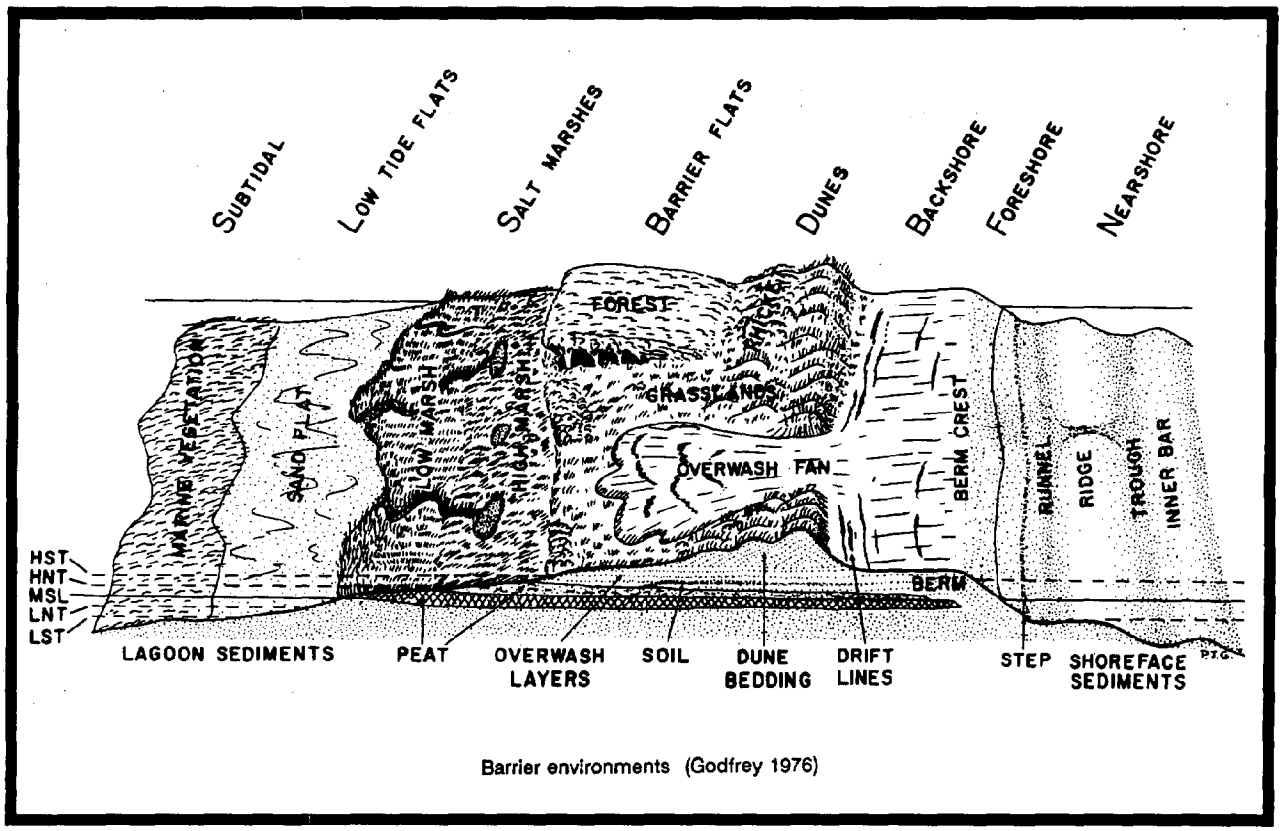
The criteria used for identifying and delineating barrier beaches in Massachusetts are based on the definition of a barrier beach as contained in the Preamble of Massachusetts Executive Order Number 181. This definition of a barrier beach is also identical to that of the Coastal Regulations of the Massachusetts Wetlands Protection Act:

> *Barrier Beach means a narrow low-lying strip of land generally consisting of coastal beaches and coastal dunes extending roughly parallel to the trend of the coast. It is separated from the mainland by a narrow body of fresh, brackish or saline water or a marsh system....(310 Code of Mass. Regulations 10.29)*

Since coastal beaches and coastal dunes comprise a barrier beach, it is important to understand the Massachusetts Wetlands Protection Regulatory definitions for these resource areas. The definitions are as follows:

> *Coastal Beach means unconsolidated sediment subject to wave, tidal and coastal storm action which forms the gently sloping shore of a body of salt water and includes tidal flats. Coastal beaches extend from the mean low water line landward to the duneline, coastal bankline or the seaward edge of existing man-made structures, when these structures replace one of the above lines, whichever is closest to the ocean....(310 Code of Mass. Regulations 10.27)*

> *Coastal dune means any natural hill, mound or ridge of sediment landward of a coastal beach deposited by wind action or storm overwash. Coastal dune also means sediment deposited by artificial means and serving the purpose of storm damage prevention or flood control....(310 Code of Mass. Regulations 10.28)*



Barrier environments (Godfrey 1976)

Figure 7. Barrier environments (Godfrey 1976).

General Characteristics

For management purposes, the Massachusetts Coastal Zone Management Office has identified and mapped 681 Massachusetts barriers in its "Coastal Zone Management Barrier Beach Inventory Project" (April, 1982). Individual maps are available to the public by contacting the Mass. Coastal Zone Management Office at (617)727-9530. Approximately 15 additional barriers have been identified and will be included in a future revision of the Inventory. The following general criteria from the regulatory definitions were used in the identification process:

narrow low-lying strip of land:

Barrier beach landforms are generally low-lying and narrow in width due to their geologic origin and evolution. The width and height of a barrier beach varies due to numerous factors including sediment supply, sediment transport patterns and rates, exposure to waves and human alterations. In Massachusetts, barrier dimensions range in width from over thousands of feet to those on the order of tens of feet.

consist of coastal beaches and coastal dunes:

Coastal beaches and coastal dunes are formed by coastal processes such as wave, tidal, wind and coastal storm action. Their existence is very important and in part distinguishes barrier beach landforms from other coastal landforms that comprise the Massachusetts coast. Unaltered dunes may range in height from a few feet above sea level to over fifty feet in elevation. As a result of filling, construction or structural stabilization, many barrier beaches have heavily altered beach and dune areas. These areas remain important buffers that help protect landward areas from storm damage and flooding. Regardless of the type of alterations that have occurred, the beach or dune deposits, if not their forms, continue to exist. Consequently, those barrier beaches that have been subject to human alteration and structural development remain protected by the Massachusetts Wetlands Protection Act and have been mapped by the Coastal Zone Management Office. Most other coastal landforms in Massachusetts consist entirely of bedrock or glacial sediment. These other areas are not barrier beaches but may be classified as another type of coastal wetland such as rocky intertidal shore or coastal bank.

parallel to the trend of the coast:

The mainland Massachusetts coast is quite irregular due to a non-uniform distribution of primary coastal deposits (glacial landforms and bedrock). Barrier beaches fill irregularities in the primary deposits, and they are generally oriented perpendicular to the direction of maximum wave fetch. Consequently, barrier beaches run parallel to the trend of the coast, but, since the coast is so irregular, barrier beach orientation is likewise variable.

separated from the mainland by a wetland or waterbody:

The definition of a barrier beach also clearly states that the landform is "... separated from the mainland by a narrow body of fresh, brackish or saline water or a marsh system." It is an important characteristic of a barrier beach that such a marsh or water body exist landward of the barrier.

a barrier beach may be joined to the mainland at one or both ends:

At the lateral boundaries the barrier beach "ends" where there is no longer a wetland or waterbody behind the landform and when a glacial, bedrock or fill upland is encountered. The barrier may also terminate at a water body, marsh or inlet. If one end terminates in this manner, the barrier is called a barrier spit. If both ends terminate this way, it is called a barrier island. Bay barriers, which are the most common barriers found in Massachusetts, occur when both margins are attached to upland areas.

developed barrier beaches:

Neither Executive Order Number 181 nor the definition of a barrier beach imply that altered barrier beaches should be identified or designated with any special status. Also, a landform does not have to be above any specific size threshold to be considered a barrier beach. Whether small or large, developed or undeveloped, these coastal barriers remain subject to significant storm damage and may provide important habitat for wildlife. Therefore, if a landform meets the geomorphic requirements, it is identified as a barrier beach regardless of size and degree of alteration (such as development). This is an important point that should not to be overlooked by barrier beach managers.

artificially created landforms:

Artificially created landforms with characteristics similar to natural barrier beaches exist along the Massachusetts coastline. These features, however, do not reflect the geologic evolution necessary for the landform to be classified as a barrier beach nor do these artificial landforms necessarily respond to storm processes in the same manner as a naturally-formed barrier does. An example of such a structure is the Stoney Point Dike in Buzzards Bay.

perched barrier beach:

In certain coastal areas, beach and dune deposits overlie irregular glacial surfaces. If a glacial landform extends above mid-tide, the overlying beach and dune resource areas are not identified as a barrier beach. When an underlying glacial surface only extends to a mid-tide elevation these landforms are identified by the Coastal Zone Management Office as barrier beaches. This criterion was selected because it could be applied to most coastal areas through a combination of aerial photo use and direct field observation. Also, identified "perched barriers" provide storm damage protection and flood control. Overwash fans are present on several perched barriers in Massachusetts indicating that these landforms are dynamic, potentially storm hazardous areas that may also play a role in providing wildlife habitat,

particularly for the rare piping plover.

influenced by regular tidal action:

All barrier beaches influenced by tidal action have been identified and mapped, even small barriers in coastal embayments. If a barrier landform is large enough to consist of a coastal dune, then it is identified as a barrier beach when it satisfies the wetland definitions. Depositional features in areas not subject to tidal influences or only subject to tidal action episodically (such as in ponds occasionally opened to the sea) are not identified as barrier beaches, because they do not satisfy the regulatory definitions.

Delineation of Barrier Margins

The margins of a barrier beach include the seaward (exposed) side to low tide in tidally influenced areas, the landward (protected) side and lateral margins.

The lateral margins of barrier beaches encountered in Massachusetts include upland margins and water body or wetland margins. The water body or wetland margin is usually a straightforward determination. The upland/barrier beach margin delineation, however, can be difficult to determine. Therefore, this delineation will be discussed in detail. There are three basic types of barrier/upland margins: (1) coastal bank; (2) dune-upland; and (3) bedrock.

coastal bank margin:

Most of Massachusetts' barriers are bay barriers with coastal bank lateral margins. In most instances, coastal banks consist of glacial sediment which were formed by major ice advances over New England. These deposits are variable in composition and texture. They may consist of glacial till, glacial outwash or glacial lake or marine deposits.

dune-upland margin:

This boundary occurs when coastal dunes are present on top of or seaward of an upland. The upland may consist of glacial material, bedrock or artificial fill. The dune-upland margin can form when a barrier beach builds laterally in front of an upland or when a barrier migrates landward and attaches itself to an upland. This margin also occurs when the landward marsh or water body behind a barrier has changed to upland as a result of artificial filling of a portion of the marsh/wetland area.

bedrock margin:

The lateral margin of a barrier beach can terminate at bedrock, which is massive rock material formed by metamorphic, igneous or sedimentary processes. Bedrock can be found in several areas along the coast of Massachusetts.

Applicable Federal and State Laws

Numerous federal, state, regional, and local laws have been enacted that pertain to the use and protection of barrier beaches. In this section, the Task Force has attempted to summarize the most pertinent aspects of each major piece of legislation. For a comprehensive citation of federal, state, regional and municipal law, see Appendix E.

FEDERAL JURISDICTION

Coastal Barrier Resources Act (1982), last amended 1990, 16 U.S. Code 3502 et seq.

Restricts future federal expenditures and federal financial assistance on designated undeveloped coastal barrier beaches which have the effect of encouraging development of the barriers. Barrier units designated by Congress have been mapped by the U.S. Department of the Interior and typically include those areas that are undeveloped (approximately 1 house per 5 acres). There are 54 units on 90 Massachusetts barrier beaches [see Appendix B]. No new federal flood insurance may be issued, as depicted on new Flood Insurance Rate Maps. Enforced by the U.S. Office of Management and Budget. Contact the Massachusetts Coastal Zone Management Office at (617) 727-9530.

Coastal Zone Management Act of 1972, last amended in 1990, 16 U.S. Code 1451 et seq.

National program overseeing the Coastal Zone Management Programs of member states, including Massachusetts. See State jurisdiction for Massachusetts Coastal Zone Management.

Endangered Species Act (1973) last amended 1988, 16 U.S. Code 1531 et seq.

Authorizes the Secretary of the Interior, through the U.S. Fish and Wildlife Service, to list fish, wildlife and plants found to be threatened or endangered, such as the Piping Plover or the Roseate Tern, and provides for their protection and recovery. Prohibits "taking" of listed species. Contact the U.S. Fish & Wildlife Service at (603) 225-1411.

Marine Plastic Pollution Research and Control Act (1987), 33 U.S. Code 1901 et seq.

Prohibits all ships from dumping plastics into the sea and regulates other type of material that may be dumped within the waters of the U.S. Contact the U.S. Coast Guard at (617) 223-3000 (N.H. border to Plymouth/Manomet Point) or (401) 528-5335 (Plymouth/Manomet Point to R.I. border) or the Center for Marine Conservation at (202)429-5609.

National Environmental Policy Act (1970), last amended 1984, 42 U.S. Code 4321 et seq.

Requires an assessment of environmental impacts from federally-sponsored projects with significant impacts and may result in the preparation of an environmental impact statement by the federal agency. Contact the Environmental Protection Agency at (617)565-3715.

National Flood Insurance Act (1968), 42 U.S. Code 4001 et seq.

Implemented by Federal Emergency Management Agency. Structures within the mapped 100-year floodplain are required to be built in accordance with the federal standards and state building code, regarding floor elevations and floodproofing. Federal regulations are implemented through the state and local building code and enforced by the municipal building inspector. Contact the Federal Emergency Management Agency at (617) 223-9561 or the municipal building department.

Submerged Lands Act (1953)

The Federal Government released and relinquished to the states, all of its claims, rights, interests, title, and ownership of the lands and resources beneath navigable waters within the territorial limits (3 miles) of the state's Mean High Water line.

Rivers & Harbors Act (1899), 33 U.S. Code 401 et seq.

Authorizes the U.S. Army Corps of Engineers to regulate structures below Mean High Water and work in navigable waters of the U.S. Permit required. Contact the U.S. Army Corps of Engineers at 1-800-362-4367.

Water Pollution Control Act (1972), 33 U.S. Code 1251 et seq.

Requires applicants to obtain a certification or waiver from the Mass. Department of Environmental Protection before the U.S. Army Corps of Engineers issues a permit for discharge of dredge or fill materials into water and wetlands of the U.S. Permit required. Contact the U.S. Army Corps of Engineers at 1-800-362-4367.

Areas of Critical Environmental Concern - Mass. General Laws Chapter 30, §§61-62H; 301 Code of Mass. Regulations 12.00

Currently there are barrier beaches located within eight of the thirteen coastal Areas of Critical Environmental Concern as designated by the Massachusetts Secretary of Environmental Affairs (see list below). The critical area program regulations direct all Executive Office of Environmental Affairs agencies to take action, administer programs, and revise regulations to: a) acquire useful scientific data on the designated area; b) preserve, restore and enhance the resources of the critical area; and c) ensure that activities in or impacting on the area are carried out so as to minimize adverse effects on the values and resources of the Area of Critical Environmental Concern. Additionally, state agency actions within a designated area, and projects requiring state permits or funding, may require Mass. Environmental Policy Act review pursuant to the Environmental Policy Act regulations at 301 Code of Mass. Regulations 11.00.

Town	Area of Critical Env. Concern
Bourne	Back River
Plymouth	Ellisville Harbor
Eastham, Orleans & Brewster	Inner Cape Cod Bay
Gloucester, Essex, Ipswich, Rowley & Newbury	Parker River/Essex Bay
Brewster, Chatham, Harwich & Orleans	Pleasant Bay
Barnstable & Sandwich	Sandy Neck/Barnstable Harbor
Falmouth & Mashpee	Waquoit Bay
Wellfleet, Truro & Eastham	Wellfleet Harbor

For further information regarding the Area of Critical Environmental Concern program, and for a copy of the "Program Guide" with detailed maps (June, 1993), contact the Mass. Department of Environmental Management, 100 Cambridge Street, 14th Floor, Boston, MA 02202 at (617)727-3160.

Clean Water Act - Mass. General Laws Chapter 21, §42; 314 Code of Mass. Regulations 1.00 - 15.00

Under §401 of the Federal Clean Water Act, the Massachusetts Department of Environmental Protection's Division of Wetlands and Waterways is required to certify that activities for which federal permits are needed, including the filling of wetlands under § 404 of the federal statute, will not violate the Massachusetts Water Quality Standards. Water Quality Certificate required. Contact the Massachusetts Department of Environmental

Protection's Division of Wetlands and Waterways at (617) 292-5695 or the appropriate Division regional office.

Coastal Wetlands Restriction Act - Mass. General Laws Chapter 130, §105; 302 Code of Mass. Regulations 4.00

Some coastal wetlands have deed restrictions which "run with the land" and limit activities that would alter the wetlands. Work in these areas requires consistency with the coastal restriction as well as an Order of Conditions from the municipal conservation commission. Contact the Massachusetts Department of Environmental Protection's Conservancy Program at (617) 292-5907.

Coastal Zone Management - Mass. General Laws Chapter 21A, §4A; 310 Code of Mass. Regulations 20.00 and 21.00

Coordinates the state's coastal zone management program and provides a role in policy development; offers technical assistance to communities to develop and implement comprehensive coastal management plans. Coastal Zone Management reviews projects that require a federal permit, receive federal funds, or are a direct federal activity for consistency with Massachusetts Coastal Zone Management enforceable Program Policies. Consistency Certificate required. Contact the Executive Office of Environmental Affairs' Coastal Zone Management Office at (617) 727-9530.

Endangered Species Act - Mass. General Laws Chapter 131A; 321 Code of Mass. Regulations 10.00

Prohibits the "taking" of State-listed rare plants and animal species. Specific Significant Habitats can be designated and any alteration requires a permit. Contact the Mass. Division of Fisheries and Wildlife at (617) 727-9194.

Fish and Wildlife Regulations - Mass. General Laws Chapter 131; 321 Code of Mass. Regulations 1.00 - 9.00

Control of the taking or possession of mammals, birds, reptiles, amphibians, and inland fish through regulation of allowable species, quantities, sizes, times, places, and methods of taking. Includes requirements for permits. Contact the Massachusetts Department of Fisheries, Wildlife and Environmental Law Enforcement's Division of Fisheries and Wildlife at (617) 727-3151.

Marine Fisheries Regulations - Mass. General Laws Chapter 130; 322 Code of Mass. Regulations 1.00 - 12.00

Control of the taking, possession, and distribution of marine finfish and shellfish through regulation of allowable species, quantities, sizes, times, places, and methods of taking. Includes requirements for state permits. Contact the Massachusetts Department of Fisheries, Wildlife and Environmental Law Enforcement's Division of Marine Fisheries at (617) 272-3193.

Public Waterfront Act - Mass. General Laws Chapter 91; 310 Code of Mass. Regulations 9.00

Codifies the Public Trust Doctrine (Colonial Ordinances of 1641 - 1647) and the public's right to fish, fowl, and navigate in the tidelands and great ponds. Subsequent case law supplements the understanding of this public right. Regulates activities below the Mean High Water line, including docks and piers, dredging, and beach nourishment. State policy for barrier beaches encourages the use of dredged material for beach nourishment, given sediment compatibility. Public funds used for beach nourishment requires strolling access for the public on the nourished beach. Permit/license required. Contact the Massachusetts Department of Environmental Protection's Division of Wetlands and Waterways Program at (617) 292-5695.

Title 5 of State Environmental Code - Mass. General Laws Chapter 21A, §13; 310 Code of Mass. Regulations 15.00

Authorizes the Massachusetts Department of Environmental Protection's Division of Water Pollution Control to regulate the design, construction, and maintenance of on-site subsurface disposal systems. Communities may adopt more stringent regulations when local conditions warrant higher standards. Permit required. Contact municipal board of health or the Massachusetts Department of Environmental Protection's Division of Water Pollution Control at (617) 292-5673.

Wetlands Protection Act - Mass. General Laws Chapter 131, §40; 310 Code of Mass. Regulations 10.00

Activities in wetland resource areas, such as dunes, beaches, tidal flats and coastal banks, are subject to performance standards outlined in the regulations that protect the interests of the Act, including storm damage prevention and protection of wildlife habitat. The local conservation commission implements the regulations as overseen by the Department of Environmental Protection's Division of Wetlands and Waterways. Orders of Conditions regulate proposed activities to minimize or prohibit impacts to wetland resource areas. Permit required. Contact the municipal conservation commission or the Massachusetts Department of Environmental Protection's Wetlands and Waterways Program at (617) 292-5695.

Executive Order Number 181 Barrier Beaches (1980)

Acknowledges the importance of barrier beaches as a migrating landform providing storm damage prevention and flood control. Discourages development on barriers with state and federal grants, and encourages preparation of management plans. These **Guidelines** further advance the Executive Order. Contact the Massachusetts Executive Office of Environmental Affairs's Coastal Zone Management Office at (617)727-9530.

Executive Order Number 190 Regulation of Off-Road Vehicle Use on Public Lands Containing Coastal Wetlands Resources (1980)

Directs state agencies to balance competing uses of public lands and

minimizes the degradation of the wetlands resources due to off-road vehicle use, through management and monitoring. These **Guidelines** further advance the Executive Order. Contact the Massachusetts Executive Office of Environmental Affairs' Coastal Zone Management Office at (617) 727-9530.

Architecture Access Board - 521 Code of Mass. Regulations 2.00 - 3.00; **Building Code**, 780 Code of Mass. Regulations 1.00 - 34.00

Rules governing construction of public and private facilities in federally mapped 100 year flood zones; construction of public facilities on bathing beaches; and access to such structures. Permits required. Contact municipal building inspectors.

CHAPTER 2

Massachusetts Wetlands Protection Act/Barrier Beach Resources
(as defined in the Massachusetts Wetlands Protection Act and Regulations)

The primary state legal requirements with which the barrier beach manager developing a management plan must comply are found in the Massachusetts Wetlands Protection Act and Regulations (Mass. General Laws Chapter 131, §40; 310 Code of Mass. Regulations 10.00). Under this Act and its Regulations, the various component parts of the barrier beach system have been defined and their functions detailed. This Chapter presents those legal definitions, the specified functions of each resource area, and summarizes the performance standards for each resource area.

Each resource area associated with barrier beach systems is discussed, with pertinent information in the following categories:

- Definitions (including exact wording from the Regulations and additional information to clarify meaning);
- Function (including "presumptions of significance," critical characteristics, physical processes, and biological processes); and
- Summary of Wetlands Protection Regulatory Performance Standards.

The barrier beach-related resource areas as listed in the Massachusetts Wetlands Protection Act and Regulations are:

- Barrier Beaches
- Coastal Beaches and Tidal Flats
- Coastal Dunes
- Salt Marshes
- Land Containing Shellfish
- Land Under Salt Ponds
- Land Under the Ocean

This Chapter also contains a separate section on rare species wildlife habitat. Note that the Wetlands Protection Act and Regulations require safeguards for rare species habitat that are in addition to the regulatory performance standards for general wildlife habitat. This section is entitled:

- Protection of Rare Species Habitat

[Fresh water wetland resources, such as bogs, can also be present on barrier beaches. For those performance standards, see the Mass. Wetlands Protection Act and Regulations at 310 Code of Mass. Regulations 10.55-60.]

General Information

Barrier beach systems are subject to a plethora of federal, state, and municipal statutes, bylaws/ordinances and regulations. The primary federal and state authorities are summarized in Chapter 1, while a more complete listing of federal and state laws appears in Appendix E.

Of the state requirements, the Massachusetts Wetlands Protection Act and Regulations are extremely important for beach stewards to understand because many activities on barrier beaches must comply with the performance standards found in the Regulations.

The Task Force offers the following regulatory summaries as a service to barrier beach stewards, but recommends a careful reading of the Act and Regulations prior to undertaking management activities. In addition, the Task Force recommends that beach managers consult with their municipal conservation commission or the Mass. Department of Environmental Protection to determine whether proposed management activities fall within the Wetlands Protection Act's jurisdiction. The Department of Environmental Protection has developed *"Recommended Conditions for Barrier Beaches,"* found in Appendix I, to assist barrier beach managers in meeting the regulatory performance standards

The "Definition" sections found in this Chapter are quoted from the Wetlands Regulations, but the "Functions" and "Performance Standards" sections are not; the "Functions" sections contains additional information not found in the Wetlands Regulations, while the "Performance Standards" sections are summaries of the regulatory requirements for each resource area. Consult the appropriate section of 310 Code of Mass. Regulations 10.00 for the exact regulatory language.

Barrier beach managers should also note that municipalities are free to adopt wetlands bylaws/ordinances and regulations which provide greater levels of protection than contained in the state Wetlands Protection Act and Regulations. (See Lovequist v. Conservation Commission of Dennis, 379 Mass. 7 (1979).) The Task Force recommends that beach managers consult with their municipal conservation commissions to learn more about local requirements.

Barrier Beaches
(310 Code of Mass. Regulations 10.29)

Definition

Barrier Beach means a narrow low-lying strip of land generally consisting of coastal beaches and coastal dunes extending roughly parallel to the trend of the coast. It is separated from the mainland by a narrow body of fresh, brackish or saline water or a marsh system. A barrier beach may be joined to the mainland at one or both ends. [310 Code of Mass. Regulations 10.29(2)]

This definition is more fully discussed in Chapter 1 of these **Guidelines.**

Functions

The Wetland Regulations presume that barrier beaches, including all of their coastal dunes, are significant to storm damage prevention, flood control, the protection of marine fisheries, wildlife habitat, and where there are shellfish, to land containing shellfish. "Significant" is defined in the Regulations to mean "plays a role" in protecting any of the interests.

Critical Characteristics, Physical and Biological Processes

The characteristics of a barrier beach which are critical to the protection of the interests listed above are those critical characteristics listed for coastal beaches, tidal flats, and coastal dunes, as well as the barrier beach's ability to respond to wave action, including storm overwash sediment transport.

The physical and biological processes of barrier beaches are discussed in detail in Chapter 1 of these **Guidelines.** In addition, the physical and biological processes of coastal beaches, tidal flats, and coastal dunes are discussed in more detail in the Sections of this Chapter pertaining to each Resource Area.

Summary of Wetlands Protection Regulatory Performance Standards

When a barrier beach is significant to storm damage prevention, flood control, marine fisheries or the protection of wildlife habitat, the following performance standards apply:

- Each of the performance standards listed for coastal beaches and for all coastal dunes which make up a barrier beach (see Sections entitled "Coastal Beaches and Tidal Flats" and "Coastal Dunes" in this Chapter).
- No project may be permitted which will have any adverse effect on the habitat of state-listed rare vertebrate or invertebrate species (See Section entitled, "Protection of Rare Species Habitat" for more information on this standard).

Coastal Beaches and Tidal Flats (310 Code of Mass. Regulations 10.27)

Definitions

Coastal Beach means unconsolidated sediment subject to wave, tidal and coastal storm action which forms the gently sloping shore of a body of salt water and includes tidal flats. Coastal beaches extend from the mean low water line landward to the dune line, coastal bankline or the seaward edge of existing man-made structures, when these structures replace one of the above lines, whichever is closest to the ocean. [310 Code of Mass. Regulations 10.27(2)(a)]

Tidal Flat means any nearly level part of a coastal beach which usually extends from the mean low water line landward to the more steeply sloping face of the coastal beach or which may be separated from the beach by land under the ocean. [310 Code of Mass. Regulations 10.27(2)(b)]

The size of the unconsolidated sediments which make up coastal beaches may range from very fine particles to small rocks several inches in diameter, as on a shingle or cobble beach. Tidal flats are commonly found both along exposed shorelines and in protected estuarine areas. They may be completely surrounded by water at mean low water and may or may not be connected to the rest of the beach.

Functions

The Wetland Regulations presume that coastal beaches, including tidal flats, are significant to the interests of storm damage prevention, flood control, and the protection of wildlife habitat. In addition, the Regulations presume that tidal flats are significant to the protection of marine fisheries and, where there are shellfish, to land containing shellfish. "Significant" is defined in the Regulations to mean "plays a role" in protecting any of the interests.

Critical Characteristics

The characteristics of coastal beaches which are critical to storm damage prevention or flood control are the ability of the coastal beach to respond to wave action, and the volume (quantity of sediments) and form of the beach. The characteristics of coastal beaches which are critical to the protection of marine fisheries or wildlife habitat are the distribution of sediment grain size, water circulation, water quality, and relief and elevation.

Physical Processes

Coastal beaches serve as a sediment source for dunes and subtidal areas and for downdrift coastal areas. Sediments move from subtidal areas to beaches to dunes and back again, in a constant shifting of sediment caused by wind and waves. Coastal

beaches prevent storm damage and contribute to flood control by dissipating wave energy, reducing the height of storm waves, and providing sediment to other coastal features which, in turn, enhance those same features.

Biological Processes

Tidal flats provide many critical links in the marine food web. They are sites where organic and inorganic materials may be entrapped and recycled into the water column for reuse by algae and other primary producers. Tidal flats are valuable habitats for many invertebrates, including a variety of polychaete worms and bivalve and gastropod mollusks. These organisms utilize plankton and microalgal-produced nutrients and detritus and contribute extraordinary numbers of larvae to the food web. These larvae in turn provide a valuable food source for the young stages of commercially-important fish and crustaceans, as well as for migratory and wintering shorebirds. Adult invertebrates that live in tidal flats provide food for a variety of species, including the commercially valuable winter flounder and crustaceans.

Coastal beaches are extremely important in recycling nutrients derived from storm drift and tidal action. Vegetative debris along the drift (or wrack) line is vital for resident and migratory shorebirds, which feed on invertebrates that eat this vegetation. The intertidal zone below the wrack line on coastal beaches supports many invertebrates such as mollusks and crustacea which are also eaten by shorebirds. A number of birds nest on the coastal berm between the toe of a dune and the high tide line. Isolated coastal beaches on small islands provide relatively predator-free areas for coastal birds to rest, feed, and nest in, and some such islands are important haul-out areas for harbor seals. Detailed information on staging areas for migratory shorebirds is found in Appendix D.

Summary of Wetlands Protection Regulatory Performance Standards

When a coastal beach is significant to storm damage prevention, flood control or the protection of wildlife habitat, the following performance standards apply:

- Any project on a coastal beach (with a few specified exceptions as stated in the Wetlands Protection Act Regulations) must not have an adverse effect by increasing erosion, decreasing the volume or changing the form of any coastal beach or an adjacent or downdrift coastal beach.
- Any groin, jetty, solid pier, or other solid fill structure which will interfere with littoral drift, in addition to complying with the foregoing standard, must be constructed as follows:
  - It must be the minimum length and height demonstrated to be necessary to maintain beach form and volume. In evaluating necessity, coastal engineering, physical oceanographic and/or coastal geologic information must be considered;
  - Immediately after construction, any groin must be filled to entrapment capacity in height and length with sediment of grain size compatible with that of the adjacent beach;
  - Jetties trapping littoral drift material must contain a by-pass system to transfer sediments to the downdrift side of the inlet or must be periodically redredged to provide beach nourishment to ensure that downdrift or adjacent beaches are not starved of sediments.

Migratory Shorebirds

A number of locations in the Bay State are vital to the migration of arctic shorebirds. These sites typically are places with unusually high biological productivity with rich invertebrate food resources favored by shorebirds to rapidly accumulate fat necessary for their 2,000-mile nonstop flights over the Atlantic Ocean to landfalls in northeastern South America. Only one species, Black-bellied Plover, gathers in Massachusetts in substantial numbers during northward migration. On the other hand, most shorebirds are migrating southward during the peak of the summer outdoor recreational season (July through mid-September). During lower tides, shorebirds are widely distributed over large expanses of tidal flats, and generally have alternate locations they can use when disturbed. In contrast, habitat requirements for resting areas seem quite specific, and at most staging areas there are few high tide resting sites available, so when disturbance occurs the species frequently have no or few alternative sites to use. Finally, the amount of coastal space available to shorebirds is substantially less at high tide times than at low tide times.

Shorebirds Defined

The Massachusetts coast plays a critical role in the international migration systems of a variety of shorebirds that are ephemeral visitors to New England, visiting during their migratory journeys between arctic nesting grounds of Canada and Alaska, and wintering grounds, which for some kinds, are as distant as the southernmost coasts of South America.

Technically speaking, shorebirds are the sandpipers, plovers and their allies. They do not include other coastal birds such as terns or gulls. In spite of their name, many shorebirds are not coastal birds; some are upland animals, some use fresh water wetlands, and one -- the Woodcock -- is essentially a woodland bird. But most species of shorebirds are essentially coastal marine animals for much of their life.

Management and Conservation

Shorebirds making stopovers on Massachusetts coastal beaches and tidal flats include some of the earliest southbound migrants seen in New England. Earliest birds appear during the first week of July. Peak numbers occur during the last third of July and the first third of August, also the peak beach recreation season in coastal New England. One species, the Dunlin, migrates substantially later with peak numbers occurring during October and November.

Just as an aircraft must store an enormous volume of fuel before a long flight, so too must migratory birds. Instead of petroleum, bird reserves are layers of fat accumulated prior to departure. A typical shorebird leaves Massachusetts after visiting 10-14 days and weighing 60% more than when it arrived.

It is this basic, ingrained need to gain fat which underlies most of the conservation issues faced in trying to protect shorebird migration systems.

In order to get the fat, shorebirds must consume enormous amounts of food. Indeed, because of their high body temperatures, and their high activity levels, even meeting daily metabolic requirements requires huge amounts of food.

There are few areas where shorebirds can meet their fattening requirements for migration. Important areas in Massachusetts include the Ipswich, Merrimac, North & South and Parker River Estuaries, and tidal embayments such the Pleasant and Nauset Bay regions, Plymouth/Kingston/Duxbury Bays, and Monomoy National Wildlife Refuge. The Westport River estuary also is important to the Dunlin. [For a complete listing of important migrating shorebird staging areas, see Appendix D.]

- Beach nourishment with clean sediment of a grain size compatible with that on the existing beach may be permitted.

When a tidal flat is significant to marine fisheries or the protection of wildlife habitat, the following performance standards apply:

- In addition to complying with the requirements for coastal beaches, a project on a tidal flat must, if water-dependent, be designed and constructed using the best available measures to minimize adverse effects, and if the project is non-water-dependent, it must have no adverse effect, on marine fisheries or wildlife habitat caused by:
  - alterations in water circulation;
  - alterations in the distribution of sediment grain size; and
  - changes in water quality, including, but not limited to, other than natural fluctuations in the levels of dissolved oxygen, temperature or turbidity, or the addition of pollutants.
- No project may be permitted on a coastal beach or tidal flat which will have any adverse effect on specified habitat sites of rare vertebrate or invertebrate species (See Section entitled, "Protection of Rare Species Habitat" for more information on this standard).

While visiting Massachusetts, shorebirds need two types of habitat resources: good feeding areas and relatively undisturbed resting areas. Coastal intertidal flats are used for feeding during lower tidal periods (day or night) whereas resting areas, typically coastal barrier beaches, or sometimes high salt marsh, are used during higher tidal periods, generally for the three hours either side of high tide times. Best feeding areas generally are in sheltered tidal waters of estuaries and bays where small sediment grain size is associated with high abundance and availability of invertebrate animal prey (small worms, crustaceans, and noncommercially-important bivalves.)

Habitat requirements of shorebirds at resting areas seem quite specific; virtually all are close to the feeding flats, are open habitats affording shorebirds good view of approaching predators, and are relatively undisturbed locations. At most coastal migration staging areas there are few high tide resting sites available, so when disturbance occurs shorebirds frequently have few, if any, alternative sites to use. Finally, the amount of coastal space available to shorebirds is substantially less at high tide than at low tide. Recent studies in Plymouth have shown that chronic disturbance of resting sites is associated with a steady decline in shorebird numbers.

Because most shorebirds are migrating southward during the peak outdoor recreational season (July through mid-September), and competing with humans for some of the most popular coastal resources, shorebird management efforts are most needed at this season. In general, management efforts are particularly needed to reduce chronic disturbance of resting areas during high tide periods; during lower tides shorebirds are widely distributed over large expanses of tidal flats, and generally have alternate locations they can use when disturbed.

Shorebirds as a Recreational Resource

Birdwatching is a popular outdoor recreational activity in coastal Massachusetts, so managing for abundant and diverse birdlife is warranted. Shorebirds are an important summer attraction to birdwatchers, including many that visit the coast from distant states to see migrating shorebirds. Minimizing disturbance of shorebird habitat from birdwatchers and other beach users will help ensure that the Massachusetts coast remains an important recreational resource to naturalists.

Figure 8. Coastal dunes with beach grass (courtesy of Mass. Department of Environmental Management).

Coastal Dunes
(310 Code of Mass. Regulations 10.28)

Definition

Coastal Dune means any natural hill, mound or ridge of sediment landward of a coastal beach deposited by wind action or storm overwash. Coastal dune also means sediment deposited by artificial means and serving the purpose of storm damage prevention or flood control. [310 Code of Mass. Regulations 10.28(2)]

Functions

The Wetland Regulations presume that coastal dunes are significant to storm damage prevention, flood control, and the protection of wildlife habitat. This is particularly true of the coastal dunes closest to the coastal beach. On barrier beaches, the Wetlands Regulations presume that **all** coastal dunes (no matter how far from the coastal beach) are per se significant to storm damage prevention and flood control. "Significant" is defined in the Regulations to mean "plays a role" in protecting any of the interests.

Critical Characteristics

The characteristics of coastal dunes which are critical to storm damage prevention, flood control, and the protection of wildlife habitat are:

1) Erosional Capability: the ability of coastal dunes to erode in response to coastal beach conditions. The erosion of coastal dunes by waves, usually during storms, supplies sand to the adjacent coastal beach.
2) Coastal Dune Form and Volume: the volume and form (height and width) of coastal dunes provide a buffer which resists wave approach during storms and retards stormline retreat. Coastal dune form and volume are the result of a combination of factors, the most important of which are wind and vegetation. Natural water flow, in the form of storm overwash, is also an important process in controlling coastal dune form and volume, because through this mechanism, sand is carried landward to initiate dune formation.
3) Vegetative Cover: vegetation contributes to the growth and stability of coastal dunes by providing conditions favorable to sand deposition. Wrack material, such as beachgrass stems, is carried to the strand line by wind and wave activity where it accumulates and often is buried by sand blowing from the coastal beach. Seeds of many plants become mixed with these materials and may subsequently germinate.
4) Ability of the Dune to Move Landward or Laterally: on shorelines, coastal dunes bordering the coastal beach move landward and laterally in response to the prevailing predominant winds with the rest of the shoreline. This allows

coastal dunes to maintain their form and volume. If the dune was not allowed to continually build landward, the dune would gradually be eroded from the seaward side and would become smaller and smaller, and would therefore be more likely to be completely washed away in a storm with its protective values lost altogether.

5) Ability of the Dune to Continue Serving as Bird Nesting Habitat: several species of birds, including terns and piping plovers, nest in dunes and depend upon the type (or lack) of vegetative cover, topography, and hydrologic regime of the dune system.

Physical Processes

The set of dunes closest to the coastal beach are the ones that are nearly always significant to storm damage prevention and flood control, and are therefore subject to the performance standards summarized below. The dunes behind the one or two rows of dunes closest to the beach may contribute to storm damage prevention and flood control, but are less likely to do so than the front dunes. However, on barrier beaches, all coastal dunes are always significant to these interests.

Artificially constructed dunes are included in the definition because they also play a role in protecting inland properties from storm waves and flooding.

All coastal dunes on a barrier beach are important because their volume constitutes the major portion of the total volume of the barrier beach above high water and each line of dunes is intricately related. The volume and form provide a buffer from storm waves and elevated sea levels for landward properties and landward coastal wetlands.

Coastal flora are also important to the functioning of coastal dune systems.

Biological Processes

A variety of birds, seabirds, shorebirds and song birds nest at the base or sides of dunes and in the interdunal area. The particular species that utilize these habitats vary depending upon vegetative community cover, topography, and hydrologic regime. Wet meadows or vernal pool habitats occur in a few dune systems, serving as important feeding areas for a wide variety of bird species. Dune systems also support a variety of mammals, amphibians, reptiles, and invertebrates.

Summary of Wetlands Protection Regulatory Performance Standards

When a coastal dune is significant to storm damage prevention, flood control or the protection of wildlife habitat, the following performance standards apply:

- Any alteration of, or structure on, a coastal dune or within 100 feet of a coastal dune must not have an adverse effect on the coastal dune by:
  - affecting the ability of waves to remove sand from the dune;
  - disturbing the vegetative cover so as to destabilize the dune;
  - causing any modification of the dune form that would increase the potential for storm or flood damage;
  - interfering with the landward or lateral movement of the dune;
  - causing removal of sand from the dune artificially; or

- interfering with mapped or otherwise identified bird nesting habitat.

• When a building already exists upon a coastal dune, a project accessory to the existing building may be permitted, provided that such work, using the best commercially available measures, minimizes the adverse effect on the coastal dune caused by the impacts listed above.

• The following projects may be permitted, provided that they have no adverse effect on the coastal dune caused by the impacts listed above:

- pedestrian walkways, designed to minimize the disturbance to the vegetative cover and traditional bird nesting habitat;
- fencing and other devices designed to increase dune development, and direct vehicular and pedestrian traffic; and
- plantings compatible with the natural vegetative cover.

• No project may be permitted which will have any adverse effect on the habitat of state-listed rare vertebrate or invertebrate species (See Section entitled, "Protection of Rare Species Habitat" for more information on this standard).

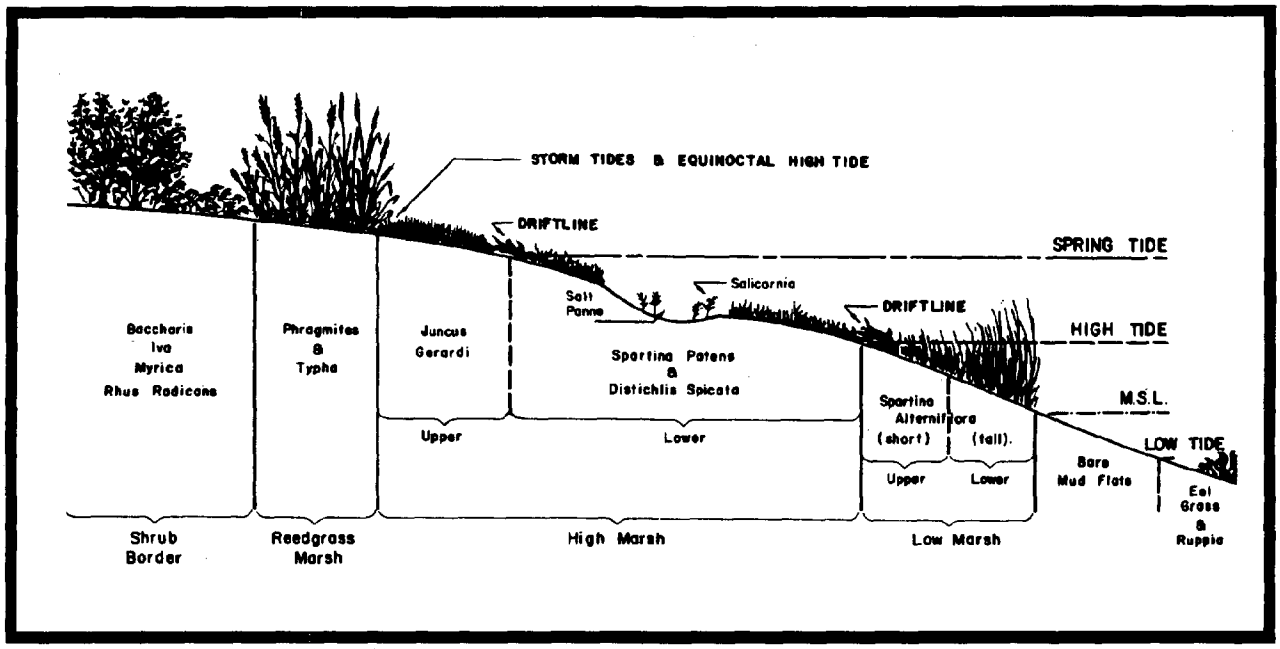


Figure 9. Salt marsh zonation for New England.

Salt Marshes
(310 Code of Mass. Regulations 10.32)

Definition

> **Salt Marsh** means a coastal wetland that extends landward up to the highest high tide line, that is, the highest spring tide of the year, and is characterized by plants that are well adapted to or prefer living in, saline soils. Dominant plants within salt marshes are salt meadow cord grass *(Spartina patens)* and/or salt marsh cord grass *(Spartina alterniflora)*. A salt marsh may contain tidal creeks, ditches and pools. [310 Code of Mass. Regulations 10.32(2)(a)]

Salt marshes are usually located adjacent to tidal waters. Salt marshes are flat, open areas characterized by grasses that are bordered by upland or inland wetland vegetation.

Functions

The Wetland Regulations presume that salt marshes are significant to the protection of marine fisheries, wildlife habitat, and where there are shellfish, to the protection of land containing shellfish, to the prevention of pollution, to storm damage prevention, and to ground water supply. "Significant" is defined in the Regulations to mean "plays a role" in protecting any of the interests.

Critical Characteristics

The characteristics of salt marshes which are critical to the protection of the interests listed above are: 1) the growth, composition and distribution of salt marsh vegetation; 2) the flow and level of tidal and fresh water; and 3) the presence and depth of peat.

Physical Processes

Salt marsh cordgrass and underlying peat are resistant to erosion and dissipate wave energy, thereby providing a buffer that reduces wave damage. The peat and fine sediment material that underlie a salt marsh function as a barrier between the fresh groundwater that is found landward of the salt marsh and the ocean. This relatively impervious layer of peat acts essentially as a dam and thus serves to help maintain the level of fresh groundwater, or the water table, in the adjacent upland areas. The destruction or removal of this peat layer could create a drainage conduit for groundwater which would lower the nearby water table.

Salt marsh plants and the sediments bound to their network of vegetative roots and rhizomes act to reduce pollution of the coastal zone by absorbing and binding contaminants such as chlorinated hydrocarbons and heavy metals delivered by surface runoff from upland areas. Salt marsh can also retain nutrients such as

nitrogen and phosphorus that otherwise may contribute to algal blooms in coastal waters.

Biological Processes

Salt marshes also play an important role in the protection of marine fisheries and land containing shellfish, and provide important wildlife habitat. Salt marshes are extremely productive natural systems that export large volumes of organic material (detritus) to the ocean and estuaries where the detritus supports extensive marine food chains. The basis of the coastal marine food web is the phytoplankton organisms which depend, in part, on these nutrients for their productivity. Changes in the growth or species composition of phytoplankton will directly affect the remainder of the food web. The young stages of many organisms entering the fisheries pass through a planktonic stage during which the availability of phytoplanktonic food organisms is a controlling factor in their survival. The total net production of salt marsh grasses may be as much as three times higher than the total net production of a Missouri tall grass prairie.

Salt marshes provide spawning and nursery areas for finfish as well as important food, shelter, breeding areas, and migratory and overwintering areas for many wildlife species. Many bird species feed on finfish, shellfish, and other food species produced in salt marshes or through the salt marsh's contribution to the marine food chain.

Summary of Wetlands Protection Regulatory Performance Standards

When a salt marsh is significant to the protection of marine fisheries, the prevention of pollution, storm damage prevention or ground water supply, the following the following performance standards apply:

- A proposed project in a salt marsh, on land within 100 feet of a salt marsh or in a body of water adjacent to a salt marsh must not destroy any portion of the salt marsh and must not have an adverse effect on the productivity of the salt marsh. Alterations in growth, distribution and composition of salt marsh vegetation must be considered in evaluating adverse effects on productivity. The harvesting of salt marsh hay is not prohibited.
- A small project within a salt marsh, such as an elevated walkway or other structure which has no adverse effects other than blocking sunlight from the underlying vegetation for a portion of each day, may be permitted if the project complies with all other applicable requirements of these regulations.
- A project which will restore or rehabilitate a salt marsh, or create a salt marsh, may be permitted.
- No project may be permitted which will have any adverse effect on the habitat of state-listed rare vertebrate or invertebrate species. (See Section entitled, "Protection of Rare Species Habitat" for more information on this standard.)

Land Containing Shellfish
(310 Code of Mass. Regulations 10.34)

Definitions

Land containing shellfish means land under the ocean, tidal flats, rocky intertidal shores, salt marshes and land under salt ponds when any such land contains shellfish. [310 Code of Mass. Regulations 10.34(2)(a)]

Shellfish means the following species: Bay scallop *(Argopecten irradians);* Blue mussel *(Mytilus edulis);* Ocean quahog *(Arctica islandica);* Oyster *(Crassostrea virginica);* Quahog *(Mercenaria mercenaria);* Razor clam *(Ensis directus)* ; Sea clam *(Spisula solidissima);* Sea scallop *(Placopecten magellanicus);* Soft shell clam *(Mya arenaria).* [310 Code of Mass. Regulations 34(2)(b)]

Land containing shellfish differs from the other Resource Areas in that it is both an interest to be protected under the Wetlands Act and a Resource Area.

Functions

The Wetland Regulations presume that "land containing shellfish" is significant to the protection of shellfish resources as well as the protection of marine fisheries when it has been identified and mapped by the conservation commission or the Massachusetts Department of Environmental Protection, either based upon maps and designations of the Massachusetts Division of Marine Fisheries or upon maps and written documentation of the shellfish constable. "Significant" is defined in the Regulations to mean "plays a role" in protecting any of the interests.

Critical Characteristics

The characteristics of land containing shellfish which are critical to the protection of the interests listed above are: shellfish; water quality; water circulation; and the natural relief, elevation or distribution of sediment grain size of the land.

Physical Processes

The quality of water over land containing shellfish is affected by alterations in salinity, dissolved oxygen, nutrients, turbidity, temperature and the addition of pollutants. These physical and chemical characteristics influence shellfish in a number of ways, including growth, reproduction and mortality. For example, various shellfish species have particular salinity requirements. A salinity range of approximately 5-8 parts per thousand is the critical salinity boundary between fresh water and marine faunas. Below this level of salinity, even the most hardy of marine organisms cannot survive because a number of vital physiological processes are impaired.

Water circulation patterns help maintain the temperature, dissolved oxygen, and salinity levels of waters over land containing shellfish, thereby helping to maintain

Figure 10. Shellfish harvesting (courtesy of Mass. Department of Environmental Management).

conditions needed for productive shellfish beds. Water currents also supply nutrients and disperse pollutants.

Bivalves that burrow into sediments have specific depth and grain size requirements. Thus, the natural relief, elevation, and distribution of sediment grain size of land containing shellfish is important. The size of sediment grains has three general effects on shellfish populations. First, the young of various species prefer specific particle sizes in which to burrow. The success of adult shellfish, therefore, depends on the availability of the specific particle size needed by the young. Second, the young larval stages respond to the microstructure of the sediment surface and will not settle successfully if particle size or texture is not suitable. Further, the success of larvae which have settled and are undergoing metamorphosis may be affected by the compaction of the surface layer of sediments. This compaction depends, in part, on particle size and shape. Third, the oxygen tension in the water within the sediments is partially a reflection of water circulation. This, in turn, is a function of the particle size and compaction. Oxygen tension within water layers affects the mortality rate of newly settled larvae.

Biological Processes

Shellfish are an important commercial, recreational and ecological resource in Massachusetts. As a food source, shellfish are important to people because they are high in protein and are produced in a relatively short period of time.

The ecological value of shellfish resources is less obvious, but no less significant. As biological consumers, shellfish are a vital link between the abundant phytoplankton and other important segments of the coastal ecosystem. As producers, shellfish may be viewed in two ways. First, adult shellfish represent a valuable resource to humans and to members of the marine ecosystem which feed directly or indirectly on them. Second, the planktonic stages of shellfish which are produced in extraordinary quantities during the spring and summer months in coastal waters represent a significant source of food for the young life stages of marine fish and crustaceans important to commercial and recreational fisheries. Therefore, the maintenance of naturally productive shellfish beds plays a direct role in maintaining fish stocks by supplying food to the young of commercially important fishes. Various birds feed on immature and mature shellfish as well as on the other invertebrate food species that are abundant in many shallow shellfish bed areas.

Summary of Wetlands Protection Regulatory Performance Standards

When a Resource Area, including land under the ocean, tidal flats, rocky intertidal shores, salt marshes, or land under salt ponds is significant to the protection of land containing shellfish and the protection of marine fisheries, the following performance standards apply:

- Any project on land containing shellfish must not adversely affect such land or marine fisheries by a change in the productivity of the land caused by:
  - alterations of water circulation;
  - alterations in relief elevation;
  - the compacting of sediment by vehicular traffic;

- alterations in the distribution of sediment grain size;
- alterations in natural drainage from adjacent land; or
- changes in water quality, including, but not limited to, other than natural fluctuations in the levels of salinity, dissolved oxygen, nutrients, temperature, or turbidity, or the addition of pollutants.

• A project which temporarily has an adverse effect on shellfish productivity but which does not permanently destroy the habitat may be permitted if the land containing shellfish can and will be returned substantially to its former productivity in less than one year from the commencement of work.

• For land containing shellfish that is significant because it has been designated by the Mass. Division of Marine Fisheries or the municipal shellfish constable (except in Areas of Critical Environmental Concern), a project may be permitted, if the shellfish are moved to a suitable location after consultation with the shellfish constable and the Massachusetts Division of Marine Fisheries. The project may not be commenced until after the moving and replanting of shellfish has been commenced.

• Projects approved by the Massachusetts Division of Marine Fisheries that are specifically intended to increase the productivity of land containing shellfish may be permitted. Aquaculture projects approved by the appropriate local and state authority may also be permitted.

• No project may be permitted which will have any adverse effect on the habitat of state-listed rare vertebrate or invertebrate species (See Section entitled, "Protection of Rare Species Habitat" for more information on this standard).

Land Under Salt Ponds
(310 Code of Mass. Regulations 10.33)

Definition

Salt Pond means a shallow enclosed or semi-enclosed body of saline water that may be partially or totally restricted by barrier beach formation. Salt ponds may receive freshwater from small streams emptying into their upper reaches and/or springs in the salt pond itself. [310 Code of Mass. Regulations 10.33(2)]

Functions

The Wetland Regulations presume that land under salt ponds is significant to the protection of marine fisheries and wildlife habitat and, where there are shellfish, to the protection of land containing shellfish. "Significant" is defined in the Regulations to mean "plays a role" in protecting any of the interests.

Critical Characteristics

The characteristics of land under salt ponds which are critical to the protection of the interests listed above are: water circulation, distribution of sediment grain size, freshwater inflow, productivity of plants, and water quality.

Physical and Biological Processes

Salt ponds are areas of high marine productivity that may function as nursery grounds for offshore fish, as well as supporting resident populations of commercially important fish, mollusks and crustaceans. The abundance of these marine organisms is dependent upon the primary production of phytoplankton, algae and other plant communities that include eel grass and *Spartina alterniflora* . Salt ponds also provide spawning areas for shellfish and are nursery areas for crabs and fish. In addition to the many birds which feed on fish found in salt ponds, waterfowl also eat invertebrates such as mollusks and crustaceans from salt ponds, and some bird species eat rupia and eel grass which may be rooted in land under salt ponds.

The critical productivity of salt ponds also depends upon the freshwater inflow and water circulation that enhance the availability of the essential nutrients required for plant growth.

Summary of Wetlands Protection Regulatory Performance Standards

When land under a salt pond is significant to the protection of marine fisheries or wildlife habitat, the following performance standards apply:

- Any project on land under a salt pond, on lands within 100 feet of the mean high water line of a salt pond, or on land under a body of water adjacent to a salt pond must not have an adverse effect on marine fisheries

or wildlife habitat of the salt pond caused by:

- alterations of water circulation;
- alterations in the distribution of sediment grain size and the relief or elevation of the bottom topography;
- modifications in the flow of fresh and/or salt water;
- alterations in the productivity of plants, or
- alterations in water quality, including, but not limited to, other than normal fluctuations in the level of dissolved oxygen, nutrients, temperature or turbidity, or the addition of pollutants.

• Projects specifically required and intended to maintain the depth and the opening of a salt pond to the ocean in order to maintain or enhance the marine fisheries or for the specific purpose of fisheries management may be permitted.

• No project may be permitted which will have any adverse effect on the habitat of state-listed rare vertebrate or invertebrate species (See Section entitled, "Protection of Rare Species Habitat" for more information on this standard).

Land Under the Ocean
(310 Code of Mass. Regulations 10.25)

Definition

Land Under the Ocean means land extending from the mean low water line seaward to the boundary of the municipality's jurisdiction and includes land under estuaries. [310 Code of Mass. Regulations 10.25(2)(a)]

Nearshore Areas of land under the ocean means that land extending from the mean low water line to the seaward limit of a municipality's jurisdiction, but in no case beyond the point where the land is 80 feet below the level of the ocean at mean low water. However, the nearshore area shall extend seaward only to that point where the land is 30 feet below the level of the ocean at mean low water for municipalities bordering Buzzard's Bay and Vineyard Sound...40 feet below the level of the ocean at mean low water for Provincetown's land in Cape Cod Bay, and 50 feet below the level of the ocean at mean low water for Truro's and Wellfleet's land in Cape Cod Bay. [310 Code of Mass. Regulations 10.25(2)(b)]

Land under the ocean includes land under bays, estuaries and under portions of rivers which are tidally influenced, such as the Taunton River in the Berkley and Dighton area, as well as land under the open ocean out to the municipality's boundary.

Functions

The Wetland Regulations presume that nearshore areas of land under the ocean are significant to the protection of marine fisheries and, where there are shellfish, to the protection of land containing shellfish, to storm damage prevention, flood control, and the protection of wildlife habitat. The Wetland Regulations presume that land under the ocean beyond the nearshore areas is significant to the protection of marine fisheries and where there are shellfish, to the protection of land containing shellfish. "Significant" is defined in the Regulations to mean "plays a role" in protecting any of the interests.

Critical Characteristics

The characteristic of nearshore land under the ocean which is critical to the protection of storm damage prevention or flood control is the bottom topography of the land. The characteristics of land under the ocean which are critical to the protection of marine fisheries and wildlife habitat are: water circulation, distribution of sediment grain size, water quality, finfish habitat, and important food for wildlife.

Physical Processes

Nearshore areas of land under the ocean (generally areas up to 80 feet of

depth below mean low water, or to a lesser depth in certain specified areas near the Cape and Islands) play an important role in storm damage prevention and flood control.

As waves travel from deep to nearshore areas, the natural bottom topography changes their direction and height because of refraction, bottom friction and percolation. The effect of these changes is to reduce the energy of the waves, thereby reducing storm damage and flooding.

The amount of wave energy which reaches the shoreline also depends, in part, upon how much energy is lost as the wave shoals, prior to breaking. The shallower the water and more gradual the slope, the greater the loss of energy. Energy is also lost due to the pumping action of shoaling waves, that is, the forcing of water (percolation) into the sea bed. Submerged bars also help dissipate storm wave energy.

Nearshore areas of land under the ocean also serve as a sediment source for coastal beaches and coastal dunes.

Biological Processes

Land under the ocean (including nearshore areas), which includes estuaries and tidal rivers, plays an important role in maintaining shellfish and marine fisheries. Such land provides habitat for productive plant communities, such as eelgrass beds, that produce large amounts of particulate matter and dissolved nutrients which support marine organisms such as phytoplankton and detritovore populations. These organisms, in turn, are prey for bottom dwelling, or benthic, organisms. Many species of commercially valuable fish consume both plankton and benthic organisms at some point in their life cycle.

Such land also provides spawning and nursery sites for fish, crustaceans, and shellfish, and prime feeding and shelter habitat for adult organisms which comprise the commercial and recreational fisheries.

Nearshore areas of land under the ocean provide important habitat for birds. Waterfowl feed heavily on vegetation (such as eel grass, widgeon grass, and macrophytic algae) and invertebrates (such as polychaetes and mollusks) found in estuaries and other shallow submerged land under ocean. Coastal waterbirds such as terns, gulls, and herons feed on fish in these areas.

Summary of Wetlands Protection Regulatory Performance Standards

When land under the ocean is significant to the protection of marine fisheries, protection of wildlife habitat, storm damage prevention or flood control, the following performance standards apply:

- Improvement dredging for navigational purposes must be designed and carried out using best available measures to minimize adverse effects caused by changes in:
  - bottom topography which will result in increased flooding or erosion caused by an increase in the height or velocity of waves impacting the shore;
  - sediment transport processes which will increase flood or erosion hazards by affecting the natural replenishment of beaches;
  - water circulation which will result in an adverse change in flushing

rate, temperature, or turbidity levels; or

- marine productivity which will result from the suspension or transport of pollutants, the smothering of bottom organisms, the accumulation of pollutants by organisms, or the destruction of marine fisheries habitat or wildlife habitat.

• Maintenance dredging for navigational purposes must be designed and carried out using the best available measures to minimize adverse impacts caused by changes in marine productivity which will result from the suspension or transport of pollutants, increases in turbidity, the smothering of bottom organisms, the accumulation of pollutants by organisms, or the destruction of marine fisheries habitat or wildlife habitat.

• Projects other than improvement or maintenance dredging must not cause adverse effects by altering the bottom topography so as to increase storm damage or erosion of coastal beaches, coastal banks, coastal dunes, or salt marshes.

• Projects other than improvement dredging must, if water-dependent, be designed and constructed using best available measures to minimize adverse effects, and if non-water-dependent, must have no adverse effects, on marine fisheries habitat or wildlife habitat caused by:

- alterations in water circulation;
- destruction of eelgrass (*Zostera marina*) or widgeon grass (*Rupia maritina*) beds;
- alterations in the distribution of sediment grain size;
- changes in water quality, including, but not limited to, other than natural fluctuations in the level of dissolved oxygen, temperature or turbidity, or the addition of pollutants; or
- alterations of shallow submerged lands with high densities of polychaetes, mollusks, or macrophytic algae.

• No project may be permitted which will have any adverse effect on the habitat of state-listed rare vertebrate or invertebrate species (See Section entitled, "Protection of Rare Species Habitat" for more information on this standard).

Protection of Rare Species Habitat (310 Code of Mass. Regulations 10.37)

Definitions

Estimated Habitat Maps (see opposite page) of state-listed vertebrate and invertebrate occurrences are provided by the Massachusetts Division of Fisheries and Wildlife's Natural Heritage & Endangered Species Program as a service to municipal conservation commissions who are charged with protecting rare species habitat under the Wetlands Protection Act. These maps define the estimated geographical extent of habitats of all listed rare wetland wildlife species for which occurrences have been reported and documented to the satisfaction of the Program.

The Mass. Department of Environmental Protection defers to the scientific opinions of the Mass. Division of Fisheries and Wildlife's Natural Heritage and Endangered Species Program in determining the location and extent of actual habitat of state-listed rare species. The Department also relies on the Natural Heritage Program to determine whether a proposed activity will have an adverse effect, whether short- or long-term, on the habitat of the local rare species population. The Heritage Program's opinion is presumed to be correct and may be overcome only upon a clear showing to the contrary.

See the next chapter of this document for a complete list of rare species likely to be associated with barrier beach ecosystems.

Function

Rare species wildlife habitat provides all the requisite essentials for breeding, nesting, foraging and resting for the species listed at 310 Code of Mass. Regulations 10.60. Certain rare, state-listed species have specialized requirements that are met by the ecosystem on barrier beaches. Selected species, which barrier beach managers are particularly likely to encounter, are discussed further on in this document.

Summary of Wetlands Protection Regulatory Performance Standards

When a project is proposed to alter a Resource Area which is part of the actual habitat of a state-listed species, the following performance standard applies:

- No project may be permitted which will have any short or long-term adverse effect on the habitat of the local population of that species.

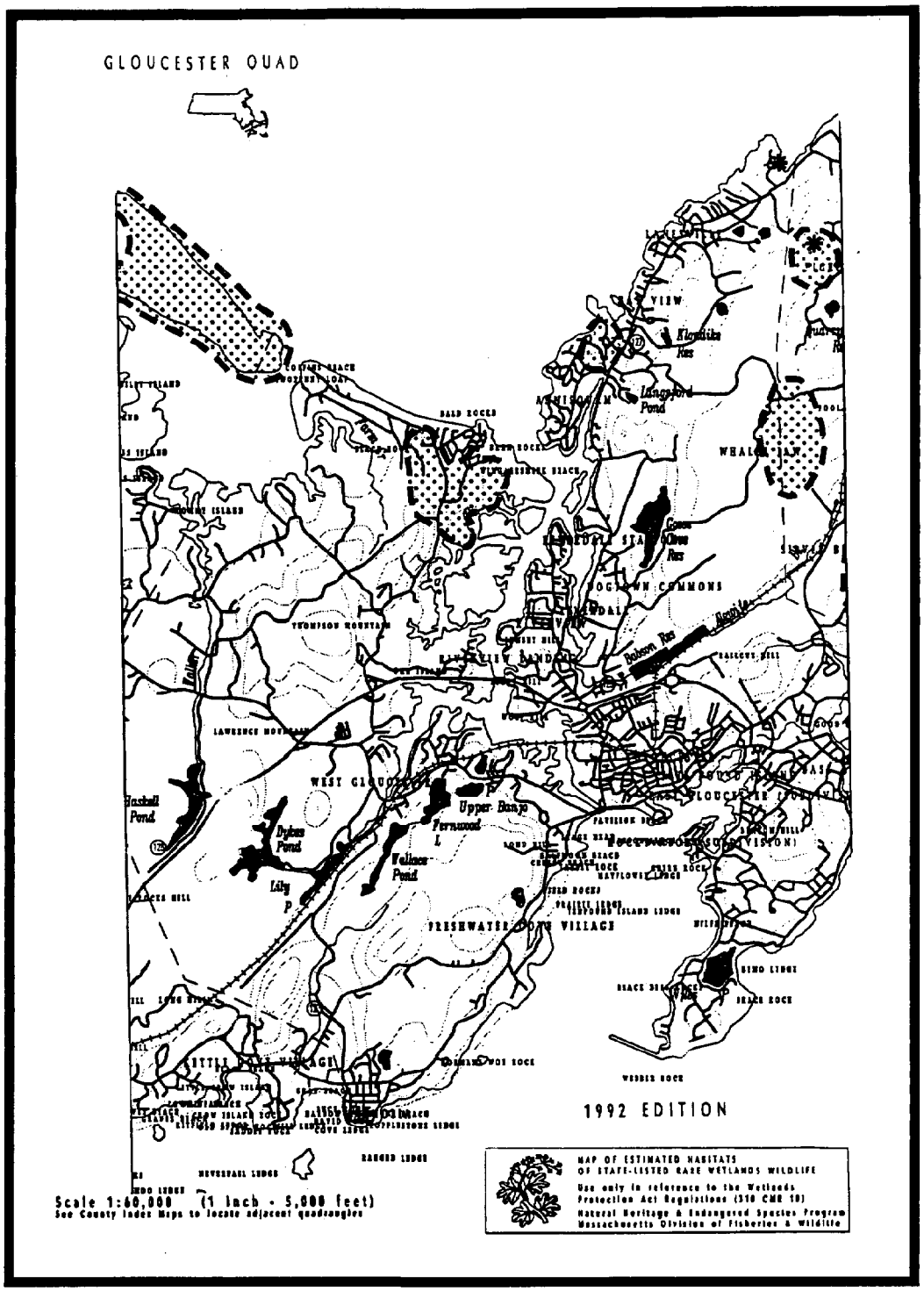


Figure 11. Mass. Natural Heritage and Endangered Species Program map of estimated habitats of state-listed rare wetlands wildlife for Gloucester.

The Massachusetts Division of Fisheries and Wildlife acts as the scientific authority in making this determination. A determination made by the Division is presumed to be correct, although it can be rebutted by a clear demonstration of contrary information before a municipal conservation commission.

Appendix H, the Division's "Guidelines for Managing Recreational Use of Beaches to Protect Piping Plovers, Terns, and Their Habitats in Massachusetts," and Appendix I, the Department of Environmental Protection's "Recommended Conditions for Barrier Beaches," should be consulted for additional information and recommended conditions.

CHAPTER 3

Other Federal and State Statutes Applicable to Barrier Beaches

Several other federal and state laws are important for beach managers to understand in carrying out their responsibilities on barrier beaches. This Chapter discusses some of the most important of these federal and state statutes and their applicability to Massachusetts barrier beaches.

Where appropriate, this Chapter includes for each piece of legislation the following information:

- General Explanation; and
- Summary of Regulatory Requirements.

The laws discussed in this Chapter are:

- Federal Endangered Species Act of 1973 (16 U.S. Code 1531);
- Mass. Endangered Species Act (Mass. General Laws Chapter 131A); and
- Mass. Historical Commission.

Additional statutes and regulations which may be of interest to barrier beach stewards are found in Chapter 1 -- "A Beach Manager's Guide to the Regulations," and Appendices E -- "Federal, State, Regional, and Municipal Laws"and K -- "Access for the Physically Challenged."

Federal Endangered Species Act of 1973 (16 United States Code 1531)

This law, and the regulations promulgated thereunder, authorize the U.S. Department of the Interior's Fish and Wildlife Service to list, based on the best available biological data, plants and animals determined to be "Endangered" or "Threatened." "Critical Habitat" designations are based on biological and other information.

If the following federally listed Endangered and Threatened species occur on Massachusetts barrier beaches, their presence may have significant management implications for beach managers.

SPECIES	STATUS
bald eagle	Endangered
peregrine falcon	Endangered
piping plover	Threatened
roseate tern	Endangered
Northeastern beach tiger beetle	Threatened

The U.S. Fish and Wildlife Service also has a list of rare flora and fauna found on barrier beaches in Massachusetts.

Direct or indirect habitat-altering activities may adversely affect listed species. Of particular importance in Massachusetts are the following species:

1) **Bald eagle:** Eagles may appear along barrier beaches at any season of the year. Barrier beaches are important to eagles primarily for foraging purposes. Eagles primarily seek carrion--dead fish, birds and mammals--scavenged on sand/mudflats and along the tide line.

2) **Peregrine falcon:** Migrant peregrine falcons may appear along barrier beaches at any time of the year, but are most frequently noted in September-October and more occasionally through the winter months to the end of May. The entire barrier beach functions as a feeding ground for the peregrine falcon. Prey consists primarily of birds.

3) **Piping plover:** Massachusetts barrier beaches provide some of the most important nesting habitat for this species on the Atlantic Seaboard. [See more complete discussion in Chapter 2 and the next section.]

4) **Roseate tern:** Small numbers of roseate terns occur within larger common tern colonies on barrier beaches in Massachusetts. These seabirds use isolated dune areas for nesting and rearing their young. Large sandflat areas adjacent to the dunes function as "nursery grounds" for recently fledged young, and, in some cases, as "staging areas" for birds prior to fall migration. [See more complete discussions in Chapter 2 and the next section.]

5) **Northeastern beach tiger beetle:** This tiger beetle formerly inhabited wide, sandy beaches throughout much of the northeastern United States. Today only a single population occurs north of Maryland, on a privately-owned beach on Martha's Vineyard. Adults feed on insects, amphipods, and carrion, and larvae inhabit burrows in upper portions of the intertidal zone. Larvae appear to be destroyed by off-road vehicles, heavy pedestrian traffic, and severe storms. Habitat may be further degraded by coastal development and beach stabilization structures.

Summary of Regulatory Requirements

Federal regulations prohibit "taking," including harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting listed wildlife species; as well as attempting to engage in such conduct; or causing such acts to be committed. In addition, federal agencies must consult with the U.S. Fish and Wildlife Service prior to undertaking, authorizing, or funding any activity that may affect listed species.

In 1979, the U.S. Fish and Wildlife Service and the Massachusetts Division of Fisheries and Wildlife executed a Cooperative Agreement, as provided under Section 6 of the U.S. Endangered Species Act, under which the two agencies share some responsibilities for management of federally-listed species. These species also occur on the "Massachusetts List of Endangered, Threatened, and Special Concern Species." For non-federal entities, compliance with the Massachusetts Endangered Species Act and the Massachusetts Wetlands Protection Act, as defined in these **Guidelines**, will generally assure compliance with the prohibitions on "take" contained in federal law. However, federal agencies are further obligated to conduct a "Section 7 consultation" under the U.S. Endangered Species Act for proposed activities that may affect listed species.

Massachusetts Endangered Species Act (Mass. General Laws Chapter 131A; 321 Code of Mass. Regulations 10.00)

This law and the regulations promulgated thereunder establish procedures for the listing of Endangered, Threatened and Special Concern species native to Massachusetts, and the designation of "Significant Habitat" for Endangered and Threatened species, and establish rules and prohibitions regarding activities which could result in a "taking" of such species or alter "significant habitat."

Rare species of plants and animals that are likely to occur on Massachusetts barrier beaches and are officially listed as Endangered, Threatened or Special Concern by the Massachusetts Division of Fisheries and Wildlife (321 Code of Mass. Regulations 10.60) are listed below. For a complete listing, refer to the Regulations.

ANIMAL SPECIES	STATUS
Diamondback Terrapin	Threatened
Short-eared Owl	Endangered
Piping Plover	Threatened
Northern Harrier	Endangered
Peregrine Falcon	Endangered
Bald Eagle	Endangered
Least Tern	Special Concern
Roseate Tern	Endangered
Common Tern	Special Concern
Arctic Tern	Special Concern
Gray Seal	Special Concern
Northeastern Beach Tiger Beetle	Endangered

PLANT SPECIES	STATUS
Seabeach Amaranth (Amaranthus pumilus)	Historical
Purple Needlegrass (Aristida purpurascens)	Threatened
Seabeach Needlegrass (Aristida tuberculosa)	Special Concern
Pygmyweed (Crassula aquatica)	Threatened
Common's Panic-grass (Dichanthelium commonsianum)	Special Concern
Mattamuskeet Panic-grass (Dichanthelium mattamuskeetense)	Endangered
Saltpond Grass (Diplache maritima)	Threatened
Sea Lyme-grass (Elymus mollis)	Endangered
Saltpond Pennywort (Hydrocotyle verticillata)	Special Concern
Oysterleaf (Mertensia maritima)	Endangered
Pinnate Water Milfoil (Myriophyllum pinnatum)	Special Concern

Adder's Tongue Fern (Ophioglossum vulgatum)	Threatened
Prickly Pear (Opuntia humifusum)	Threatened
Stigose Knotweed (Polygonum setaceum var. interjectum)	Special Concern
Lion's Foot (Prenanthes serpentiaria)	Endangered
Seabeach Dock (Rumex pallidus)	Threatened
Knotted Pearlwort (Sagina nodosa var. nodosa)	Threatened
Bristly Foxtail (Setaria geniculata)	Special Concern
Salt Reedgrass (Spartina cynosuroides)	Special Concern
American Sea-blite (Suaeda americana)	Special Concern

Summary of Regulatory Requirements

Regulations pursuant to the Massachusetts Endangered Species Act prohibit the "take" of any species of animal or plant listed as Endangered, Threatened or Species of Special Concern in Massachusetts. In reference to animals, "take" means to harass, harm, pursue, hunt, shoot, hound, kill, trap, capture, collect, process, disrupt the nesting, breeding, feeding or migratory activity or attempt to engage in any such conduct, or to assist in such conduct. In reference to plants, "take" means to collect, pick, kill, transplant, cut or process or attempt to engage or to assist in any such conduct. The regulations further state that: "All state agencies shall utilize their authorities in furtherance of the purposes of the Massachusetts Endangered Species Act and these regulations; review, evaluate and determine the impact on Endangered, Threatened and Special Concern species or their habitats of all works, projects or activities conducted by them; and use all practicable means and measures to avoid or minimize damage to such species or their habitats." This includes any work, project or activity either directly undertaken by a state agency or indirectly by other parties with funds provided by a state agency.

The Massachusetts Division of Fisheries and Wildlife has prepared "Guidelines for Managing Recreational Use of Beaches to Protect Piping Plovers, Terns, and Their Habitats in Massachusetts," found in Appendix H, to assist barrier beach managers in meeting these regulatory requirements.

Piping Plover

Piping plovers are small, sand-colored shorebirds that nest on sandy beaches along the Atlantic Coast from South Carolina to Newfoundland. The U.S. Atlantic Coast population is listed as "Threatened" by the U.S. Department of the Interior's Fish & Wildlife Service under provisions of the U.S. Endangered Species Act of 1973 and was estimated at 790 pairs in 1992 (a 6% increase over the previous year). In Massachusetts, the piping plover is also listed as "Threatened" by the Massachusetts Division of Fisheries and Wildlife under provisions of the Massachusetts Endangered Species Act. An estimated 290 pairs nested in Massachusetts in 1993, from Plum Island south to the Rhode Island border and east to Cape Cod, Martha's Vineyard and Nantucket.

Piping plovers nest on coastal beaches above the high-tide line, sand flats at the end of sand spits, gently sloping foredunes and in blow-out or washover areas between or behind primary dunes. They also nest on areas where sandy dredged material has been deposited. Nests are simple "scrapes" in the sand or mixtures of sand, gravel and shells. Nests are placed on open sand or in patches of sparse to moderately dense beach grass and other dune vegetation. Piping plovers are dependent upon natural processes of beach erosion and accretion through wind and wave action to maintain areas of suitable nesting habitat.

Piping plovers return to nesting beaches in Massachusetts from mid-March through late April or early May. Males establish and defend territories and court females. Nesting may occur from mid-April through late July. Clutch size is usually 4 eggs; average incubation period is 27-28 days. Piping plovers fledge only a single brood per season, although renesting will occur in response to nest loss. Chicks are precocial and able to move about within hours after hatching. Chicks remain together with one or both parents until they fledge at 25-35 days of age. Both adults and chicks feed on a variety of invertebrates found in intertidal sand and mud flats, wrack, and on upper beaches and dunes. Preferred feeding habitats of both adults and chicks are intertidal areas of wrack (seaweed, vegetation, shells and other organic debris deposited on the beach by tidal action). Unfledged chicks may be present from late May until mid-August.

Least Tern

Least terns are whitish-colored black-capped birds sporting a white forehead and a black-tipped yellow bill. These small (10") seabirds nest along the Atlantic Seaboard from southern Maine to Florida. In Massachusetts, the least tern is listed as a "Species of Special Concern" by the Massachusetts Division of Fisheries and Wildlife under provisions of the Massachusetts Endangered Species Act. An estimated 2,642 pairs nested at 51 sites in Massachusetts in 1992.

Least terns occupy nesting grounds similar in most respects to those of the piping plover and the two species commonly nest in close proximity to each other. Least terns arrive in Massachusetts in early May, engage in elaborate courtship rituals, mate and quickly establish colonies. Actual nesting occurs from about the third week of May through mid-July. Nesting groups range in size from just a few pairs to 500 or more pairs. Nesting groups mount mutual defense tactics, notably mobbing and defecating upon intruders with great accuracy. Least terns nest in their own colonies and do not join in mixed colonies with other species of terns.

Nests are formed as shallow "scrapes" in the sand, usually in sandy areas devoid of vegetation, but sometimes in areas of sparse beach grass, beach pea and other dune vegetation. Least terns, like the piping plovers, have nested along the eastern barrier beaches for thousands

of years, capitalizing opportunistically on natural processes of beach erosion and accretion.

Clutches consist of 1-3 eggs. The average incubation period is 21-23 days. Incubating adults, clutches of eggs and the young are extremely cryptic. These terns are single brooded, but will renest multiple times in response to nest loss. Chicks are precocial and may run considerable distances along the beaches in the prefledging period. Fledging occurs at about 20-22 days. Adults deliver fish caught in the surrounding waters to the chicks. Soon after fledging, least terns stage and depart southward; most are gone before the end of August.

Common, Roseate and Arctic Terns

These 3 similar-appearing species of whitish-colored black-capped seabirds commingle in large nesting colonies and are hence treated as a group. The common tern is indeed the most "common" of the group. In 1992, some 8,600 pairs were estimated at 35 sites in Massachusetts; only 9 of these sites exceeded 100 pairs. Unlike the common tern, the Arctic tern is regarded as a "peripheral" species in Massachusetts. At the southern limits of its natural range in Massachusetts, the Arctic tern has been declining since the 1950s and reached an all-time low of only 8 pairs in 1992. Both of these species are listed by the Massachusetts Division of Fisheries and Wildlife as a "Species of Special Concern" under provisions of the Massachusetts Endangered Species Act.

The Northeastern population of the roseate tern is listed as "Endangered" by both the U.S. Department of the Interior's Fish and Wildlife Service under the U.S. Endangered Species Act of 1973 and the Massachusetts Division of Fisheries and Wildlife's Natural Heritage and Endangered Species Program under provisions of the Massachusetts Endangered Species Act. In 1992, nearly 85 percent of the entire Northeastern population was concentrated in two colonies--Bird Island, Buzzards Bay, Massachusetts and Great Gull Island, off the eastern end of Long Island, New York. Out of an estimated 1,412 pairs in Massachusetts in 1992, 1,375 pairs (97 percent) were at Bird Island. Away from Bird Island, small numbers of roseates may be found and should be expected with large nesting groups of common terns.

All three of these "larger" tern species differ dramatically from the least tern in habitat preference. Unlike the least tern, they prefer to establish colonies on offshore islands including barrier islands and the remote tips of barrier beaches. Unfortunately for these terns, most of the optimal offshore nesting sites have been gradually usurped by gulls since the 1950's. As a result, terns have been forced to settle at a limited number of secondary inshore sites that leave them more exposed to disturbance by a variety of factors including human activity and a host of land-based predators.

The life histories of these 3 species of terns is generally similar though differing in particulars. Exemplifying the three, common terns select dune areas with moderate to dense stands of beach grass and other dune vegetation. Birds arrive from the south in early May. Colony sites are generally selected before the end of May. Ritualized courtship and pair formation occurs on the beach and sandflats about the colony site. Nesting groups range from just a few to 4,000 or more pairs. Nests are "scrapes" in the sand, usually lined with beach grass and seaweed. Clutches of 2-3 eggs are produced. Both parents share incubation duties for a term of about 23 days. The young are precocial and seek the shade of vegetation and are brooded by the adults. Diet of these terns is almost exclusively fish. Adults rise from the colony to aggressively mob and defecate on intruders.

As the young approach fledging at about 28 days, the bare sandy berm areas proximate to the colony assume importance to the birds as rearing or nursery areas for the young. At some sites, thousands of young terns may be present in these areas from late July through mid-August. After mid-August, most terns have fledged and all three species gather in "staging areas" prior to departure for winter quarters by the end of August.

Massachusetts Historical Commission

As early as possible in the planning stages of a project licensed or permitted by the Massachusetts Department of Environmental Protection, in whole or in part, the Department should notify the Massachusetts Historical Commission in order for the Commission to determine whether the project will have an effect on a historic or archaeological property which is listed in the State Register of Historic Places. The Department does not have to notify the Commission of a project if it clearly does not have an area of potential impact due to the nature of the project. However, if a project is likely to impact a geographical area and cause a change in the historical, architectural, archaeological, or cultural qualities of a property, the Department should notify the Massachusetts Historical Commission. Notification to the Commission is through the project applicant's submission of a Project Notification Form, or, in the case of a project which also requires a Massachusetts Environmental Policy Act review, an Environmental Notification Form. [A Massachusetts Historical Commission Project Notification Form is found in Appendix A of 950 Code of Mass. Regulations 71.00.]

Within thirty days of receipt of a Project Notification Form, the Historical Commission will determine whether the project will have any adverse effect on a State Register property and will provide written comment. If the Commission determines that a project will have an adverse effect, the Commission and Department of Environmental Protection should immediately consult to discuss ways to eliminate, minimize or mitigate the adverse effect. The purpose of the consultation process is to avoid damage to historic or archaeological properties through the adoption of prudent and feasible means. Under Chapter 9 §27C of the Mass. General Laws, the discovery of any archaeological resources on lands owned or controlled by the Commonwealth or any of its subdivisions, should be reported to the State Archaeologist at the Massachusetts Historical Commission.

For further information, contact the Massachusetts Historical Commission, 80 Boylston Street, Boston, MA 02116, (617) 727-8470.

CHAPTER 4

Public Use/Recreational Activities

Barrier beaches have long been used by the public for a variety of purposes, including many recreational activities. While many uses have little impact on the resources of the barrier beach, other activities have been shown to have significant impacts.

This Chapter describes, for the barrier beach resource areas addressed in Chapter 2:

- Activity Descriptions;
- Resource Impacts; and
- Recommended Management Measures.

The activities covered in this Chapter include:

- Pedestrian Uses, including Hunting, Fin and Shellfishing, Kite-flying, Pets, and Hiking;
- Camping, including Fires;
- Watercraft, including Boats and Jet-Skis;
- Plant Harvesting;
- Non-Motorized Transport, including Horseback Riding and Bicycles;
- Fireworks; and
- Off-Road Vehicle Use.

Pedestrian Uses, including Hunting, Fin and Shellfishing, Kite-flying, Pets and Hiking

Pedestrians engage in a variety of activities on barrier beaches, including: wildlife observation (birdwatching), beach strolling, fishing access, hunting, and jogging. Kite flying at the beach is a popular sport that is viewed as a passive activity. Shellfishing in the intertidal and subtidal areas abutting the barrier is common for both recreational and commercial purposes. Hunting and fishing can occur throughout the barrier beach ecosystem.

Resource Impacts

Pedestrian access is important to encourage and maintain at barrier beaches. However, if left unmanaged, large, concentrated and frequent volumes of pedestrians can have significant impacts on barrier beach resources, including:

- dune vegetation (destruction of vegetation can lead to blow-outs and general lowering of dune profiles and impact wildlife habitat);
- wetlands (marshes, swamps, semi-flooded areas) which contain peaty soils (destruction of vegetation can produce depressed trails, with subsequent widening as pedestrians seek drier ground);
- upper wrack line (destruction of sand-binding plants which would otherwise start growing there);
- wildlife (the human disturbance factor and low tolerance of some species).

Wildlife can be adversely impacted by visitor-generated garbage left at the beach, since it may be ingested or may attract predators to nesting areas.

Discarded kite string and monofilament line can cause wildlife entanglement problems.

Nesting and feeding shorebirds may perceive kites as potential predators, thereby temporarily abandoning nests, leaving young vulnerable to temperature changes and predation. Shorebirds, terns and waterfowl may suffer serious injury or death from entanglement in kite strings, either during flight or from lengths of string discarded on the beach.

Unleashed or uncontrolled pets can harass, capture or kill wildlife, particularly nesting birds, eggs, and hatchlings. Additionally, unleashed or uncontrolled pets may cause disturbance to other beach users during seasonal high use periods. Animal waste can have an adverse impact on coastal beaches, water quality, and tidal flats. Vegetation, dune form and function can also be adversely affected.

Recommended Management Measures

- The Mass. Division of Fisheries and Wildlife's "Guidelines for Managing Recreational Use of Beaches to Protect Piping Plovers, Terns and Their Habitats in Massachusetts," found in Appendix H, and the Mass. Department of Environmental Protection's "Recommended Conditions for Barrier Beaches," found in Appendix I, should be consulted.

General Pedestrian Use/Hiking

- Pedestrian impacts should be managed in order to minimize adverse impacts to barrier beach natural resources associated with this activity.

- In most instances, large, concentrated and frequent volumes of pedestrian activity should be prohibited from coastal dunes and wetlands. However, where large, frequent and concentrated volumes of pedestrians will be channeled through dunes, the following precautions should be taken:
  - in establishing cross-over paths through dunes, there should be the minimum number of paths necessary to provide safe access and egress from the back of the barrier beach to the beach front;
  - pedestrian traffic should be managed through the use of ramps and elevated boardwalks, fences, thick vegetation, and signs;
  - trails should be constructed such that they cause no harm or disturbance to state-listed rare species;
  - non-ramped pedestrian trails through dunes to the beach front should be periodically inspected in order to determine whether or not the location of the trail or the volume of traffic are contributing to excessive wear and erosion. If so, the trail may have to be relocated or a ramp or boardwalk built and the old trail restored;
  - trails should not be constructed so that they create blowouts;
  - pedestrian trails should not cross over unstable dunes; and
  - pedestrian routes should not be constructed so that they create wind and wave tunnels; they should follow an "S" pattern. [See Chapter 5 for information on construction of pedestrian pathways and boardwalks.]

- On beaches where there is pedestrian traffic which could harm or disturb incubating plovers or terns, their eggs, or chicks, refuge areas with at least a 50 yard-radius around nests should be delineated with warning signs and symbolic fencing above the high tide line [see figure on page 72]. Only persons engaged in rare species monitoring, management, or research activities should enter the refuge areas, although individuals may pass by outside. Refuge areas should remain fenced as long as viable eggs or unfledged chicks are present.

- Refuge areas around nests should be expanded if a 50-yard radius is deemed inadequate to protect incubating adults or unfledged chicks from harm or disturbance. This may include situations where plovers or terns are especially intolerant of human presence, or where a 50-yard radius refuge provides

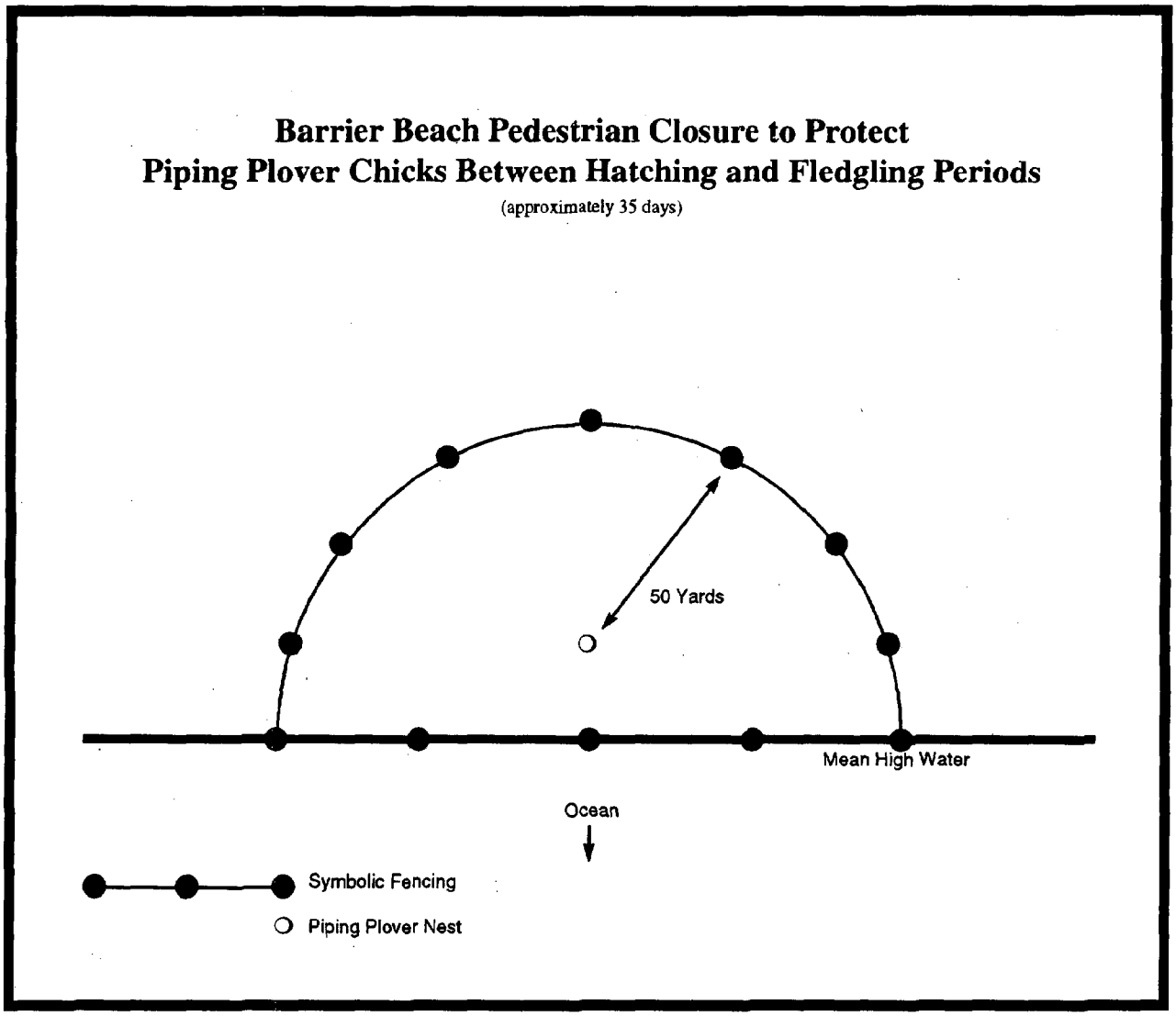


Figure 12. Barrier beach pedestrian closure to protect piping plover chicks between hatching and fledging periods (approximately 35 days).

insufficient escape cover or alternative foraging opportunities for plover chicks. If nests are discovered outside fenced areas, fencing should be extended to create a sufficient buffer to prevent harm or disturbance to incubating adults, eggs, or unfledged chicks. On some beaches where plovers and terns have traditionally nested or where suitable habitat occurs, it may be necessary to symbolically fence portions of habitat during March or April, prior to plover nesting, or during May, prior to tern nesting, if, in the opinion of the Massachusetts Division of Fisheries and Wildlife, or its agent, failure to do so could discourage plovers or terns from nesting as a result of disturbance from human use.

- Rearing or nursery areas used by unfledged or recently-fledged tern chicks, as identified by the Massachusetts Division of Fisheries and Wildlife, or its agent, should be delineated by beach managers with posts, warning signs, or symbolic fencing not later than June 21. Only persons engaged in rare species monitoring, management, or research should enter posted or fenced tern nursery areas while unfledged tern chicks or tern chicks being fed by adult terns are present, although individuals may pass by outside these areas. Such nursery areas may be re-opened when all tern chicks have fledged and are not being fed by adult terns.

- Viewing platforms should be constructed where people congregate at stairways and scenic overviews.

- Concessions that sell refreshments should be encouraged to use biodegradable materials and seek alternatives to enhance waste reduction.

- Users should be encouraged to follow a carry in-carry out policy on garbage, trash, and refuse.

Hunting

- Hunting conducted in accordance with existing Mass. Division of Fisheries and Wildlife regulations is a legitimate and acceptable recreational activity on barrier beaches.

Pets

- Pets should be leashed or under control of their owners at all times from April 1 to August 31 on beaches where piping plovers or terns are present or have traditionally nested. Pets should be prohibited on these beaches from April 1 through August 31 if, based on observations and experience, pet owners fail to keep pets leashed and under control and staff resources prohibit enforcement of leash laws. Hunting dogs, as is traditional, should be kept under the control of hunters at all times. This guideline is especially important in remote areas which are difficult to manage and yet attractive to wildlife.

Kite-Flying

- From April 1 to August 31, kite flying should be prohibited within 200 yards of both nesting territorial adults and unfledged juvenile piping plovers and terns.

Finfishing

- Sport finfishing on barrier beaches is an activity that, for public safety reasons, should be separated from recreational swimming areas during active beach use hours.

Shellfishing

- Shellfishing is regulated at the municipal level by Mass. General Laws Chapter 130 and by Fishing & Shellfishing Regulations at 322 Code of Mass. Regulations 1.00 - 12.00. Aquaculture is also regulated under the Mass. Wetlands Protection Act and Regulations at 310 Code of Mass. Regulations 10.04 (a)(b).

All Activities

- Informative and educational signs are encouraged.

Camping, including Fires

Uses include people staying overnight in tents, self-contained camping vehicles or in the open. This activity may also include accessory uses such as camp fires and chase vehicles.

Resource Impacts

Tenting and associated heavy pedestrian use may impact vegetation or landform. Generally, when limited and well managed, there are few impacts on coastal beaches or heavily vegetated areas. Other activities, such as accessory fires and waste disposal, including human waste, may cause significant impacts if not properly managed. Camping and fires can: destroy vegetated cover as well as alter dune form and function; can impact rare species, rare species habitat, and migratory shorebirds through disturbance of nesting, resting, and feeding activities; and can impact erosion control structures and signage through the use of these structures as combustion material. Fires can create a public safety threat and debris problem through improper disposal. The procedure of extinguishing a fire through burial is dangerous as coals may continue to burn underground for an extended period of time, producing no visible smoke, but posing a safety threat to barefoot beachgoers.

Recommended Management Measures

- Camping areas should be delineated by beach managers and cited in their plans. The areas should be located at least 100 yards from identified nesting sites and off-road vehicle corridors.
- Camping should be prohibited in rare species habitat and significant migratory shorebird areas, and limited in coastal dunes.
- Designation of camping areas should include assessment of flammability of adjacent flora, access availability by vehicle or foot, waste disposal facilities, wildlife considerations, and scenic views.
- Educational programs for campers should take place.
- A "carry in-carry out" policy for trash should be implemented.
- A policy requiring fires in containers will alleviate the problem of buried fires as the camp fire user can carry the fire to the water to extinguish it or fill the container with water on location.
- Informative and educational signs are encouraged.
- See section on "Off-road Vehicle Use" (page 85)

Watercraft, including Jet Skis

In some instances, vessel access to barrier beaches has been encouraged by beach managers where vehicular access has been restricted. In order to properly manage vessel access to barrier beaches and islands, beach managers are encouraged to work closely with municipal harbormasters, the Massachusetts Harbormasters Association, the boating public, yacht clubs, the U.S. Coast Guard Auxiliary and the U.S. Power Squadron.

Recreational watercraft, including boats, jet skis, sailboards and other vessels are popular at many beaches. Some of these activities have occurred at beaches since colonial times and, in certain instances, are provided for in the Colonial Ordinances of 1641 and 1647. However, watercraft use adjacent to public bathing beaches is also regulated by other state and federal laws, such as 323 Code of Mass. Regulations 2.00-2.14 (others are cited at Appendix E). Small craft, typically under twenty-five feet in length, are most commonly observed launching and landing around beach and marsh areas. Such vessels anchor just offshore and move passengers to the beach in small dinghies. In addition, individual watercraft such as jet skis and sailboards have become more popular.

Impacts from watercraft can take two forms: on-water and/or onshore. Although on-water activities may impact barrier beaches directly or indirectly, the impacts of onshore activities of humans accessing beaches via watercraft have a more direct affect on a beach.

Resource Impacts

Most vessel owners in Massachusetts operate their boats in a conscientious and environmentally sensitive manner. In some instances, however, adverse impacts to the barrier environment can occur when vessel and beach regulations are not in place or are violated, more often at remote barrier beach locations not easily managed by beach managers.

Impacts are not likely to occur from minimal or occasional use of watercraft. It is the chronic impacts that should be evaluated due to popular use in specific areas.

Barrier beach resources impacted by watercraft include: beaches, salt marsh, land containing shellfish, and land under the ocean. Coastal dunes may be impacted by pedestrians associated with vessel use. Vessel access at barrier beaches may conflict with recreational swimming. It may also conflict with rare species and wildlife habitat protection, especially at remote ends of barrier spits. Changes in bottom topography, alteration of substrate vegetation, and increased sedimentation due to prop wash and hull impacts may also occur. Increased access by small craft on barrier spits can create a large human disturbance factor to areas otherwise inaccessible to most people but commonly used as nesting, feeding, resting and migration habitat for rare species and other wildlife.

On-water

Barrier beaches in Massachusetts that are popular for watercraft activities share many common traits. Often the preferred areas for landing and recreating are on the sheltered backside of beaches. These areas are typically associated with a salt marsh system or a bay, important resource areas known for their fragility. Many times the preferred watercraft use areas are also remote, enhancing their wildlife value. Resource impacts that may occur from on-water watercraft activities include changes in underwater topography from increased water column mixing and sedimentation; disturbance and contamination of economically-important shellfish beds and waters; increased beach and marsh bank erosion from watercraft wake; water contamination from gas, oil and waste tank discharges; and disturbances to nesting, feeding, resting and migration habitat for rare species and other wildlife from watercraft noise.

Onshore

Onshore activities of humans accessing beaches from watercraft take on similar characteristics to other forms of human use on beaches. Individuals from watercraft do not necessarily act differently than other persons accessing a beach by other means. However, onshore activities related to watercraft regularly occur in remote areas where management is difficult. Therefore, activities prohibited in well-patrolled areas of beaches may occur more often in remote areas accessed by watercraft due to lack of enforcement. Specific potential onshore impacts from humans accessing beaches via watercraft include damage to dunes and fragile beach vegetation, disturbance to wildlife (primarily resting, nesting and feeding shorebirds and terns) from humans and pets, and contamination from trash and human waste.

Recommended Management Measures

General

- Watercraft use should be balanced with other uses, potentially warranting special area use designations both on-water and shoreside.

- Where symbolic fencing is inadequate in protecting rare species, such as terns and plovers, or wildlife habitat, such as significant migratory shorebird staging areas, and where there is no active rare species management plan in place, beach managers should consider negotiated alternative management measures, including, but not limited to, temporary restrictions on the launching and beaching of small craft on those portions of the barrier beach that provide nesting, feeding, resting, or migration habitat for rare species and other wildlife. Discussions should include representatives from the beach owner and manager, the municipal conservation commission, The Massachusetts Division of Fisheries and Wildlife, and the user groups.

- In order to protect dunes, beaches, and salt marsh resources, the number of watercraft and associated visitors should be assessed and managed where and when necessary.

- Signs should be erected at these areas to inform users of the management issues.

On-water

- Management of on-water activities of watercraft involves regulatory statutes that exceed the scope of this document. However, there are certain measures a beach manager can employ, such as working with appropriate authorities to designate areas for swimming or boat landing only, in an effort to ensure public safety. Speed limits can be posted around high-use watercraft areas for public safety. Buoys and signs should delineate such special use areas. Unfortunately, certain other on-water impacts may be impossible for a beach manager to enforce. In such cases, cooperation with local harbormasters, Massachusetts Environmental Police Officers and the U.S. Coast Guard may assist in solving a problem. [See Mass. General Laws Chapter 90B, §§1-5.]

- Potential conflicts can exist between exercise of the public trust rights to "fish, fowl and navigate," recreational swimming, and the protection of rare species and wildlife habitat. Beach managers are therefore urged to designate, wherever safe and practicable, launching and landing areas for watercraft.

Onshore

- Impacts from onshore activities associated with watercraft can be effectively managed using a variety of techniques that allow for continued use of the resource while balancing the needs for conservation with recreation. However, to achieve this balance, beach managers must commit resources to specific areas where pedestrians from watercraft regularly come onshore. Some of the recommended management measures include: fencing and signage to protect fragile dune areas; fencing and signage to protect wildlife areas; general signage to inform users about the area and regulations governing its use; regular staffing to directly educate users about the fragile barrier beach environment and encouraging respect for the resources; enforcing regulations; and encouraging conscientious on-water operation of watercraft. These techniques have proven effective and should be adopted for all high-use watercraft areas.

Pedestrian Impacts

- Pedestrian impacts associated with vessel landings and launching can have an impact on barrier beach natural resources, especially in remote areas of barrier beaches not easily managed. Refer to the "Pedestrian Use" section in this Chapter regarding the impacts and recommended management measures.

Plant Harvesting

Plant Harvesting includes removal of living and dead plant material from the barrier marshes and beaches. Sea lavender is commonly removed from high salt marsh areas, and American Beach Grass seed stocks are commonly removed from dune areas. Large scale removal of coastal vegetation can have an adverse impact on dunes and beach stabilization, seed sources and food sources for animals.

Resource Impacts

Removal of sea lavender has effected the Massachusetts population of sea lavender by depleting the seed source within the salt marsh community.

Removal of American Beach Grass seed stocks can limit the spread of the grass and lead to dune destablilization and erosion.

Recommended Management Measures

- Unauthorized harvesting of barrier beach plants, such as sea lavender, American Beach Grass and *Spartina*, should be prohibited.
- Informative and educational signs are encouraged.

Non-motorized Transport, including Horseback Riding and Bicycles

Non-motorized transport uses include: recreational horseback riding, horseback patrol, and mountain biking.

Resource Impacts

Within the barrier beach system, there are areas where this type of activity is more appropriate or less damaging than others. However, where this activity destroys vegetation, it also is likely to adversely impact dune shape and function. The introduction of feces from horses to land or water from direct contact or runoff can contribute to human health problems and water quality degradation.

Recommended Management Measures

- Bicycles and horses should be encouraged to remain on established paths. The use of coastal dunes for official horse patrol or recreational purposes is discouraged. Dunes should only be traversed when accessing or exiting a coastal beach, and then, access should be over a designated trail. Horses should also be directed away from tidal flats as feces can have an adverse impact on shellfish.

- On beaches where horses are used and could harm or disturb incubating plovers or terns, or their eggs, or chicks, refuge areas of at least a 50-yard radius around nests and above the high tide line should be delineated with warning signs and symbolic fencing.

- Refuge areas around nests should be expanded if a 50-yard radius is deemed inadequate to protect incubating adults or unfledged chicks from harm or disturbance. This may include situations where plovers or terns are especially intolerant of human presence, or where a 50-yard radius refuge provides insufficient escape cover or alternative foraging opportunities for plover chicks. If nests are discovered outside fenced areas, fencing should be extended to create a sufficient buffer to prevent harm or disturbance to incubating adults, eggs, or unfledged chicks. On some beaches where plovers and terns have traditionally nested or where suitable habitat occurs, it may be necessary to symbolically fence portions of habitat during March or April, prior to plover nesting, or during May, prior to tern nesting, if, in the opinion of the Massachusetts Division of Fisheries and Wildlife, or its agent, failure to do so could discourage plovers or terns from nesting as a result of disturbance from human use.

- Rearing or nursery areas used by unfledged or recently-fledged tern chicks, as identified by the Massachusetts Division of Fisheries and Wildlife, or its agent, should be delineated with posts, warning signs, or symbolic fencing not later than June 21. Only persons engaged in rare species monitoring, management, or research should enter posted or fenced tern nursery areas while unfledged tern chicks or tern chicks being fed by adult terns are present, although individuals may pass by outside these areas. Such nursery areas may be re-opened when all tern chicks have fledged and are not being fed by adult terns.

- Beach managers should establish appropriate areas for the use of all non-motorized transport to avoid rare species habitat and other sensitive coastal resources according to season.

- Non-motorized transport often allows the public easy access to distant areas. Beach managers should develop measures to manage and educate this user group as enforcement of rules and regulations is often difficult in remote areas.

- Informative and educational signs are encouraged.

Fireworks

This activity includes the setting-off of large scale, municipally sanctioned Fourth of July-type fireworks attracting thousands of people.

Resource Impacts

The landing of fireworks and associated debris can result in quick-moving fires, especially during dry summer months. The result is destruction of vegetation that holds dunes in place. Fireworks may cause disturbance to nesting, feeding, and resting rare species and cause disturbances to wildlife habitat.

Recommended Management Measures

- The launching and large-scale viewing of fireworks should be prohibited on coastal dunes, in salt marshes, and near wildlife habitat, especially that of nesting rare species (April 1 to August 31).

- Launching and viewing areas for municipally sanctioned Fourth of July-type fireworks events should be established in conjunction with the beach manager and municipal fire warden so as to avoid adverse impacts to rare species, wildlife habitat and barrier beach and wetland natural resources. Particular attention should be paid to the management of large and concentrated volumes of pedestrian traffic associated with this activity in order to avoid adverse impacts to sensitive and critical natural resources. [See "Pedestrian Use" section earlier in this Chapter.]

- Codes regulating the launching or lighting of fireworks should be strictly enforced on barrier beaches.

Off-Road Vehicle Use

The off-road vehicle user group includes: beach-goers; fisherman; recreational overnight users with self contained campers which may have trailered "chase" vehicles and boats; private property owners; and special users such as those engaged in research and monitoring, minimal maintenance, law enforcement, emergencies and public safety.

Resource Impacts

Most off-road vehicle owners in Massachusetts operate their vehicles in a conscientious and environmentally sensitive manner. In some instances, however, adverse impacts to the barrier environment may occur when vehicle and beach regulations are not in place or are violated, more often at remote barrier beach locations not easily managed by beach managers.

Coastal beaches may be impacted through the churning of tires; tidal flats may be impacted through compaction of the substrate; vegetation may be destroyed; and dunes may be destabilized.

According to "The Impact of Off-Road Vehicles on Coastal Ecosystems in Cape Cod National Seashore: An Overview" (Leatherman and Godfrey, 1978), it is said that: "The sheering and compressional effects of off-road vehicle passage extend to a depth of approximately 20 centimeters; the shear stresses of the turning wheels disaggregate the drift and break plant rhizomes. The integrity of drift lines is destroyed by off-road vehicle traffic, as the material is scattered about the beach. Vehicle impact also decreases the rate of decay of organic material. Bacterial counts associated with the drift were normally very high but were markedly reduced when vehicles pulverized the organic deposits."

"Vehicle traffic also crushes and kills seedlings of annuals and the young plants of perennials, such as *Ammophila,* which are associated with the drift. It was found that the effect of 100 passes of an off-road vehicle does not differ significantly from that of 10 passes; only a few passes are required to break up the deposit and kill all the vegetation. Thus, the major effect of vehicles on the high beach was on drift lines and developing dunes, with traffic severely limiting new dune formation."

Vehicle travel through the coastal dune can destroy the vegetated mat and can contribute to erosion of dune form and function. Travel over salt marshes can destroy the vegetated mat and cause erosion. Shellfish resources may be impacted due to compaction of soil and crushing existing organisms, depending on the depth of shellfish and other organisms, substrate type, weight and use of vehicle.

Off-road vehicle use may degrade piping plover habitat by crushing wrack (seaweed, shells and other organic material deposited on the beach by tidal action) into the sand and making it unavailable to the plovers as cover or foraging substrate. Wrack is a preferred feeding habitat for piping plovers, especially chicks.

Vehicles can degrade piping plover habitat by creating ruts that may trap or impede movements of chicks, and by causing disturbance that may prevent plovers

from using habitat that is otherwise suitable (Goldin and others, 1990; Strauss, 1990; Melvin and others, 1993). For a complete list of citations, see Appendix H, the Massachusetts Division of Fisheries and Wildlife's "Guidelines for Managing Recreational Use of Beaches to Protect Piping Plovers, Terns and Their Habitats in Massachusetts."

The use of off-road vehicles may also impact other migratory shorebirds feeding and resting on beaches, tidal flats, coastal dunes and salt marshes. Vehicles and other associated activities may disturb and interrupt feeding and resting activity by driving through or adjacent to the associated habitats. Impacts are potentially greatest during the southward part of shorebird migration (July 1st - September 15th) when public use of beaches is highest.

The use of off-road vehicles may affect the survival and productivity of state and/or federally listed endangered species, such as piping plovers and terns. Vehicles can crush concealed eggs and chicks, even adult birds. Typical behaviors of piping plover chicks make them much more vulnerable than least tern chicks to off-road vehicles. Chicks frequently move back and forth between the foredune and preferred feeding habitats in the wrack line and intertidal zone. These movements place piping plover chicks in the paths of vehicles moving along the berm or through the intertidal zone. Because piping plover chicks typically leave the nest within a day of hatching and typically run out onto the open beach, the wire fencing placed around nests or nesting areas to deter predators is ineffective in protecting chicks from vehicles. Plover chicks and least tern chicks may stand in or walk and run along tire ruts, and young chicks sometimes have difficulty crossing deep ruts or climbing out of them. Chicks sometimes stand motionless or crouch, rather than flee, as vehicles pass by.

Piping plovers may be vulnerable to disturbance during periods of courtship and territory establishment in March and April. Similarly, least terns may be vulnerable in May and June. Common, roseate and Arctic terns are highly disturbed by any vehicle or pedestrian intrusion into their colonies. Prolonged or repeated disturbances at colonies can lead to egg and chick loss from exposure and predation or site abandonment.

1) OFF-ROAD VEHICLE DRIVING CORRIDORS

Recommended Management Measures

- The Mass. Division of Fisheries and Wildlife's "Guidelines for Managing Recreational Use of Beaches to Protect Piping Plovers, Terns and Their Habitats in Massachusetts," found in Appendix H, and the Mass. Department of Environmental Protection's "Recommended Conditions for Barrier Beaches," found in Appendix I, should be consulted.

Beach Corridors

- Where off-road vehicle use takes place or is proposed to take place on a barrier beach, off-road vehicle beach driving corridors should be designated by beach managers. Corridors should be located such that they avoid wildlife habitat, particularly that of rare species; wrack lines; salt marsh; vegetated areas on coastal beaches; tidal flats; overwash areas; and coastal dunes. A coastal beach off-road vehicle driving corridor should be located at a minimum of 10 feet seaward of the spring high tide line to the most seaward berm crest (see figure on page 88). Back dune or back barrier vehicle routes should be eliminated wherever and whenever possible and restored.

- When designating beach driving corridors, beach managers should also consider separating vehicle use areas from other beach recreational activities, such as bathing, hiking and walking.

- Between July 1 and September 15, areas that are identified as significant feeding, resting and staging areas for migratory shorebirds should be closed to off-road vehicles by posting and fencing the areas or by altering off-road vehicle travel corridors. Shorebirds are most suscetible to disturbances at high tide when they roost on upper portions of the beach. This is a recommendation only, designed to protect from disturbance migratory shorebirds that are feeding and roosting while on their way to South America.

- In instances where off-road vehicle access has been closed in order to comply with environmental laws, beach managers are encouraged to work with local officials, the public, and, where appropriate, state and federal officials to resolve any conflicts through planning and discussions. Reasonable alternative access routes should always be investigated.

- When the use of a vehicle corridor creates an unstable dune area such as a blowout, or results in a reduction in foredune height, volume or function, then the trail should be relocated with the old crossover closed and the area restored. Activities that produced such damage should be reviewed for compliance with environmental law. [Such contingency plans should be part of the overall beach management scheme.]

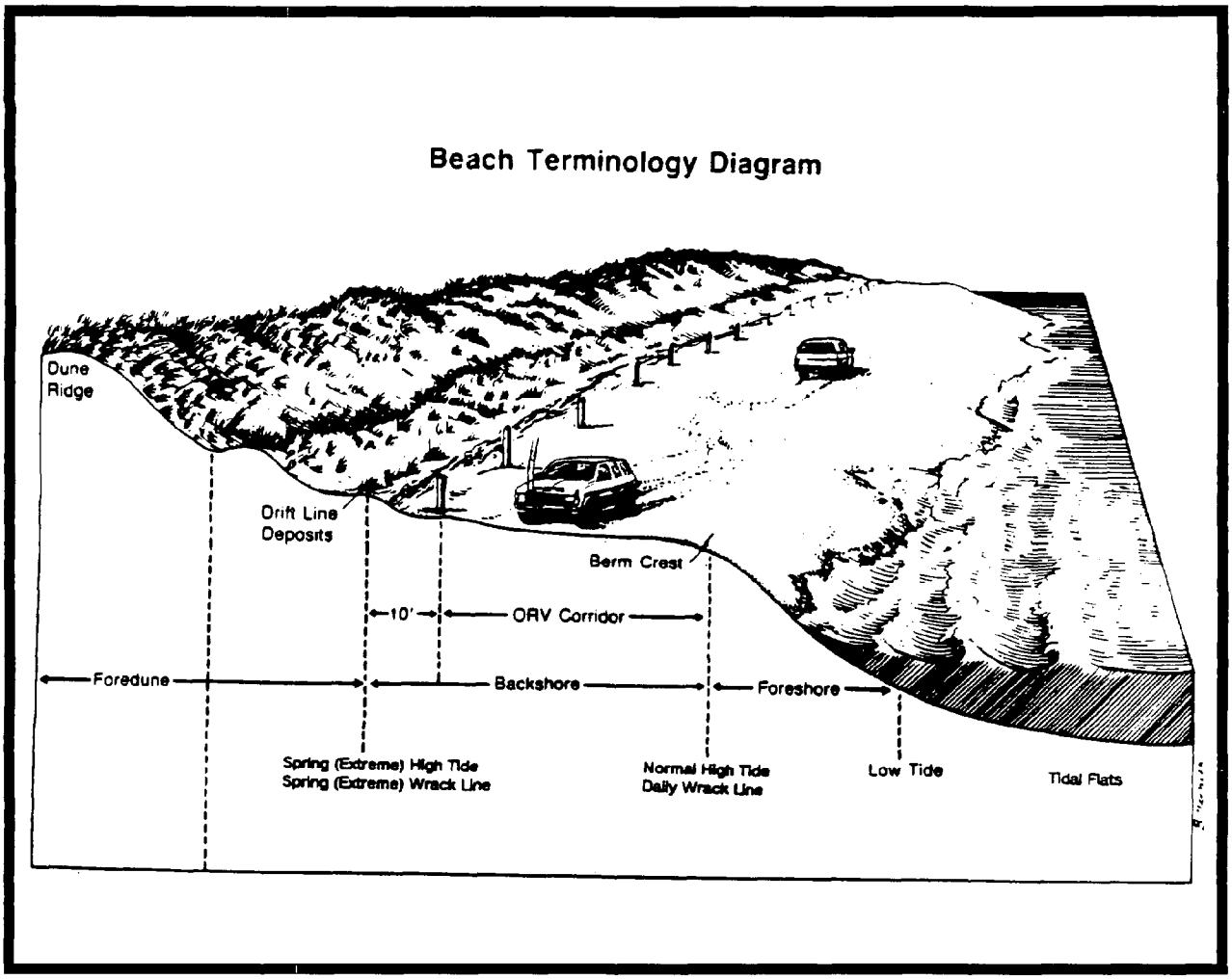


Figure 13. Beach terminology diagram (adapted from: U.S. Department of the Interior/National Park Service/Cape Cod National Seashore).

- Travel through off-road vehicle corridors should be on well established vehicle trails, delineated with posts, signs, and/or fencing.

- Adequate protection measures should be applied to beach trails during high or exceptionally high tides so that drivers will not damage the seaward edge of dunes. Some trails may be closed during certain time periods depending on the width of the beach and height of the tide.

- Travel may be further restricted due to other changing beach conditions and rare species nesting activity.

- Severely rutted trails should be repaired in order to keep off-road vehicles from using unauthorized areas and to confine vehicles to designated routes.

- All designated off-road vehicle corridor routes should be indicated on maps and diagrams provided with off-road vehicle permits.

- Parking should be permitted only within oversand vehicle corridors. However, in order to avoid traffic obstruction, parking should not be permitted on previously made trails within the corridor.

- Parking in blowout areas should be prohibited and controlled by posting and cable fencing. The use of snow fence in such areas is not encouraged as it may adversely impact nesting shorebirds.

- In some instances, beach managers may be able to provide for overnight camping by self-contained vehicles along the coastal beach corridor. A self-contained vehicle is a motor home or truck with an attached camper shell, with permanently mounted holding tanks with a 3 day capacity for containing black and gray water.

- Overnight camping and sleeping should be permitted only in self-contained recreational vehicles along the off-road vehicle corridor. For safety reasons, tents should not be permitted within the corridor. Vehicles and campers should possess a valid permit visibly displayed.

Dune Crossovers

- Where off-road vehicle corridor crossover routes are located on coastal dunes, they should be the minimum number of routes necessary in order to provide safe access and egress over the dune to the vehicle corridor located on the beach front.

- Ramps should be constructed as the prime vehicle corridor route through coastal dunes. Vehicle ramps can be constructed by placing 2x4 inch boards on edge, with short spacers between each 2x4, and held together by cables which pass through the studs and spacers. The spaces between the studs allow sand to filter through when the ramp is lifted and reset. If the site becomes

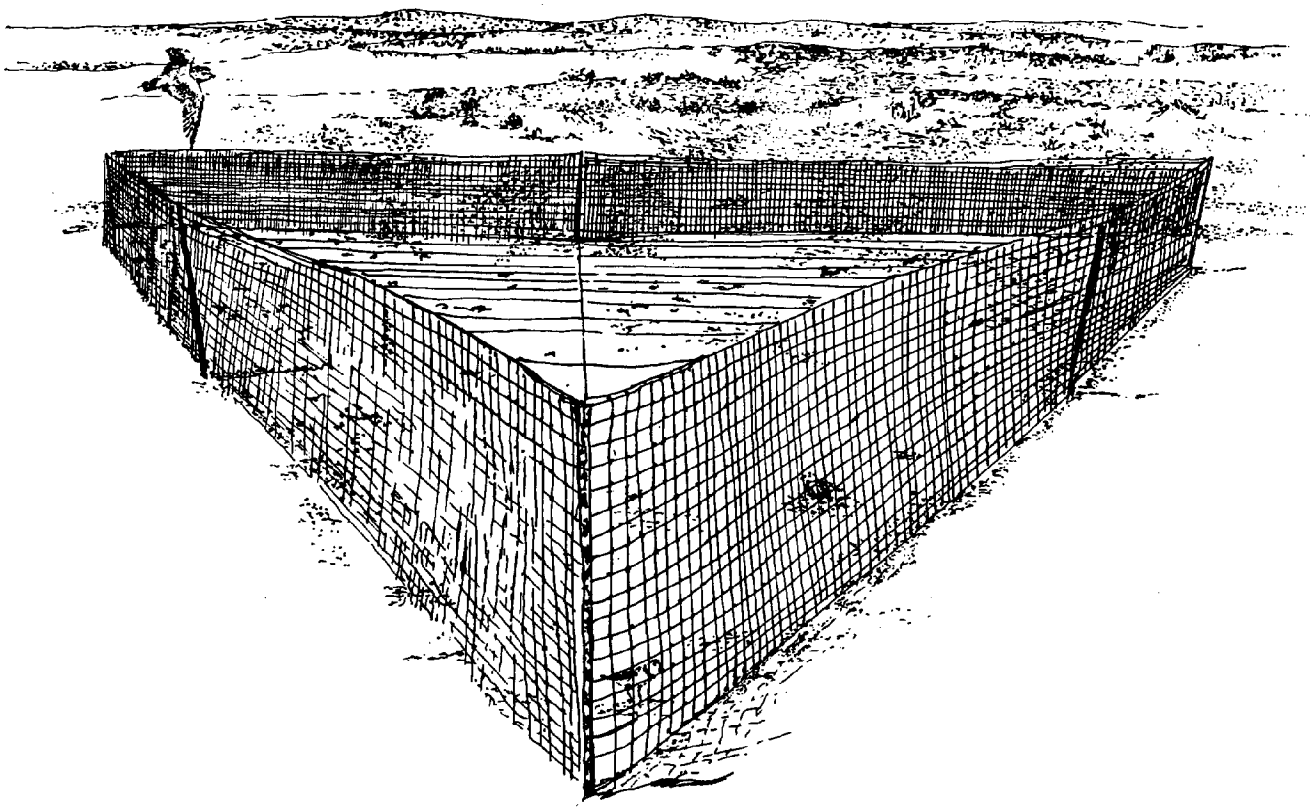


Figure 14: Fencing plan to protect piping plover nests and unfledged chicks from pedestrian, non-motorized transport, and off-road vehicles (courtesy of Mass. Department of Environmental Management).

stable, beach grass plants will grow in the spaces between the studs (Carlson and Godfrey, 1984). Also see the **Guidelines'** Chapter 5.

- Non-ramped crossover trails from the backside of the beach through dunes to the beach front corridor should be periodically inspected in order to determine whether or not the location of the trail or volume of traffic is contributing to excessive dune erosion. If so, the trail may have to be relocated or a ramp built and the old trail restored.

- Non-ramped trails should be constructed such that:
  a. Dune routes do not include sharp turns and steep grades;
  b. Trails do not cross unstable dunes;
  c. Trails avoid sensitive areas such as nesting bird areas, blowouts, and sites of rare species of plants and animals;
  d. Wind and wave tunnels are not created. Routes through dunes should be curved in an "S" fashion.

- Dune crossover traffic should be confined to designated routes by use of cable fences.

- See Appendix D, "Off-road Vehicles, Recommended Equipment and Suggested Trail and Driving Guidelines."

Information/Education

- Use of vehicles allows access to remote areas and as a result the impact may involve human waste. The use of public or privately maintained toilet facilities may be necessary.

- Driving hours should be established, advertised, and well know by all beach users.

- Speed limits should be 15 miles per hour, unless otherwise posted.

- Speed limits in self-contained vehicle areas should be 5 miles per hour.

- Speed limits near posted bird nesting colonies, nursery areas or roosting areas should be 5 miles per hour for <u>all</u> vehicles.

- Informative and educational signs should be used to:
  a. Mark designated off-road vehicle trails and access points across foredunes; and
  b. Mark restricted areas, when appropriate, such as rare bird species nesting areas.

- Along with the issuance of an off-road vehicle permit, educational information

specific to the beach should be provided to drivers. Some beach managers also require drivers to view a brief audio-visual presentation. [See Chapter 6 -- "Public Education and Outreach."]

2) BARRIER BEACH VEHICLE QUOTA

Recommended Management Measures

- As a general rule, it is recommended that a certain number of square feet of frontal coastal beach be allowed for each off-road vehicle entering the beach. This will determine the amount of vehicles allowed on a barrier beach at any one time.

In determining the appropriate number of vehicles for a specific area, the beach manager should first estimate the square footage of available coastal beach, ten feet from the Spring High Tide to Mean High Tide. Bathing areas, salt marshes, coastal dunes, tidal flats, rare species habitat, wrack, and staging areas for migratory shorebirds should not be included in the land areas used to calculate the number of square feet allowable.

Available Area/Number of Vehicles = Area per Vehicle (in square feet)

This recommendation must be interpreted by beach managers on a case-by-case basis depending largely upon the characteristics of the barrier beach under consideration for off-road vehicle operations.

3) RARE SPECIES MANAGEMENT

Recommended Management Measures

The following jurisdictional matters should be evaluated by beach managers and regulators:

1) Wildlife habitat and rare species habitat is protected under the Massachusetts Wetlands Protection Act and enforced by the municipal conservation commission and the Massachusetts Department of Environmental Protection;

2) Rare species are protected under the federal Endangered Species Act and the Massachusetts Endangered Species Act, which are enforced by the U.S. Fish and Wildlife Service and the Massachusetts Division of Fisheries and Wildlife, respectively; and

3) Wildlife habitat, including that for rare species can and in some instances may be protected under municipal wetlands protection by-laws/ordinances and enforced by the municipal conservation commission.

- Refer to Appendix H, Massachusetts Division of Fisheries and Wildlife's "Guidelines for Managing Use of Beaches to Protect Piping Plovers, Terns and Their Habitats in Massachusetts."

Under the Massachusetts Wetlands Protection Act regulations, if a proposed project is found to alter a resource area which is part of the actual habitat of a state-listed rare wildlife species, such project shall not be permitted to have any short or long term adverse effects on the habitat of the local population of that species. The Natural Heritage and Endangered Species Program of the Massachusetts Division of Fisheries and Wildlife acts as the scientific authority to determine what is actual habitat and to provide an opinion about whether proposed activities subject to the Mass. Wetlands Protection Act will have adverse effects on rare wildlife habitat. An opinion issued by the Natural Heritage and Endangered Species Program is presumed to be correct, although this presumption is rebuttable and may be overcome upon a clear showing to the contrary.

The Massachusetts Endangered Species Act and its regulations are administered by the Massachusetts Division of Fisheries and Wildlife. The Act prohibits the "taking" of any species of animal or plant listed as "Endangered," "Threatened," or "Species of Special Concern" in Massachusetts. For animals, "taking" is defined as: "to harass, harm, pursue, hunt, shoot, hound, kill, trap, capture, collect, possess, disrupt the nesting, breeding, feeding, or migratory activity or attempt to engage in any such conduct, or to assist such conduct." Regulations implementing the Act state further that: "All state agencies shall utilize their authorities in furtherance of the purposes of Massachusetts Endangered Species Act and these regulations; review, evaluate and determine the impact on Endangered, Threatened and Special Concern species or their habitats of all works, projects, or activities conducted by them; and use all practicable means and measures to avoid or minimize damage to such species or their habitats." This includes "any work, project, or activity either directly undertaken by a state agency, or if undertaken by a person, which seeks the provision of financial assistance by an agency or requires the issuance of permits by an agency."

- Where there is no management undertaken to effectively implement the Massachusetts Division of Fisheries and Wildlife's "Guidelines for Managing Recreational Use of Beaches to Protect Piping Plovers, Terns and Their Habitats in Massachusetts" (Appendix H), estimated rare species habitat should be closed entirely to all off-road vehicle activity from mid-April through late July. It should be noted, that development and implementation of a management plan, which includes comprehensive monitoring, may result in temporary closures of less duration then closures made without any management. The Massachusetts Division of Fisheries and Wildlife should be consulted regarding the development of such plans and the employment of rare species monitors.

- Off-road vehicular access for shellfishing should be a component of beach management plans and cross-reference municipal shellfish management plans. Such plans should be established by and with local officials, the Massachusetts

Types of Barrier Beach Off-Road Vehicle Closures to Protect Piping Plover Chicks Between Hatching and Fledgling Periods

(approximately 35 days)

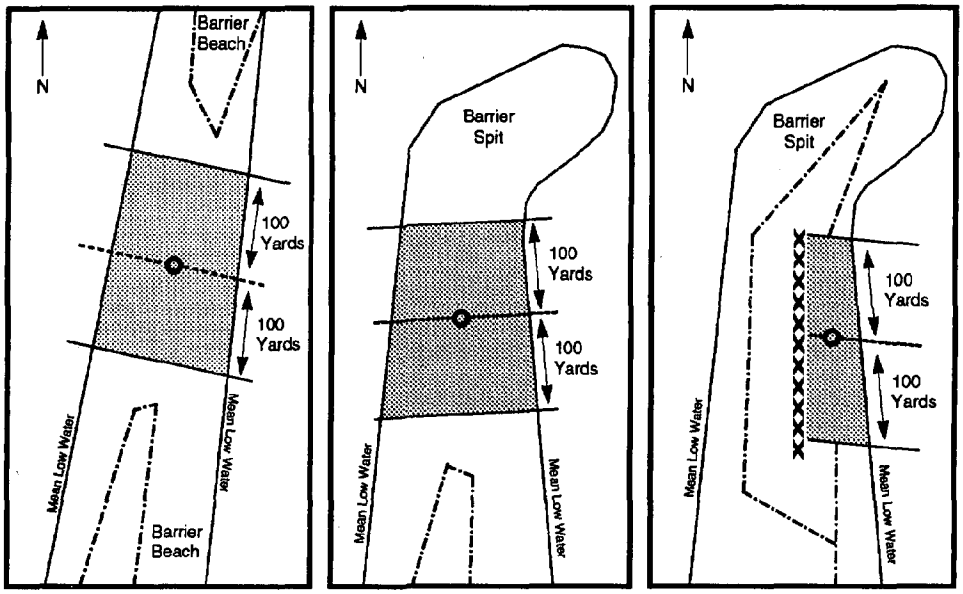


Figure 1

Closure of a section of beach to through traffic. Access/egress to open beach areas is possible in either direction. Not excluding pedestrian access.

Figure 2

Nest situated such that closure of beach 100 yards north and south of the nest is necessary. Traffic originates from one direction only or by ferry. Not excluding pedestrian access.

Figure 3

Closure of beach 100 yards north and south of the nest. Continued vehicle/foot passage allowed in area of barrier beach inaccessible to plover chicks due to natural features such as high dunes. Not excluding pedestrian access.

Key:

-·-·- Off-road vehicle corridor

Area temporarily closed to off-road vehicles

Rare species nest with hatched but unfledged birds

Impenetrable natural feature

Figure 15: Types of barrier beach off-road vehicle closures to protect piping plover chicks between hatching and fledging (approximately 35 days). (This is a graphic illustration of Appendix H: Massachusetts Division of Fisheries and Wildlife's "Guidelines for Managing Recreational Use of Beaches to Protect Piping Plovers, Terns and Their Habitats in Massachusetts."

Division of Marine Fisheries and in compliance with the above recommended regulatory and management measures of the Massachusetts Wetlands Protection Act, Mass. Endangered Species Acts, and U.S. Endangered Species Act.

4) ESSENTIAL VEHICLES

Recommended Management Measures

- When all or part of a barrier beach is temporarily closed to off-road vehicle use due to the presence of rare species, such as unfledged plover or tern chicks, the beach manager should establish a policy that considers closing the beach entirely to all off-road vehicles or closing it to recreational vehicles with the exception of one or more "essential uses," where absolutely necessary. The use of essential vehicles at a barrier beach will depend upon the site, its conditions, and the amount and type of essential use proposed.

  A certain amount of essential off-road vehicle use may be appropriate and necessary for effective management of the barrier. The use of such vehicles may be considered essential for the minimal amount of activity necessary to provide for:
  - Public safety;
  - Law enforcement;
  - Minimal maintenance of public property;
  - Access to private dwellings not otherwise accessible;
  - Rare species monitoring and management; and
  - Research (wildlife, plants, geology).

- Escorts are recommended for essential vehicles to insure compliance with all pertinent regulations and guidelines.

- Refer to Appendix H, Massachusetts Division of Fisheries and Wildlife's "Guidelines for Managing Use of Beaches to Protect Piping Plovers, Terns and Their Habitats in Massachusetts," especially "IV. Management Guidelines" for "Essential Vehicles."

- After a period of time where essential vehicles are used, a thorough re-evaluation should be made regarding any impacts from such use on wildlife habitat and rare species. Management plans should be adjusted accordingly.

- Also see the previous section on Management Measures for "Off-road Vehicle Driving Corridors."

CHAPTER 5

Restoration and Management Activities

Due in part to the uses described in the previous chapter, as well as the natural actions of erosion and relative sea level rise, the barrier beach manager is often confronted with various management options regarding restoration or protection of resources. These options range from "hands-off" or "let nature take its course" policies to engineering/construction solutions.

This Chapter describes the various restoration and management activities that occur on barrier beaches, including:

- Activity Descriptions;
- Resource Impacts; and
- Recommended Management Measures.

Among the activities covered are:

- Erosion Control and Restoration Techniques, including: 1) dune and beach construction and reconstruction; and 2) moving beach material. Covered under construction and reconstruction are soft solutions (fences, Christmas trees, native and exotic plants, and beach nourishment) and hard structures (groins, jetties, revetments, seawalls, and bulkheads). Moving beach material entails overwash deposits and beach scraping;
- Beach Cleaning of: 1) stone and gravel; 2) litter; and 3) wrack (including day-to-day, storm, and winter wrack);
- Construction of Facilities, including pedestrian crossovers and walkways, vehicle crossovers, roadways and parking lots, buildings and septic systems, and access for the physically challenged;
- Nuisance Control, including: 1) insects; and 2) exotic plants;
- Rare Species Predators;
- Other Wildlife Issues; and
- Trash.

These activities generally occur in resource areas subject to the jurisdiction of the municipal conservation commission and the Mass. Department of Environmental Protection under the Mass. Wetlands Protection Act and will require the filing of a Notice of Intent. Consult Appendix I, the Massachusetts Department of Environmental Protection's "Recommended Conditions for Barrier Beaches" for additional guidance. In addition, many municipalities have adopted wetlands bylaws/ordinances that further regulate activities in resource areas, and should be consulted prior to undertaking these restoration and management activities.

Erosion Control and Restoration Techniques

1) Dune and Beach Construction and Reconstruction

Under the Massachusetts Wetlands Protection Act, two of three primary functions of a barrier beach are storm damage protection and flood control. Managing a barrier beach in order to preserve these important natural functions becomes increasingly necessary as development along the coast continues to increase and relative sea level continues to rise. Barrier beaches must also be protected and managed as places that provide important wildlife habitat, including that of rare species -- the third primary function regulated on barrier beaches under the Wetlands Act. Beach managers are thus placed in the precarious position of drafting management plans that serve all these functions. When public health, safety and structures are threatened by erosion, in and near rare species habitat, conflicts can arise regarding the best methods of simultaneously protecting structures, wildlife habitat, and rare species. The following may serve as helpful discussion in determining the best methods for achieving these goals.

Management strategies should be determined by local issues in conformance with federal, state, and local law. Consideration should be given to storm damage prevention, flood control, and wildlife habitat in determining specific actions.

Resource Impacts -- Soft Solutions

Coastal dunes and beaches can be naturally or artificially established or enhanced. High dunes, natural or artificial, reduce erosion of the foreshore during storms by acting as a sediment supply. Small, localized dune stabilization efforts, particularly the planting of dune vegetation, are usually considered conservation and storm damage prevention measures. Dune building techniques are generally used only when there is a need to protect existing facilities or access to those facilities.

A variety of measures have been used effectively over the years to stabilize dunes, slow erosion of dunes and beaches, and trap and accrete sand to build up beaches and dunes. Snow fences are placed along foredunes or beach berms to trap and accrete sand. Rows of discarded Christmas trees are used to fill breaks in foredunes, and beach grass or other vegetation is planted to trap sand and stabilize beaches and dunes. Hard structures, such as jetties and breakwaters, (discussed later on in this chapter) have been used to reduce wave action, and groins have been placed on many beaches to trap sand. Seawalls constructed of concrete or stone have been built on a number of beaches and dunes in an attempt to protect buildings from damage by waves.

While many of these methods have been effective in preventing or slowing erosion on a limited scale, they do not offer the all purpose panacea -- for they too can present problems for beach managers. Sand gathering devices can alter the natural geology and ecology of the barrier beach; create aesthetic problems by introducing man-made structures or non-indigenous items into the natural environment; and reduce the ability of the beach to allow for dune rollover and to

protect the backshore from flooding.

In addition, sand gathering devices can affect wildlife habitat and rare species. Breeding habitat for terns and piping plovers and other barrier beach species in Massachusetts and elsewhere along the Atlantic coast has been degraded or lost as the result of a variety of coastal development and coastline stabilization activities. Beaches and dunes have been altered to the point of being unacceptable to terns and plovers through construction of recreational and residential dwellings, commercial buildings, boardwalks, piers, roads and parking lots. Such activities not only physically alter or cover over habitat used by nesting terns and nesting, feeding and roosting plovers, but may also increase human use of adjacent beaches, which in turn may result in increased human-caused disturbance of adult birds or mortality of eggs or chicks.

Snow Fences and Christmas Trees

Snow fences and Christmas trees may be an appropriate means of building dunes for storm damage protection and flood control or maintaining a barrier beach system to manage blowing sand in and around built facilities and structures. However, snow fences may create steep dune faces that are incompatible with plover nesting. Snow fencing or Christmas tree fences placed in washover areas, blowouts, or other areas used for nesting may represent actual physical barriers to plovers. The planting of beach grass or other vegetation may result in habitats that are too densely vegetated to be used by nesting least terns and plovers. All of these stabilization structures or activities may temporarily impede some coastal storms from eroding and scouring dunes and beaches, but they can also adversely affect least tern and plover nesting habitat.

Wire from damaged snow fencing can also pose a threat to coastal wildlife, including birds, fish, marine mammals, and others.

Discarded Christmas trees used in coastal beach and dune erosion control and restoration projects may become unearthed through wind and wave action and become a solid waste nuisance along the coast.

Beach Nourishment

"Nourishment" refers to the placement of sand on a beach or barrier beach to increase its volume. The feasibility of nourishment should be evaluated in combination with modification to any existing erosion control structures.

Nourishment sand may be obtained from several different sources and by different methods. Sand may be moved from updrift of a groin to the downdrift beach with an earthmoving machine such as a front-end loader. Sand dredged from navigation channels may be pumped onto the eroded beach with hydraulic machinery. Typically, sand nourishment must be performed periodically if the source of natural sand no longer exists for a given beach area. Beach erosion rates should be determined, the sources of sand and the mechanisms of beach nourishment must be investigated, and the frequency and volume of sand necessary to maintain the beach must be identified. Storm frequency and magnitude can greatly affect how much and how often sand nourishment may be required.

Beach renourishment using dredged and other off-site materials is often the

preferred alternative to hard structures and a positive step for storm damage prevention on barrier beaches. Beach nourishment projects also could be a significant type of habitat alteration that may be either beneficial or detrimental to nesting plovers and terns, particularly least terns. Deposition of dredged material on beaches can substantially improve the quality and availability of plover and least tern habitat by creating areas of nesting substrate that are higher, wider, and less vegetated than were previously present at the site. Beach nourishment activities may adversely affect breeding terns and plovers, if dredged material is not suitable nesting substrate, or if deposition of dredged material occurs at a time and place that disturbs nesting birds.

Plants

Restoring dunes and marshes with vegetative plantings in appropriate areas can be an effective method of storm damage restoration and erosion control, especially in overwash areas in front of sections of developed barrier beaches. In planning such restoration activities, care must be taken not to destroy rare species habitat by improperly planting in overwash fans and low relief foredune areas that may be utilized by species, such as piping plovers.

Recommended Management Measures

General Information

- The Mass. Department of Environmental Protection's "Recommended Conditions for Barrier Beaches," found in Appendix I, should be consulted.

- Environmental impacts may be less of a concern in small dune stabilization projects outside of rare species habitat. Large dune building or restoration projects require serious consideration. An investigation of the dynamics of the barrier beach and the role the existing size of the dunes play in the barrier dynamics, such as landward migration, must be considered. In addition, the volume of sand added and its ultimate destination as a result of reworking by aeolian and storm processes must be considered. Impacts to saltmarsh and shellfish habitat are examples of off-site impacts that must be considered.

- It should be remembered that coastal dunes are presumed to be significant to, among other interests, storm damage prevention, flood control, wildlife and rare species habitat.

- The source of sand for natural dune building is the adjacent beach. Where beach volume has been reduced by human alterations (such as coastal engineering structures), another sand source may be required. Sand which is artificially or mechanically brought in to build a dune should be compatible with the sand in adjacent natural dunes (see "Nourishment" section in this chapter). Vegetative plantings should be done in conjunction with this artificial dune construction.

- The dimensions of an artificial dune should be similar to adjacent unaltered natural dunes, if the latter are available for comparison. If not, an experienced coastal geomorphologist should be consulted to determine the optimum dune dimensions and locations.

Geomorphic Needs for Maximum Shoreline Property Protection on Barrier Beaches

This opinion is based solely on shoreline property protection interests. It is recognized that multiple interests, such as rare species protection, for barrier beach use must be balanced in any initiative.

The geomorphic needs for maximum shoreline property protection include:

- A wide, gently sloping beach or steep foreshore with a high, wide, multiple berm backbeach;

- A continuous, densely vegetated foredune ridge;

- High volume foredunes, ideally with the frontal dune reservoir greater than 540 square feet (as explained in the National Flood Insurance Program and Related Regulations [44 Code of Federal Regulations, Chapter 1, §65.11]. For example, a dune with greater than 540 square feet of sand in the frontal dune quadrant has in most cases survived a 100-year storm event, although in a seriously eroded state; dunes without the requisite amount of sand in the frontal quandrant may be washed away in a similar type of storm [see figure on page 102];

- Densely vegetated, continuous or undulating, high volume inter- and backdune fields;

- When considering the long-term stability of a barrier beach, some overtopping of dunes may be beneficial in certain areas in order to allow for storm-related (wave) energy release mechanisms to occur and in order to allow for dune and beach overwash, necessary in any barrier beach migration. However, in the sole interest of protecting property/structures, artificial dune construction with dune grass plantings or dune building enhancement techniques in overwash areas, such as constructing multiple rows of snow/sand fencing accompanied by dense dune grass plantings, should begin immediately following an overwash event; and

- A nearshore sand bar is also beneficial.

In summary, for maximum shoreline protection, it may be necessary that there be a continuous, high volume, densely vegetated dune field, particularly foredunes, fronted by a wide, gently sloping beach, or steep foreshore, with multiple berm backbeach.

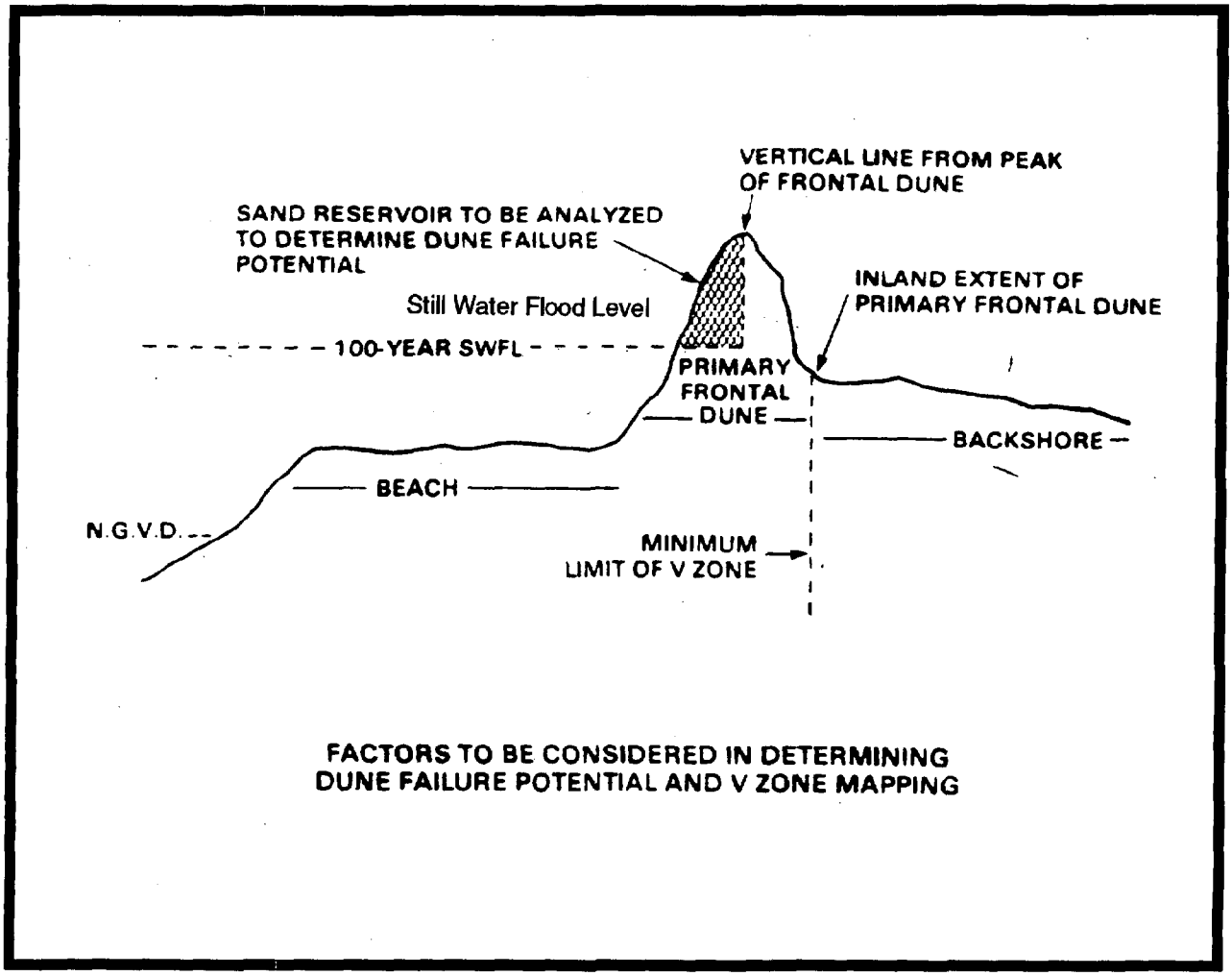


Figure 16: Factors to be considered in determining dune failure potential and velocity zone mapping (adapted from Federal Emergency Management Agency National Flood Insurance Program and Related Regulations, Federal Register, Volume 53, Number 88, May 6, 1988, page 16271).

Sacrificial Dunes

- "Sacrificial dunes," as defined by the U.S. Army Corps of Engineers and supported by the Federal Emergency Management Agency have been designed and erected on some barrier beaches in Massachusetts as a means of short-term storm damage protection to landward development. These are typically low-lying man-made dunes, the purpose of which is to withstand a storm of five years in frequency. However, in their design, they will be sacrificed during a minor storm while having provided only temporary protection for landward development. These dunes must also be regularly maintained, often at significant expense for the protection they provide. Because these are federal activities, they will be subject to a §7 finding made by the U.S. Fish and Wildlife Service and the permitting federal agency under the U.S. Endangered Species Act (see page 63). Such activities will also be reviewed by the Mass. Coastal Zone Management Office for federal consistency with state coastal policies.

Fences

- In highly exposed areas, sets of sand fence installed during the autumn and parallel to the beach and dune face build a dune more quickly than beach grass plantings (Knutson, 1977). The most effective technique, however, is to plant beach grass in conjunction with fence use.

- The best fence material is snow fence with a 50% porosity, held in place by posts at 10 to 15 foot intervals. Snow fence is widely available, catches sand better than brush fence, is less expensive than fabric fence, requires less labor to install than fabric or brush fence, and is less subject to vandalism than fabric fence (Woodhouse, 1978).

- Whenever and wherever possible, coastal managers should allow natural processes of beach and dune accretion and erosion to occur, and should not undertake beach and dune stabilization projects that will alter and degrade wildlife habitat, particularly for rare species such as terns and plovers. Although installation of snow fencing and beach grass plantings are usually encouraged as the most natural stabilization methods, they should generally not occur in actual rare species habitat.

- Use of snow fencing and shrubs is typically an effective means for controlling pedestrian access and delineating vehicle travel corridors and parking lots in heavy use areas. There should be no placement of tires, pallets or other solid waste on barrier beaches.

Christmas Trees

- The use of discarded Christmas trees for coastal beach and coastal dune erosion control and restoration purposes should be carefully scrutinized. Discarded Christmas trees may be used in appropriate instances to restore an eroded dune which protects an existing built facility, previously designated off-

road vehicle routes, or pedestrian access routes. However, discarded Christmas trees should not be placed in actual rare species habitat.

Beach Nourishment

- Sand used for nourishment should be similar in size to that of the natural beach. Sometimes sand of a larger size is necessary for nourishment if all natural sources of sand have been depleted.

- When used for beach nourishment, compatible material should have a grain size that is equal to or less than 10% of that which is presently on site or was on site. To determine if sand is "compatible" with the nourishment site, scientific assistance should be sought.

- Dredged material to be deposited on tern and plover nesting beaches for the function of storm damage prevention should be sand or a combination of sand, gravel or shells if it is to also be acceptable nesting substrate. Deposition should take place between September 15 and April 1, when nesting terns and/or plovers and migratory shorebirds are not present. In accessing dredging work sites, vehicles should not enter areas where there are unfledged terns and plovers. Compatible dredged material will be most attractive to breeding least terns and piping plovers if the deposition area gradually slopes to the water's edge and if it is not subsequently planted with beach grass or crisscrossed with snow fencing for stabilization purposes.

Dune Stabilization in Rare Species Habitat

On beaches and dunes that have been determined to be actual rare species habitat, alterations to the natural system are generally discouraged and often prohibited under the Mass. Wetlands Protection Act and Mass. Endangered Species Act.

However, there may be instances where erosion control projects, such as dune and beach rebuilding and enhancement, including the installation of snow fences, the planting of beach grass, and other soft solutions for beach and dune stabilization, may be necessary in order to protect public health and safety by preventing or minimizing an imminent threat from storm damage and flooding.

In such cases, the Mass. Coastal Zone Management Office, Mass. Division of Fisheries and Wildlife, and the Department of Environmental Protection will provide technical assistance and will determine, on a **case-by-case** basis, whether such projects may be permitted with appropriate monitoring and controls.

In such instances, the following information should be provided in a Notice of Intent, filed under the Mass. Wetlands Protection Act, to the municipal conservation commission, Mass. Department of Environmental Protection, and Mass. Division of Fisheries and Wildlife:

1. **Documentation** showing that the erosion control project as designed will prevent or minimize an imminent threat from storm damage and flooding to existing:
   - Structures;
   - Necessary infrastructure;
   - Sole access to existing structures; and/or
   - Necessary navigational interests.

2. **A written opinion** from a qualified coastal geologist, geomorphologist, or other expert in such matters, showing that the erosion control project, as designed, will prevent or minimize an imminent threat to those interests it is designed to protect. [This minimum level of documentation may be supplemented with additional supporting materials.]

3. **A timetable** showing that no work will take place when rare species are present on site.

4. **Comprehensive data** necessary to determine whether or not an imminent threat exists (as requested in #1 above) could be quite costly. Therefore, a preliminary analysis may be performed which incorporates a minimal amount of necessary information. Such information should include:
   - Beach and dune cross-sectional profiles;
   - Tidal and storm elevations, such as mean high water, mean low water, ten-, fifty-, and 100-year storm elevations superimposed on the beach and dune cross-sectional profiles;
   - Location and elevation of structures, access to those structures, navigation channels and basins, and/or natural resources that are claimed to be in imminent danger from storm and flood damage. For structures, first floor and ground elevations should be indicated and accompanied by notation on the community Flood Insurance Rate Map. In addition, the presence of a coastal engineering structure, such as a revetment, seawall, groin, jetty, or breakwater, protecting the structure should be noted;
   - A plan, or preferably a low altitude aerial photograph, showing the location of existing conditions, such as: state-listed rare species habitat; overwash areas; snow fencing; areas of planted beach grass; off-road vehicle and pedestrian corridors; jeopardized dwellings; dwelling access routes; jeopardized necessary infrastructure; navigation basins and channels; natural resources; and proposed dune construction or dune building enhancement projects, including proposed snow fence, beach grass, and sediment nourishment locations.
   - Tidal elevations and tidal time lags for both bay and ocean side of the barrier, along with any other relevant supporting data.

A written opinion from the Mass. Natural Heritage and Endangered Species Program will then be issued to the municipal conservation commission and Mass. Department of Environmental Protection regarding whether the proposed minimum necessary erosion control project, with mitigative measures, will or will not have a short- or long-term adverse impact on the local population of rare species. The municipal conservation commission or the Mass. Department of Environmental

Protection will then decide whether or not the proposed project meets the Performance Standards of the Mass. Wetlands Protection Act.

These technical requirements are based on the agencies' best and current thinking and are subject to change as more research is completed and more individual cases are reviewed under the Mass. Wetlands Protection Act and Mass. Endangered Species Act.

Plants -- Native Species

The following is a suggested species list for the various vegetated zones found on barrier beaches:

Pioneer Zone (beach face)

- Beach pea *(Lathyrus japonicus)*
- Seabeach sandwort *(Arenaria peploiles)*
- Sea rocket *(Cakile edentula)*
- Dusty miller *(Artemisia stelleriana)* - a "naturalized" species

The above plants may be termed "dune initiators" in that over time they can form embryonic dunes by trapping sand and by providing a seed source for the foredune areas. These plants often occur naturally from seed sources brought in with wrack material.

Primary Dune

- American beachgrass *(Ammophila breviligulata)*
- Beach pea *(Lathyrus japonicus)*
- Seaside Goldenrod *(Solidago sempervirens)*

American beachgrass is the best species to use for erosion control because of it's extensive root systems and ability to accumulate sand rapidly. However, for reasons not well understood, it does not do well in sand-starved interdunal areas (some scientists attribute this phenomenon to the nutrient supply associated with fresh sand).

Secondary Dune

- American beachgrass *(Ammophila breviligulata)*
- Beach plum *(Prunus maritima)*
- Seaside Goldenrod *(Solidago sempervirens)*
- Bayberry *(Myrica pensylvanica)*
- Beach heather *(Hudsonia tomentosa)*
- Bearberry *(Arctostaphylos uva-ursi)*
- Beach rose *(Rosa rugosa)*

This last item is a "naturalized" species that may be used as a last resort in pedestrian control. Care should be taken so that the planting of beach rose does not in any way adversely effect rare species habitat.

Secondary Dune Salt Marsh Border

- Marsh elder *(Iva frutescens)*
- Groundsel - tree *(Baccharis halimifolia)*

- Sweet gale *(Myrica gale)*

These species should be planted above the spring tide line.

Salt Marsh

- Smooth Cordgrass *(Spartina alterniflora)*
- Saltmeadow Cordgrass *(Spartina patens)*

Smooth cordgrass requires daily inundation by the tides. Therefore, this species should be planted between mean low water and mean high water. Saltmeadow cordgrass may be planted from mean high water to spring high water.

Planting Information -- Native Species

- For a detailed description and information on propagation and planting techniques for dune and marsh areas, there are several good publications listed at the end of this section. The following are some general guidelines for American Beachgrass and smooth cordgrass.

American Beachgrass: Plant 1-2 culms on 18 inch centers, 8 inches in depth. For a greater density, culms can be planted 12 inch on center, but keep in mind the rhizomes (underground roots) of this plant can spread 6 to 10 feet horizontally annually. Sand should be pressed firmly down around the culms after planting. Planting should occur from fall to early spring. Planting fertilization may be done with low amounts of nitrogen (15-25 pounds per acre) to enhance the establishments of the new culms.

Smooth Cordgrass: There are three factors to consider when deciding whether or not to plant *Spartina alterniflora:* tidal range, wave activity, and salinity. In areas with a limited tidal range of less that three or four feet, the plants can be placed between Mean Low Water and Mean High Water. However, in areas with a larger tidal range, plants may only survive between Mean Sea Level and Mean High Water. The upper and lower limits of growth may be estimated by looking at nearby established stands of marsh grass. Salt marshes occur generally in areas of low wave energy. The larger the open water (referred to as off-shore fetch) over which wind can blow and generate waves, the more intense wave conditions will be at the shoreline. If planting or transplanting is not to originate from a site nearby with similar soil salinity, soil should be tested for salinity. *Spartina alterniflora* will tolerate a wide range of salinity, from almost fresh to very salty (2.5 to 42.5 parts per thousand) soil solutions. Salinities of soil solutions exceeding 45 parts per thousand could cause a die-back of plantings.

Sprigs (part of plant consisting of a least one node) or plugs (mass of roots and stems with some original soil) should be planted four to six inches deep, two to three feet spacings between plants in staggered rows. In more exposed sites, plugs should be planted closer together.

Planting Information -- Exotic Species

- When selecting the plant species, only indigenous species should be used. Native plants have evolved over time to adapt to the region's climate, soil conditions, diseases, and other factors. Native plants are much more valuable to the native wildlife who have also evolved utilizing the indigenous plant species for food, cover and brooding areas. Introducing exotic plant materials can have devastating effects on the local ecological balance. For example, common reed *(Phragmites),* long presumed to be an exotic, has taken over many acres of formerly highly productive fresh and salt water marshes across the nation.

References

Lewis, Roy R. III, editor. "Creation and Restoration of Coastal Plant Communities." CRC Press, Incorporated, Boca Raton, Florida.

"Propagation of *Spartina* for Coastal Erosion Control," University of Massachusetts Cooperative Extension Service, Information Bulletin No. 3, July 1985.

"Marine and Coastal Facts, Establishing New Salt Marshes," University of Massachusetts, Cooperative Extension Service, and Massachusetts Institute of Technology Sea Grant Program. No. 7.

Groins and Jetties

Groins are designed to trap sediment from longshore drift to build a protective or recreational beach. Jetties are designed to direct or confine river or tidal flow into a channel and prevent or reduce the shoaling of the channel by littoral material. Both are generally shore perpendicular structures which interrupt longshore sediment transport. Beaches generally accrete on the updrift side of these structures, however, without adequate natural or artificial sediment by-passing, areas immediately downdrift become sediment starved and erosion results. Erosion of the downdrift beach diminishes the storm damage prevention and flood control characteristics of the beach possibly resulting in unnecessary storm damage to landward structures and resources. Increased overwash events may occur as a result of downdrift erosion caused by these structures. In addition, the resultant changes in sediment volume and elevation may affect shellfish and finfish and their habitat.

Revetments, Seawalls and Bulkheads

Revetments, seawalls and bulkheads are structures placed parallel or nearly parallel and adjacent to the shoreline in order to separate a land area from a water area. The primary purpose of a seawall or revetment is to protect the upland area from erosion by waves and currents. The distinction between the three structures is mainly a matter of purpose. It is generally accepted that seawalls are vertical structures for protection against heavy wave action whereas bulkheads act as retaining walls, preventing crumbling or slumping of the earth or sand behind them. Bulkheads are often associated with piers, wharves, and filled tidelands. Revetments are placed on a slope for protection against waves and currents and largely depend on the underlying soil for support.

All three structures prohibit natural processes from eroding the underlying landform, thereby trapping the primary source of beach and dune material that is required to resupply beaches and dunes (and other landforms formed by coastal processes). These coastal engineering structures, particularly vertical structures, can also cause erosion in front of them due to reflection of storm waves. Flanking erosion and scouring of abutting property due to wave refraction can also occur and can be a major concern. Over the short-term, in addition to the above impacts, in the presence of these engineered structures the critical sand sharing system between dunes, beaches and the nearshore areas, particularly during coastal storms, is unable to function. This sand sharing system contributes to decreased storm wave damage by temporary erosion of the dune and beach to form nearshore sand bars which help dissipate storm wave energy. Following a storm, nearshore bars migrate landward and lead to berm development and eventually sand transport back to the primary dunes by way of aeolian processes. Over the long-term, the most serious adverse effect of these coastal engineering structures is their interference with the landward shifting of the barrier beach.

Recommended Management Measures

General Information

- The Mass. Department of Environmental Protection's "Recommended Conditions for Barrier Beaches," found in Appendix I, should be consulted.

Groins and Jetties

- Groins are generally prohibited on barrier beaches under the Mass. Wetlands Protection Act. Jetties may only be allowed to protect existing navigation channels.

- Several corrective techniques are suggested to minimize downdrift erosion problems being caused by existing groins: remove, shorten, or lower the groin; increase the porosity of the groin; backfill the groin to capacity with compatible material; or nourish the eroding downdrift beach.

- Adverse impacts caused by jetties can be minimized by establishing or constructing a sediment by-pass system across the inlet. Downdrift beach nourishment may also be required.

- Site specific analyses are necessary to determine the appropriate corrective techniques(s).

Revetments, Seawalls and Bulkheads

- New seawalls, revetments and bulkheads on barrier beaches are generally inconsistent with the performance standards under the Mass. Wetlands Protection Act, and, therefore, are likely to be prohibited.

2) Moving Beach Material

Resource Impacts

Overwash Deposits

Barrier beaches exhibit a dynamic equilibrium due to the forces of winds, waves, tides, currents, storms and relative sea level rise. The stability of a barrier beach depends primarily on its ability to respond and reshape to these natural forces and to maintain its dynamic equilibrium through overwash. Overwash is the principal mechanism by which sediment is transported across a barrier beach and occurs when storm waves breach or overtop a dune system. Overwashed material is commonly carried into the landward bay or onto the landward saltmarsh and visibly extends the landward limit of the barrier. The overwashed material provides for new substrate for both new dune and saltmarsh development with drift piles (wrack) providing the nuclei for their growth. On an eroding or transgressive barrier, overwash is critical to the continued existence of the barrier. As the seaward side of the barrier erodes, overwash allows for the same environmental conditions and habitats to be continually recreated through time, only shifting more landward. If overwash is prevented or overwashed material is removed on an eroding or transgressive barrier, the barrier will continue to narrow over time (from both sides) and the barrier may become increasingly susceptible to breaching. The physical removal of sand and gravel from overwash areas artificially narrows and lowers the barrier on the landward side. This practice results in erosion of both sides of the barrier and a hastened demise of the beach. In addition, removal of sand and gravel from an overwash area may make the barrier more susceptible to storm wave damage from the bay side if an adequate distance (fetch) across the landward water body exists for waves to develop.

Beach Scraping

Beach scraping is the process of removing sand from a beach in order to rebuild storm-damaged dunes. Artifically removing sand from a beach lowers the beach elevation and may change the slope of the beach thereby causing subsequent, increased storm damage to landward areas. In addition, if a coastal beach slope is altered as a result of scraping, waves may break differently on the beach face mimicing storm conditions with the result being increased erosion. Typically, the beach will repair itself with time to create a stable slope/profile.

Recommended Management Measures

General Information

- The Mass. Department of Environmental Protection's "Recommended Conditions for Barrier Beaches," found in Appendix I, should be consulted.

Overwash Deposits

- The removal of overwash material that has been deposited on a coastal beach, coastal dune or salt marsh is generally not consistent with the performance standards of the Massachusetts Wetlands Protection Act and is therefore likely to be prohibited. Overwash materials, in this instance, should be left in place.

- Management options for removal of overwash material in roads and parking lots or back barrier navigation channels is site-specific. However, the preferred managment option is to place the overwash material back into the pre-storm foredune location, or if possible, slightly landward of this location. It should be noted, however, that continually removing the material from the barrier may have the long-term impact of narrowing the barrier by starving the barrier of needed sediment.

- Overwash sites on barrier beaches and dunes are often prime rare species habitat for piping plovers and should generally be left in an unaltered state.

Beach Scraping

- Beach scraping is generally not consistent with the performance standards of the Mass. Wetlands Protection Act, as changing the form or volume of a coastal beach is not allowed. Therefore, beach scraping is likely to be prohibited.

Beach Cleaning

1) Stone and Cobble

Resource Impacts

Stone and cobble are natural by-products of glacial erosion; much of the cobble on Massachusetts beaches was created during the last great Ice Age as ice sheets retreated northward. Pieces of rock were subsequently deposited in secondary landforms, such as beaches. Eroding beaches with low volumes of updrift sediment input generally contain sizable volumes of cobble in the nearsurface substrate. Cobble on a beach provides for substrate which helps provides elevation to the beach profile or berm. A high sandy or cobble berm provides storm damage prevention and flood control for landward areas.

The practice of removing cobble from beaches has been identified as a possible cause of increased storm damage. The removal of sand or cobble from a beach lowers the beach profile thereby allowing storm wave energy to dissipate in more landward areas possibly causing otherwise avoidable damage. The isolated cases where this practice has been conducted in the Commonwealth have usually been for the purpose of recreational enhancement resulting in a greater expanse of sandy beach surface. However, if cobble exists on the surface of a beach, it is generally just as abundant below the surface due to the glacially derived nature of landforms in Massachusetts. After a short period of time following cobble removal, surficial sands are generally winnowed out and cobble reappears.

Recommended Management Measures

- The Mass. Department of Environmental Protection's "Recommended Conditions for Barrier Beaches," found in Appendix I, should be consulted.

- The practice of stone and cobble removal from beaches is generally inconsistent with the performance standards under the Massachusetts Wetlands Protection Act and is therefore likely to be prohibited.

- Management options for removal of overwash materials, such as cobble, that have been deposited on roads and parking lots or back barrier navigation channels is site-specific. However, the preferred management option is to place the overwash material back onto the pre-storm location, or if possible, slightly landward of this location. It should be noted, however, that continually removing overwash cobble from the barrier beach may have the long-term impact of narrowing the barrier (as shown previously in the section on "Moving Beach Material - Overwash Deposits").

2) Litter

Resource Impacts

Although litter may be considered primarily a problem of aesthetics, debris items on the beach may also lead to wildlife entanglement or ingestion. Known causes of entanglement include monofilament line and netting, six-pack yokes, and rope. Mistaking debris as food items, marine animals have eaten balloons, plastic bags, and assorted plastic pieces. Debris may come from either land-side sources, such as beachgoers, or marine sources, such as recreational and fishing boats. A large portion of the marine debris is caught up in the wrack line, while land-side litter often blows up into dunes and beach grass areas.

Recommended Management Measures

- Litter should be removed by hand whenever possible. For public safety and aesthetic reasons, litter should be removed on a daily basis early each morning and, when possible, each evening at recreational beaches during the summer season. Lifeguards are often best employed to carry out this function with hand-held poled nets prior to going on life saving duty.

- The Massachusetts Coastal Zone Managment Office sponsors a "Coastsweep" program each September (traditionally the third Saturday in September) during "Coastweeks." This type of volunteer cleanup has proven to be an effective means of educating the public about the problems and hazards of debris along the beach. By involving schools, youth groups, civic organizations, and businesses, this public service program creates a feeling of stewardship among participants for their beaches. The program also gives beach managers the opportunity to clean sections of beach that are typically inaccessible, due to distance or topography, to typical beach cleaning methods.

  During the cleanup, volunteers use data cards to catalog the types of debris collected. This information is later analyzed at both state and national levels. In Massachusetts, it has been shown that plastics represent about two-thirds of all debris counted (by item number, not weight). Cigarette butts are the single most prevalent debris item.

  Cleanup volunteers are instructed to collect all man-made items, such as plastic, foamed plastic (such as styrofoam), rubber, glass, metal, paper, wood, and cloth, but to leave organic materials in place. These "natural" items include animal wastes, seaweeds, dead animals, and drift wood. Volunteers are told to notify the beach manager or local cleanup coordinator when they come across any potentially hazardous materials, such as suspected medical wastes, and not touch the materials themselves. With items such as 55-gallon drums of unknown contents, they are instructed to mark the information on the card, notify the beach manager, but not attempt to remove the item personally.

- A regular program of volunteer beach cleanups, or an "Adopt a Beach" program, can provide the needed hands to remove the constant influx of debris that comes from both landside and waterside sources, as well as many of the small, but oftentimes dangerous items such as broken glass, that may be missed during regular beach maintenance. Contact the Massachusetts Coastal Zone Mangement Office at (617) 727-9530 to participate in "Coastsweep."

- Spring beach cleanups are also encouraged.

- Beach concessions should be encouraged to use recycled materials and to recycle discarded items.

- Also refer to the section on "Trash" discussed later in this Chapter.

3) Wrack

Resource Impacts

Day-to-Day Wrack

Washed-up eel grass or seaweed is a source of nutrients and seeds for the pioneer species of flora associated with wrack lines, provides foraging habitat for shorebirds, and provides substrate for accumulating sand for the beach berm.

Storm Wrack and Winter Wrack

In "The Impact of Off-Road Vehicles on Coastal Ecosystems in Cape Cod National Seashore: An Overview" (Leatherman and Godfrey, 1978), the authors state that: "The most sensitive zone of the high beach is the drift-line zone, which consists chiefly of organic material deposited on the backshore during high spring tides or storms. Drift lines on northern beaches contain large quantities of marine algae, eelgrass, and marsh detritus. Bacteria and fungi quickly break down this organic matter, releasing nutrients into the sand and eventually back to the sea. The drift-line zone also contains fragments and seeds of dune plants and is therefore a significant site for new dune development on open sand. Regeneration of beach grass *(Ammophila)* on a bare sand beach is almost exclusively by growth of plant fragments washed from eroding dunes and redeposited on the beach as drift. Once the plants are established, embryonic dunes can develop, provided they are not destroyed by storms or off road vehicle impact."

Beach cleaning may have an effect on wildlife habitat and rare species. Beach cleaning, done either by hand or mechanically, such as with a Cherrington machine, may substantially reduce the quality and quantity of foraging substrate available to shorebirds, including the rare piping plover, by removing wrack (seaweed, vegetation, shells and other organic debris deposited by tidal action). Wrack is beneficial to piping plovers in two ways. First, it is a primary substrate for invertebrate life, such as various types of amphipods and dipteran larvae, eggs and adults that serve as food for plovers. Second, wrack provides cover for plovers, especially small chicks.

Data from three separate studies have shown that wrack is a preferred feeding habitat for piping plover chicks. At Breezy Point on Long Island, Goldin and others (1990) found that plover chicks spent 59% of their time feeding. Of that feeding time, 76% was spent in wrack, although wrack comprised only 8% of available feeding habitat above the intertidal zone. At 6 beaches in Massachusetts in 1988 and 1989, plover chicks spent 35% of their time feeding (Hoopes and others 1992, unpublished data). Of that feeding time, 63% was in wrack, although wrack comprised only 3% of available feeding habitats at all sites combined. At Seawall Beach in Maine, Gibbs (1986) found that plover foraging activity on the upper beach was concentrated around seaweed clumps, and track densities in plots that contained seaweed were more than twice that of plots without seaweed.

In the "Buzzards Bay Comprehensive Conservation and Management Plan," published by the Massachusetts Coastal Zone Management Office and the U.S. Environmental Protection Agency (August, 1991), the issue of beach wrack at Buttermilk Bay in Bourne was thoroughly researched and monitored by the Buzzards

Bay Project. The document's "Management Recommendations and Action Plans (Volume I, page 167) contains the following:

> *"Beach wrack, which in Buttermilk Bay consists largely of decaying eelgrass and algae, appears to act as a protected repository for fecal coliform. This wrack has been found to be an important source of fecal coliform. The relationship between wrack and the fecal indicator was studied in the field as well as under simulated conditions in the laboratory. Laboratory experiments showed that (1) fecal indicators are present and dissociate from wrack and (2) incubation in wrack piles along the shoreline prolongs survival, and possibly induces growth, of fecal coliform.*
>
> *Field testing involved removing wrack from four beaches and monitoring bacteria before and after removal. At one of four sites, bacterial counts on outgoing tides were distinctly lower than counts prior to removal. Both laboratory experiments and field observations clearly show the potential for wrack to be a signficant factor influencing fecal coliform levels in the bay. However, it is probably only in poorly flushed areas that removing the wrack will show major water quality improvement. Because the efficiency of this strategy is questionable and probably impractical on a large scale, it does not appear that this is a priority management option."*

Recommended Management Measures

- The Mass. Division of Fisheries and Wildlife's "Guidelines for Managing Recreational Use of Beaches to Protect Piping Plovers, Terns and Their Habitat in Massachusetts," found in Appendix H, and the Mass. Department of Environmental Protection's "Recommended Conditions for Barrier Beaches," found in Appendix I, should be consulted.

- Mechanical beach cleaning equipment, such as Cherrington machines, should not be used in rare species habitat. Inorganic debris and materials considered hazardous to public health or safety should be removed by hand as soon as possible.

- Sufficient wrack should be left on the beach in order to provide a seed source, nutrient source, and foraging habitat for shorebirds. Wrack removal should be prohibited in rare species habitat and significant migratory shorebird staging areas from April 1 to September 15.

- Managers should limit the amount of eel grass or seaweed removed from the beach by the public for composting or aesthetic reasons, to protect the interests described.

- In areas where it has been determined by public health officials that excessive amounts of washed up vegetation is a public health and/or safety hazard, only that amount of material necessary to abate the public health or safety threat should be removed from the beach. The municipal conservation commission should be consulted prior to any removal activity.

Salt Ponds

Recommended Management Measures

- Where it is proposed to cut or dredge a barrier beach in order to "drain" a salt pond to improve marine fisheries, the Massachusetts Wetlands Protection Act must be complied with along with Mass. Department of Environmental Protection Policy 91-2 "Criteria for Evaluating and Permitting Openings of Salt Ponds in Order to Manage, Maintain or Enhance Marine Fisheries," found at Appendix J.

Construction of Facilities

Recommended Management Measures

General Information

- The Mass. Division of Fisheries and Wildlife's "Guidelines for Managing Recreational Use of Beaches to Protect Piping Plovers, Terns and Their Habitat in Massachusetts," found in Appendix H, and the Mass. Department of Environmental Protection's "Recommended Conditions for Barrier Beaches," found in Appendix I, should be consulted.

- This section has been the subject of statutory and regulatory interpretation by municipal conservation commissions and the Massachusetts Department of Environmental Protection since promulgation of the Massachusetts Wetlands Protection Act's Coastal Regulations in 1978 and the subsequent adoption of municipal wetlands bylaws/ordinances. There is thus a well defined and documented case history guiding beach managers and others on how to properly address proposed construction activities on barrier beaches. For statutory, regulatory, and policy information, contact the relevant municipal conservation commission at the city or town hall and the Massachusetts Department of Environmental Protection's Division of Wetlands and Waterways at (617) 292-5695. For technical assistance, contact the Massachusetts Coastal Zone Management Office at (617) 727-9530.

- For information on the restoration and development of ocean beach recreation areas, see the Massachusetts Department of Environmental Management publication: "Sandcastles and Sandpipers" (1988). The publication provides detailed guidelines on: dune stabilization, protection and access; beach parking and circulation; construction of beach facilities, including compliance with regulations, architectural style and scale, building materials and structure locations; bathhouses and comfort stations; and management and maintenance operations of beach facilities. Copies of the document can be obtained from the Department by calling (617) 727-3160.

- Development on barrier beaches is discouraged. However, recreational, environmental protection, and interpretive facilities may be appropriate in some instances.

Buildings and Septic Systems

- Septic system placement is regulated through the Massachusetts Sanitary Code, Title 5. Contact the Mass. Department of Environmental Protection's Division of Water Pollution Control at (617) 292-5673 or the municipal board of health office for more detailed information.

- Septic systems should not be located in flood plain Velocity Zones as

indicated on the Federal Emergency Management Agency's Flood Insurance Rate Maps.

- All new or expanded structures on barrier beaches should be elevated, at a minimum, above the 100-year floodplain on pile foundations and in accordance with the State Building Code and Federal Emergency Management Agency regulations and be at a minimum of two (2) feet above existing topography to allow for the movement of sand and sediments due to wave and wind action.

- Habitable structures should not be built in flood plain Velocity Zones on barrier beaches, as identified on the Federal Emergency Management Agency's Flood Insurance Rate Maps.

- Where coastal erosion seriously threatens the integrity of an existing structure and the safety of its occupants, a policy of shoreline retreat should be considered by barrier beach residents. Such a policy can include relocation of a structure on site, to complete removal of a structure from the barrier beach. Where properties have been repeatedly and substantially damaged by storms, funds should be made available to acquire abandoned sites from willing sellers. Such properties should eventually be turned over to local authorities and managed for public access purposes.

Vehicle Crossovers, Roadways and Parking Lots

- In some instances where roads on migrating barrier beaches are subject to continual and repeated storm damage, it may be necessary to investigate permanent road abandonment and relocation, such as was done with Pamet Road at Ballston (barrier) Beach in the Town of Truro; or the construction of a bridge, as was done at Doane Road at Coast Guard (barrier) Beach in Eastham.

Pedestrian Crossovers, Walkways and Boardwalks

- Control of Access -- The barrier dune system, associated coastal wetlands, and the adjacent pioneer vegetation community are all very sensitive to foot traffic. Because pedestrians will use the easiest route to their destination, beach access routes must be designed to appear the easiest and most direct in order to be successful in protecting the coastal environment. Access should be controlled beginning as far back from the beach as possible, with fencing, a railing or vegetation barrier around the parking lots and along walks, and through the use of elevated boardwalks with handrails on both sides.

- Boardwalk Walkover System -- Coastal regulations prohibit alteration of the grade or profile of barrier dunes or the installation of structures that impede the free movement of sand or water. Therefore:

  1) Elevated boardwalks should be constructed in a manner which involves negligible alteration to the primary dune;

2) Boardwalks should be elevated to a minimum 2-foot clear space with only posts or pilings in contact with the dune. This 2-foot minimum clear space will allow for penetration of sunlight, grass growth, and easy movement of sand underneath and will help in restricting random beach access. Planking should be one (1) inch apart;

3) Elevated boardwalks should be ramped where possible (avoiding steps) with railings on both sides and designed for accessibility by the physically challenged (see Appendix K);

4) Periodically along the length of a boardwalk (particularly at the ocean end), the boardwalk should be constructed in abutting breakaway segments. In the event of a major storm, damage would be confined to only a portion of the boardwalk instead of the entire structure; and

5) Boardwalks should be constructed in a zig-zag fashion in order to avoid the development of wind and wave tunnels through the dune systems.

Access for the Physically Challenged

- Access for the phycially challenged (also known as handicapped access) at barrier beaches is a topic deserving of special attention and is thus detailed in Appendix K. Access to barrier beaches must comply with the Americans With Disabilities Act of 1990. Care must also be taken to comply with the Masachusetts Wetlands Protection, Endangered Species, and Public Waterfront Acts. The general guiding principle is to provide the highest level of access while preserving the environment and character of access sites.

Nuisance Control

1) Insects

Resource Impacts

Greenhead Flies

Greenhead flies complete their entire lifecycle within a few miles of salt marsh areas, and larvae forage around the surface muck, wet thatch and vegetation. Female flies are equipped to pierce the skin, thus acting as a nuisance to humans. This occurs mainly during daylight hours.

Greenhead flies have few natural predators. Robber flies, kingbirds, large dragonflies and swallows capture adults while larvae are consumed by other insects and crustaceans. Greenhead larvae prey on deer fly larvae, somewhat controlling their numbers. Greenhead flies are not known to cause a public health or ecological risk.

Mosquitoes

The salt marsh mosquito *(Aedes solicitans)* also occurs in great numbers near salt marsh areas. Adult females bite humans and animals and may fly over ten miles in search of blood. Salt marsh mosquitoes are generally a nuisance from early June to late September and are most active at dawn and dusk.

Recomended Management Measures

Greenhead Flies

- The use of commercial pesticides to kill greenhead flies should be avoided in barrier beach ecosystems.

- Control of greenhead flies around high intensity public beach use areas, such as coastal summer residences and marinas, may be politically necessary. One common method of control that poses no public health risk is the use of greenhead fly box traps. These traps attempt to control greenhead fly populations by capturing adults, although their overall effectiveness remains questionable. Greenhead fly trap boxes attract only female flies after they have laid their eggs and are looking for a warm spot in which to die. Attracting tree swallows through the establishment of tree swallow nesting boxes along barrier beaches may be a more effective means of controlling a greenhead fly nuisance as the tree swallow feeds on these flies throughout the course of their lifecycle.

- Other means of greenhead fly management include educating the public and the use of warning signs during the peak fly season of July and August.

Personal measures to reduce the fly nuisance to humans include: the wearing of light colored or ultraviolet (UV) reflective clothing and long sleeved shirts and pants (biting flies prefer dark objects over light); the application of a repellant; avoiding use of sprays and perfumes, and decreasing metabolic activity (and concomitant sweating) that serves to attract the biting fly; conducting activities in wind-prone areas and when flies are less active, especially in the early morning; keeping vehicle windows closed; and using screens at coastal residences.

Mosquitoes

- Adult mosquitoes have few natural predators. Some birds, such as swifts and swallows, and small bats consume mosquitoes but only in a small proportion to their total diet. Larvae are heavily predated by marine fish. One possible, yet scientifically unproven, method of control that is ecologically safe is open water marsh management, whereby a system of interconnecting pools permits fish to move into shallow areas to feed where mosquitoes breed. It is very difficult to control the nuisance level of salt marsh mosquitoes once they have emerged as adults. Because mosquitoes will fly miles to obtain a bloodmeal and are active during the day, it is difficult to avoid this species when engaged in outdoor activities within a few miles of a salt marsh.

- The use of commercial insecticides should be avoided on barrier beach ecosystems.

- Public education and personal control methods should be made available to the public by beach managers. Control techniques for salt marsh mosquitos, biting midges, and others include: the wearing of light colored clothing; frequenting breezy areas; avoiding peak activity at dawn or dusk; and using screens at coastal residences.

- An "integrated pest management" approach should be taken to manage any insect species below its nuisance level. Water management in combination with biological pest control can be used to control salt marsh mosquitoes without negatively impacting the environment. It is important to emphasize the potential negative impact of aerial spraying.

- Insect repellents may be a problematic solution. Recently, the Massachusetts Audubon Society issued a warning about a common active ingredient in these products. They reported: *"The safety of insect repellents has undergone closer review. Repellents with DEET (N,N-diethyl-m-toluamide) as the active ingredient are the most effective but have caused serious toxic effects when ingested, including seizures, a coma and even death. The chemical also is readily absorbed through the skin and should be applied sparingly, especially on children if it is used daily. Applications to the clothing may be preferable in any case. Preparation with lower concentrations of DEET (35% or less) are also effective and may be a better choice because they are less likely to cause dangerous side effects."*

2) Exotic Plants

Barrier beach wildlife depend upon many types of vegetation for food, nesting and predator escape. Purple loosestrife (*Lythrum salicaria L.*) and Phragmites (*Phragmites australis*) are examples of invasive plants which are of particular concern to barrier beach managers due to their tendency to crowd out competing native vegetation in marshes, bogs, wet meadows, and other areas.

Resource Impacts

Purple Loosestrife

Purple loosestrife was introduced to North America from Eurasia in the early 1800's. This magenta flowering plant began rapid expansion westward away from the Northeast seaport communities until today where it has reached the Pacific Northwest.

Purple Loosestrife occurs widely in wet habitats such as marshes, fens, sedge meadows, wet meadowlands, along roadside ditches, and around impoundments. It can quickly crowd out native vegetation creating a monoculture which provides little food or shelter for wildlife. Of particular interest is it's fecundity. A single stalk can produce in excess of 300,000 seeds with a seed viability rate of 98%. Densities of 80,000 + stalks/acre have been observed in some locations, which has the potential of creating a seed stock of 24 billion seeds/acre. Seeds are carried afield by wind, water and in mud attached to animals.

Common Reed *(Phragmites)*

Phragmites australis is a perennial wetlands grass which can attain heights of 6-12 feet and is usually found in dense colonies bordering on marshes, swamps, potholes and along the marsh-upland interface. *Phragmites* occurs naturally as well as in disturbed areas. Often, it is an indicator of ecosystems stressed by pollution, sedimentation, flooding, and filling.

As in purple loosestrife control, *phragmites* should first be identified as either stable noninvasive stands or as expanding/invasive. Stable naturally occurring stands should be left alone as this species does not preclude biodiversity as some other nuisance species may.

Phragmites is comprised of a horizontal rhizome which allows the stand to spread, a vertical rhizome which comprises the stalk and an aerial rhizome which bears the fruit. The aerial shoots emerge and flower from July-September. The seeds may be distributed by wind or by birds which nest among the *Phragmites.*

Phragmites has the ability to draw upon subsurface water sources and thus may be effected by water table levels. It can withstand flooding up to 3 feet in depth which can also limit competition from other native plant species. The plant however has a limited tolerance to wind and wave action which may break the stalks. It's biggest threat is to destabilize spartina marshes which support large diverse populations of wildlife.

Recommended Management Measures

Purple Loosestrife

- Most property managers have resorted to mechanical and chemical means of control. However, the best control method is by far early detection and removal of the few individual specimens by hand, using care not to shake seeds or fragments of the plant.

- The Nature Conservancy, U.S. Fish and Wildlife Service and various state environmental management agencies recommend that affected areas of 3 acres or less with less than 100 plants be treated by hand removal of all purple loosestrife plants, taking care to remove the stock and tap root. Bag and remove the plants immediately from the area and burn the plants to prevent accidental seed distribution to other non-affected sites.

- Where there are 4 acres or more of 100 plants, it is recommended that, wherever possible, natural levels of salinity be restored to the barrier beach ecosystem in order to inhibit the spread of such invasive species.

- Monitoring: Beach managers should properly plan for purple loosestrife control by documenting area size affected, relative number of plants in the treatment area and the creation of photo documentation showing pre-control and post-control. Monitoring and control efforts for loosestrife should be conducted over several years since the plant can be expected to recolonize areas after initial control efforts have ceased.

- Future Control Efforts: Purple loosestrife control must be handled aggressively to prevent uncontrolled spread of this non-indigenous vegetation.

Common Reed (Phragmites)

- Areas that have been invaded by *Phragmites* have excellent potential for recovery by natural wetlands vegetation. *Phragmites* control should be centered around hand and mechanical removal.

- Prescribed burning is effective in destroying the seed inventory of a stand but firebrands can create uncontrolled spot fires and generally the prescribed burn temperatures cannot kill the underground rhizomes due to the wet soil conditions under which *Phragmites* exists.

- Selective manipulation of water levels can also be effective in controlling vitality of established stands, however this action may be unacceptable for wildlife management purposes.

- Selective cutting or mowing may be effective if the cutting is done in late July since most of the food reserves can be removed from the upper portions of the plant. This method must be used over successive years in order to remove

regenerated stalks. Care must also be used not to mow the stand too early or late in the year, as the result may be to increase the density of the stand.

- Wherever possible, vegetation along public access trails should be maintained by careful and selective hand pruning methods.

- In all cases, the beach manager must ensure that rare/threatened species are protected.

- It is imperative that barrier beach managers learn as much as possible about vegetation control techniques, and consult with local, regional and wildlife regulators.

- Monitoring: Beach managers are urged to adopt a plan for controlling *Phragmites* before taking any action. The first issue is to decide if the stand in question is expanding in size. If not, it is recommended that no further control be attempted. If monitoring of the stand area or density indicates invasive tendencies, then the beach manager should begin photo documentation of the area along with species inventories and planning for prescribed controls.

References

The Nature Conservancy has produced several resource pamphlets on *Phragmites* and purple loosestrife which can assist managers in deciding the best methods for controlling these species. Copies of the "Element Stewardship Abstract for *Phragmites Austrailis* and Purple Loosestrife (*Lythrum salicaria L.*)" are available from The Nature Conservancy, 1800 North Kent Street, Arlington, VA 22209.

In addition, the Illinois Department of Conservation has produced a document, entitled "Vegetation Management Guideline, Purple Loosestrife," which can be obtained by writing to Randy Heidorn, Illinois Department of Conservation, Region II Office, 110 James Road, Spring Grove, Illinois 60081.

Rare Species Predators

Resource Impacts

Management to reduce effects of predators on plover and tern productivity is an important component of rare species recovery efforts on many Massachusetts beaches. Potential predators of plover and tern eggs or chicks include red foxes, striped skunks, mink, raccoons, opossums, Norway rats, feral cats, crows, gulls, grackles, black-crowned night-herons, great-horned owls, northern harriers, and American kestrels. Populations of many of these species have probably increased as human use of the coastal zone has increased. Predation on eggs or chicks can substantially reduce productivity of ground-nesting birds such as plovers and terns. Predator management to enhance breeding success of plovers and terns should only be considered if predation has been clearly identified as a significant factor limiting productivity. Predator management should be undertaken only after consultation with the Mass. Division of Fisheries and Wildlife and, when appropriate, the U.S. Fish and Wildlife Service, and after appropriate letters of authorization or depredation permits have been obtained from the Division and the Service.

Recommended Management Measures

- Predators of plovers and terns can often be managed through non-lethal means. Wire mesh predator enclosures placed around plover and tern nests have proven effective in deterring many predators and reducing egg losses (Rimmer and Deblinger, 1990, 1992; Melvin et al. 1992). Predator exclosures are relatively cost-effective, especially when used around individual plover nests or small numbers of tern nests, and should be considered as the first option for predator management. Managers wishing to erect predator exclosures around tern or plover nests must first obtain a letter of authorization from the Mass. Division of Fisheries and Wildlife.

- Predator removal through lethal means, such as shooting, trapping, or poisoning should only be considered as a last resort. Predator removal can be costly and time-consuming, and is often of questionable effectiveness. Beach managers considering lethal predator control should first consult with the Mass. Division of Fisheries and Wildlife. For furbearers, which are considered valuable natural resources, the first attempt at lethal predator control should be to open the area to trapping during the regulated trapping season. However, efforts to control predators to reduce impacts to rare, ground-nesting birds may not be effective unless all individuals are removed. Continued removal may be possible, but requires a permit from the Division. Lethal control or trapping and removal of avian predators protected by the federal Migratory Bird Treaty Act (e.g., raptors, gulls, night-herons, grackles) also requires a permit from the U.S. Fish and Wildlife Service.

- Beach managers should take all possible steps to remove garbage that may attract predators to beaches. Trash containers should be placed at all parking lots and beach access points and around concession areas, bathhouses, and restrooms. Trash containers should be emptied frequently enough to prevent them from overflowing. Beach users should be educated about how their litter may indirectly affect beach-nesting birds by attracting predators.

References

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Rimmer, D.W. and R.D. Deblinger. 1990. *"The use of predator exclosures to protect Piping Plover nests."* J. Field Ornithol. 61:217-223.

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Other Wildlife Management Issues

Resource Impacts

Just as predators affect the reproductive success of piping plovers and least terns, other species of wildlife have the potential of affecting ecological features of barrier beaches leading managers to consider developing management programs.

White-tailed deer have become too abundant at various coastal sites in the northeastern United States due to a lack of predators, no-hunting policies, and mild winters. Epidemic Lyme disease occurs only in areas where populations of white-tailed deer are dense (Spielman et al. 1985, Lastavica et al. 1989, Wilson and Deblinger 1993). Lyme disease is caused by the bite of an infected deer tick. Deer tick abundance is correlated with the presence and abundance of white-tailed deer (Wilson and Deblinger 1993). In addition, deer have the capability of exceeding ecological carrying capacity and causing extensive destruction to vegetation, including American beachgrass (Deblinger et al. in press). Although such destruction has not been correlated with increased erosion rates, the possibility exists. Moreover, a lack of understory vegetation could reduce habitat of other species, thereby decreasing biodiversity (Diamond 1992).

Other species of wildlife that may affect barrier beaches include raccoons (inhabit buildings, carry rabies) and muskrats (destroy newly planted beachgrass).

Recommended Management Measures

- Hunting or trapping programs should be developed within the existing framework of seasons and bag limits published in the Mass. Division of Fisheries and Wildlife Abstracts. In special circumstances, when wildlife becomes a nuisance to the public health and safety or causes property damage, the Division should be contacted. Controlled, limited deer hunting has been shown to reduce deer to acceptable levels while reducing the threat of Lyme disease (Deblinger et al. 1993).

- Beach managers should educate the public about these potential public health risks and provide the following safety tips: vaccinate cats and dogs for rabies; do not feed wild animals; do not approach or handle wild animals; secure food, garbage, and trash; distribute literature and post warning signs about rabies and Lyme disease.

References

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Trash

See previous section in this chapter on "Beach Cleaning -- Litter."

Recommended Management Measures

- It is especially important that trash of any kind not be discarded in remote barrier beach areas that are typically difficult to manage. Such debris can create a nuisance among wildlife and result in artificially created dependent feeding behaviors not supported in the already stressful winter months.

- Trash barrels should not be located on the beach itself but at pedestrian access/egress sites. This will eliminate the need for maintenance vehicles to travel through dunes and onto the beach and eliminate an attractive destination for nuisance animals.

- Trash containers should be tightly secured against racoons, dogs, gulls, and wind. Trash can attract predators and thus should be removed from the barrier on a routine basis.

- Garbage should be contained in order to avert predator and pest species problems. Managers may consider a "carry in-carry out" policy which eliminates the need for garbage containers at beach access sites. Weather and animals can spread trash left unattended in containers. There should be regular trash removal from beaches at the end of each day during the summer season. Where there are lifeguards and parking lot attendants at beaches, a routine "clean sweep" should be made of the beach early each morning by beach personnel using poled nets prior to intensive visitor use.

- Public education should be directed to minimizing trash and can be highlighted during beach cleanup events. Again, the Massachusetts Coastal Zone Management Office sponsors such events each September during "Coastweeks" and encourages additional cleanups in the spring.

CHAPTER 6

Public Education and Outreach

One of the most important means of achieving performance standards pertaining to barrier beach management and for maintaining barrier beaches in optimum condition is through a well-designed and understandable public education program. An informed beachgoer is much more likely to abide by proposed management guidelines if he/she understands the principles involved in the posted rules and regulations. An educated beach-goer is the best beach-goer.

Unfortunately, education is often the last item on a beach manager's busy schedule. Creating an effective program takes time, funding, and the personnel resources that are often tied up in other projects. Writing and producing education materials, such as flyers, brochures, exhibits, may overburden an already meager park budget.

In the best of all possible worlds, it would be great to have the resources to produce individually tailored education materials for each site. But, as this is the real world, education often requires the adaptation of existing materials. Sadly, a review of education materials now available for use by beach managers, shows few listings for materials on barrier beach dynamics or beach management options. But that does not mean that there is nothing out there, or that something cannot be created in the future.

The following listing offers the best of the materials now available, a short description of each, and where to obtain them. Materials include:

- Brochures
- Curricular Materials
- Signs and Exhibits
- Videos/Slide Shows
- Other Materials -- books, booklets, maps, reports

One additional method by which a beach manager may wish to get a message out to the public is to enlist the assistance of the local media. Local newspapers and radio stations may be interested in periodic reports on beach management issues. Talk to the paper's editor or the station manager about a continuing feature (the beach manager or a designee may be asked to write the copy and submit it to the paper/station for editing).

Reference Materials

BROCHURES

Brochures are an ideal way of quickly explaining a complicated issue to a large population. If the material needed is not on this list, try creating an original publication. For ease of reading and comprehension, try to keep the amount of copy down; illustrate with drawings, photos, or graphics where appropriate; and leave enough white space to create high readability -- too much copy will discourage many readers. Keep the material lively, with lots of active verbs, and make the message a positive one -- lots of "do's" rather than "do not's." A wealth of information can be contained on one 8-1/2"x11" paper (2 sides, three columns per side, two folds, photocopied).

The "Plymouth Long Beach Information Booklet" is an excellent example of a locally-produced beach information document. The publication, produced on 8-1/2 x 11" paper and folded, 16 pages total, covers general rules and regulations, town by-laws, summary of off-road vehicle/wildlife mangement plan, a map, description of permitted activities, driving and safety tips, flora and fauna, other beach facts, and a beach violation report form.

The Beach, The Dunes And You; Alabama Department of Environmental Management, 2204 Perimiter Road, Mobile, AL 36615. Also available in photocopy from Mass. Coastal Zone Management, 100 Cambridge St. Boston, MA 02202

Description: Describes why dunes are important, how to build dunes, how to save dunes.

Beachcombers Guide to the North Atlantic Seashore; Massachusetts Audubon Society, Lincoln, MA 01773. 1993.

Description: Plastic foldout brochure with full color illustrations of plant and animals that live in tide pools and on the beach. Explains in simple terms how beaches work and outlines a typical marine food web. Excellent field guide for a wet environment.

The Care and Feeding of Sand Dunes; by Stephen Gabriel, Coastal Management Specialist, City of Ocean City (1980). Copies available through Mass. Coastal Zone Management Office.

Description: Describes the importance of dunes and how to go about developing a dune stabilization program, including snow fencing and dune grass planting.

Oversand Vehicles; Cape Cod National Seashore, National Park Service, Department of the Interior, South Wellfleet, MA 02663; 508-487-3698.

Description: Brochure includes oversand vehicle route map, how to obtain permits, required equipment, tire standards, beach driving tips, and regulations.

Plymouth Long Beach Information Booklet; Plymouth Park Division, 508-830-4095.

Description: Excellent example of a locally-produced document that provides user information pertaining to regulations and permitted activities. Insert includes tide calendar (high and low tides, time and height) for May-September season.

The Roseate Tern; U.S. Department of the Interior, Fish and Wildlife Service, New England Field Office, 400 Ralph Pill Marketplace, 22 Bridge St. Concord, NH 03301. October 1991

Description: Endangered Species Fact Sheet describes the bird, nesting habits, why Roseate Terns are so rare, the Endangered Species Act, why should we be concerned, and what you can do to help. Basic information.

Sandy Neck Beach Regulations; Town of Barnstable Natural Resource Department, 508-790-6272.

Description: General information brochure details off-road vehicle driving tips, motor vehicle regulations, hunting regulations, fishing and shellfishing regulations, horse regulations, general policy, and steps for obtaining permits.

Sharing the Beach with Least Terns; U.S. Department of the Interior, Fish and Wildlife Service, One Gateway Center, Newton Corner, Mass. 02158. no date

Description: Describes the bird, it's range, threats, nesting and chick rearing, protection, and things you can do. Basic information.

Terns: Their Ecology and Conservation; Massachusetts Audubon Society, Lincoln, MA 01773. 1988.

Description: Describes the family of birds closely related to gulls, their current status, and life cycle. Ways to help protect terns are listed.

What's All this About Critical Habitat for Piping Plovers; U.S. Department of the Interior, Fish and Wildlife Service, 22 Bridge St. Concord, NH 03301-4901 (603)225-1411. 1989.

Description: Describes the bird, the status, and steps needed to protect critical habitat. Very thorough.

You Can Help Protect the Piping Plover; U.S. Department of the Interior, Fish and Wildlife Service, One Gateway Center, Newton Corner, Mass. 02158; no date.

Description: Describes the bird, it's range, breeding and feeding habits, threats, and things you can do. An abridged version of #1 above.

CURRICULAR MATERIALS

Educational programs, whether offered in visitor centers, on the beach with park naturalists, or through schools, are important means of spreading the word about proper barrier beach management. If there is interest in setting up or supplementing primary/secondary education programs, there are a variety of materials available for your use.

The New England Aquarium has a Teacher Resource Center that is open by appointment for teachers and other educators (beach managers or park interpreters). Videos, filmstrips, slide shows, "The Coast Kit," as well as books, magazines and curricula can either be borrowed (usually free of charge) or copied (copies are $0.10 each). There is a wealth of information stored here. Contact Joel Rubin at 617-973-6590 for more information.

Other materials that may prove useful in setting up an education program for students (as well as their parents and other adults) include:

The Atlantic Coast: Piping Plover Lesson Plans. Produced by the U.S. Fish and Wildlife Service. Available from U.S. Fish and Wildlife Service, New England Field Offices, 400 Ralph Pill Marketplace, 22 Bridge Street, Unit #1, Concord, NH 03301-4901; 40 pages, 20 slides/free.

Description: This package includes background information, slides, lesson plans, a simulation game, and worksheets intended for grades 5-7. Included in the package are two brochures -- "Why Save Endangered Species?" and "You Can Help Protect the Piping Plover" and the poster "Atlantic Naturalist: The Piping Plover."

Atlantic Naturalist: The Piping Plover (poster). Produced by the Quebec Labrador Foundation/Atlantic Center for the Environment, 1988. Available from the Atlantic Center for the Environment, 39 South Main Street, Ipswich, MA 01938, 508-356-0038 or the U.S. Fish and Wildlife Service, New England Field Offices, 400 Ralph Pill Marketplace, 22 Bridge Street, Unit #1, Concord, NH 03301-4901.

Description: Poster illustrates the habitat and problems facing the piping plover with tips on what individuals can do to protect this endangered species.

Beaches, Dunes and Barrier Islands: Habitat Pac. Produced by the U.S. Fish and Wildlife Service. Available from U.S. Fish and Wildlife Service, Department of Refuges, Educational Outreach Program, 300 Westgate Center Drive, Hadley, MA 01035, 413-253-8515; 30 pages/free.

Description: The Habitat Pac includes background information, posters, student pages, and three activities. The materials are designed for use with students in grades 4-7.

Charting Our Course - Educator Activity Book. Produced by Mass. Coastal Zone Management and the Mass. Marine Educators with funding from the Mass. Environmental Trust. Available from Mass. Coastal Zone Management, 100 Cambridge St. Boston, MA 02202, 617-727-9530; 83 pages/free.

Description: An excellent activity guide for teachers of grades 4-12 on the Gulf of Maine and the other coastal waters of Massachusetts. Five chapters of information divided into background information, references and several activities. Access to the coast is not a requirement for these activities, and many of the experiments and projects can be done for minimal cost and with readily available materials.

Erosion: The Good & Bad. Resource Lesson Package from Cape Cod National Seashore, National Environmental Education Development Program, Headquarters, Marconi Site, South Wellfleet, MA 02663; 508-349-3785; 6 pages/free.

Description: Lesson Plan, to be used in conjunction with a visit to the Cape Cod National Seashore and viewing of "Sands of Time" video, contains fact sheets on "Beaches and Breaches," "Erosion...The Good and Bad of It," and "The Eroding Cape Cod Landscape and Dune Stabilization," as well as list of possible field trip and classroom activities.

Illustrated Field Guides to Eastern Shore Marine Environments. Written by Barbara Waters and illustrated by Carole Eldridge. 5 posters/free. Copies available from Mass. Coastal Zone Management Office or Barnstable County Cooperative Extension Office.

Description: These field guides cover: 1) Sandy Shore and Dunes; 2) Salt Marshes; 3) Rocky Shore and Wooden Structures; 4) Salt Ponds; and 5) Tidal Flats. Each has a drawing on one side and descriptive material about the marine life on the reverse side. Appropriate for all elementary and secondary school students.

Save Our Seas: A Curriculum for Kindergarten Through the Twelfth Grade. Center for Marine Conservation and California Coastal Commission; 106 pages/free. Copies available through Mass. Coastal Zone Management Office.

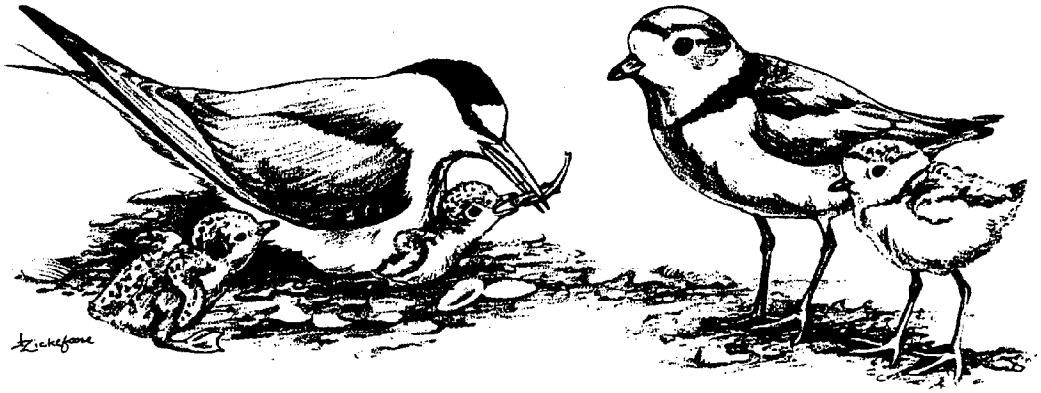
Description: This compendium of activities, divided into four age groupings (K-3, 4-6, 7-8, and 9-12), covers the issues of overpackaging, recycling, and the hazards of marine debris. The curriculum can be combined with a class/school beach cleanup or used alone.

Turning the Tide on Trash: A Learning Guide on Marine Debris. U.S. Environmental Protection Agency; 80 pages/free. Copies available from U.S. Environmental Protection Agency or Mass. Coastal Zone Management Office.

Description: This book provides background information on the hazards of marine debris and includes a variety of activities that develop critical thinking skills in various content areas. Includes a wall poster -- "Save Our Seas: Help Stop Marine Debris!" Materials are designed for use in grades 3-6.

RESTRICTED AREA

This area is a natural breeding ground for Terns and Plovers



THESE RARE BIRDS, THEIR NESTS AND EGGS ARE PROTECTED

UNDER MASSACHUSETTS AND FEDERAL LAWS

Persons May Be Arrested and Fined for Killing, Harassing or in Any Way Disturbing Birds Nesting in This Area (MGL c. 131 § 5,74 and Title 50 CFR).

Division of Fisheries & Wildlife

ILLUSTRATION BY JULIE ZICKEFOOSE, HADLYME, CT 06439

VOSS SIGNS, MANLIUS, NY 13104-0553 (315) 682-6418

Figure 17. Sample of warning sign for nesting area.

SIGNS AND EXHIBITS

For quick information and warnings, on-location signage is the best means of informing the beach-going public. The signs must be quickly readable with a short, pointed message. People loaded with beach gear and caring for children do not have time to read anything longer than a few sentences. Signs must also fit into the landscape without being so inconspicuous that they are ignored. Try to avoid visual pollution (garish colors, overpowering designs), but attract attention with appropriate use of color and careful attention to sign placement (high visibility, accessibility, readability). All signs must be maintained for readability and quickly replaced if lost, stolen or damaged.

The Massachusetts Coastal Zone Management Office is working with the Massachusetts Department of Environmental Management to develop a generic "sand dunes/beach grass" information sign to be installed at state beaches within the next year. The template will be available at no charge to any beach managers wishing to install such a sign at their beaches.

Other materials include:

Sign: *"Restricted Area... This area is a natural breeding ground for Terns and Plovers."* Massachusetts Division of Fisheries and Wildlife, Field Headquarters, Westboro, MA 01581.

Description: 8 1/2 x 11" sign to be posted on active breeding areas. Cites Mass. General Laws Chapter 131 and 50 Code of Federal Regulations. Produced by Voss Signs, Manlius, NY 13104-0553, 315-682-6418. [See sample sign in this chapter.]

Sign: *"Seal pups rest on shore. Do not disturb them! It's the law."* New England Aquarium, Marine Mammal Rescue Program, Central Wharf, Boston, MA 02110-3399, 617-973-5200.

Description: 8-1/2 x 11" sign to be posted on active seal pupping areas. Available from the New England Aquarium. [See sample sign in this chapter.]

Figure 18. Sample of warning sign for seal pupping area.

VIDEOS/SLIDE SHOWS

The Mass. Coastal Zone Managment Office has an extensive library of coastal related educational video materials; call (617)727-9530 for more information. In a cooperative effort, the Mass. Coastal Zone Management Office and the Woods Hole Oceanographic Institution's Sea Grant Office have instituted a 13-week video project for cable stations (13 weeks of 1/2-hour programs on various coastal issues, including barrier beach management) entitled "Shorewatch." The following shows may be of particular interest to barrier beach managers.

In addition, the management at two Massachusetts beaches (Race Point, Provincelands, Cape Cod National Seashore and Sandy Neck in Barnstable) require that individuals purchasing off-road vehicle permits view a short slide show pertaining to beach driving safety and environmental care. Contact either of these programs for more information about designing a similar type of program

America's Vanishing Coastlines; 19 minutes, color, VHS format. Available on loan from Mass. Coastal Zone Management Office.

Description: Produced by the National Committee on Property Insurance and narrated by famed coastal geologist Dr. Orrin Pilkey, this video presents an interesting look at the issue of coastal erosion.

The Beaches are Moving: The Drowning of America's Shoreline ; 60 minutes, color, VHS format. Available from Environmental Media, 1-800-ENV-EDUC (1-800-368-3382); $29.95. ISBN 1-56791-069-6. Order No. BM101.

Description: Hosted by Dr. Orrin Pilkey, this hour-long show illustrates beach evolution using contemporary and historical film, video, and state-of-the-art animation. Companion piece to book of the same name.

Cape Cod: The Sands of Time; 15 minutes, color, VHS format. Available through the Cape Cod National Seashore, Eastern National Park and Monument Association. Cost is $19.95.

Description: This concise and well-illustrated video explains the formation and geological history (and future) of Cape Cod, with particular reference to its important coastal and barrier beaches (tape also includes three other short programs).

Fabulous Wetlands; 7 minutes, color, VHS format. Available on loan from Mass. Coastal Zone Management Office.

Description: A humorous but informative look at the function and importance of wetlands to the ecosystem. Produced by the State of Washington, Department of Ecology.

Plight of the Plover; 6 minutes, color, VHS format. Available through the U.S. Department of the Interior, Fish and Wildlife Service or the Mass. Coastal Zone Management Office/Woods Hole Oceanographic Institution Sea Grant Office --

Shorewatch Program.

Description: The conflict of wildlife habitat vs. recreational use is never more evident than in the efforts to protect the piping plover. This program points up the problems facing the survival of this small but important shorebird species.

Portrait of a Coast; 30 minutes, color, VHS format. Available on loan from Mass. Coastal Zone Management Office.

Description: This informative half-hour program looks at a wide range of coastal beach processes, including sediment transport, dune building, stabilization methods, and effects of development on shorelines. Scenes from the Blizzard of '78 are included.

Shifting Sands; 28 minutes, color, VHS format. Available on loan from the New England Aquarium.

Description: Produced by the Florida Institute of Oceanography and a Florida television station, this show looks at beach processes, particularly on the barrier beaches of the State of Florida.

Sea Beaches -- Their Formation and Erosion; Slide show with script. Available on loan from the New England Aquarium.

Description: This 24-slide show was produced by Educational Images in 1979 and has a discussion on the function and dynamics of barrier beaches. Although some of the material is dated (discussion of pre-Miami dune nourishment), there are still some interesting images and discussion.

OTHER MATERIALS

At the Sea's Edge: An introduction to coastal oceanography for the amateur naturalist. Fox, William T. New York: Prentice Hall Press (1983).

Description: Chapter on "Barrier Islands and Spits" contains an excellent review of various theories of barrier beach formation and migration.

Barrier Beach Inventory Project. (1982) Mass. Coastal Zone Management, 100 Cambridge St. Boston, MA 02202. 57 maps. Individual maps available from Massachusetts Coastal Zone Management Office.

Description: Geologic field research and mapping compiled and produced under a contract with The Provincetown Center for Coastal Studies, 1982. All beaches in the Commonwealth are listed and coded. A good reference tool.

Barrier Island Handbook. Leatherman, S.P. College Park, MD: University of Maryland Coastal Publications Series (1988).

Description: A nontechnical explanation of barrier island environments, their evolution, and the impact of recreation and construction on them.

The Beaches are Moving: The drowning of America's shoreline. Kaufman, Wallace and Orrin Pilkey. Chapel Hill, NC: Duke University Press (1983, 1992). $12.95. Available from Environmental Media, P.O. Box 1016, Chapel Hill, NC 27514; 1-800-ENV-EDUC (1-800-368-3382). ISBN 0-8223-0574-7. Order No. BM102.

Description: This 355-page book describes how shorelines work and how, left to their own devices, they protect and maintain themselves. A companion piece to the video of the same name.

Coastal Rescue: Preserving Our Seashores. Miller, Christina G. and Louise A. Berry. New York: Atheneum: (1989). ISBN 0-689-31288-1.

Description: This children's book (grades 5-9) examines different types of coasts, how they are shaped by nature, how the development of coasts has destroyed plant and animal life, beaches, and marshes, and ways to use the coasts' valuable resources and still preserve them.

Coastal Waterbird Newsletter. Scott Hecker, Editor. Massachusetts Audubon Society, Lincoln, MA 01773.

Description: This newsletter describes nesting sites statewide and provides news items on coastal waterbirds and the Audubon Society's Coastal Waterbird Program.

Final Report: An Ecological Evaluation of Human Impacts on the Wasque Reservation and Cape Poge Wildlife Refuge, Edgartown, MA; Phase III-1989. Lars H. Carlson and Paul J. Godfrey, Department of Botany, UMASS/Amherst, Amherst, MA 01003 March 19, 1990.

Description: Provides good information on how to manage a site-specific barrier beach that is heavily used by a variety of visitors for many purposes.

Land's Edge: A natural history of barrier beaches from Maine to North Carolina. Hoel, Michael L. Newbury, MA: The Little Book Publishing Company (1986). 142 pages/$6.95. Available at Monomoy National Wildlife Refuge headquarters, Chatham. ISBN0-9616080-0-5.

Description: Provides a short history of barrier beaches, a description of barrier dynamics, plants and ecosystems, predators and prey.

Restless Ribbons of Sand: Atlantic & Gulf Coastal Barriers. Wells, John T. and Charles H. Peterson. U.S. Department of the Interior, Fish and Wildlife Service. 20 pages/free. Available from the Cape Cod National Seashore headquarters.

Description: Excellent booklet describing attributes of barrier beaches from Maine to south Texas -- a protective fringe along 2,700 miles of our nation's shoreline.

Sanctuary: The Journal of the Massachusetts Audubon Society. Vol. 31, No. 6, July/August 1992 -- "On The Beach." Massachusetts Audubon Society, Lincoln, MA 01773.

Description: This issue contains articles on piping plovers, Plymouth Beach, and the Coastal Waterbird Program.

Selection and Maintenance of Plant Materials for Coastal Landscapes. Karl Rask, Cooperative Extension/University of Massachusetts and Soil Conservation Service/U.S. Department of Agriculture, Issues in Water Quality Series, June 1990. Available from Barnstable County Extension Service; copies also available from Mass. Coastal Zone Management.

Description: Provides a concise review of the basic principles of coastal landscaping including a list of plants for various settings.

U.S. Fish and Wildlife Service publications:

Atlantic Coast Piping Plover Recovery Plan. 1988. U.S. Fish and Wildlife Service, Hadley, MA. 74p.

Roseate Tern Recovery Plan – Northeast Population. 1989. U.S. Fish and Wildlife Service, Hadley, MA. 86p.

Northeastern Tiger Beetle Recovery Plan. 1993. U.S. Fish and Wildlife Service, Hadley, MA. 46p.

With Help of Friends, the Plover's Coming Back. Scott Allen, The Boston Globe, August 24, 1992, p.29.

Description: This newspaper article explores the decline of this species and what appears to be a comeback for the northeast population.

APPENDIX A

Barrier Beaches in Massachusetts

COASTAL ZONE
MANAGEMENT

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, Massachusetts 02202

Barrier Beach Inventory Project

(State Designated Barrier Beaches)

Maps available from the Mass. Coastal Zone Management Office.

Map #	UNIT CODE	UNITS INCLUDED
2	Nb-1	Sb-1 Salisbury Beach Np-1 Plum Island Nb-1 Plum Island Rl-1 Plum Island
4	Is-2	Rl-1 Plum Island Is-1 Plum Island Is-2 Plum Island Sandy Point Is-3 Clark Pond Is-4 Little Neck Is-5 Cranes Beach Is-6 Cranes Beach/Castle Beach
5	Gt-9	Is-6 Cranes Beach Gt-1 Castle Beach/Castle Neck Gt-2 Two Penny Loaf Gt-3 Coffins Beach Gt-4 Wingaersheek Beach Gt-6 Good Harbor Beach Gt-7 Brace Cove Gt-8 Easter Point Gt-9 Old House Cove Mc-1 Gray Beach Mc-2 Lily Pond Mc-3 Black Beach Mc-4 White Beach
6	Rp-4	Rp-1 Loblolly Cove Rp-2 Pebble Beach Rp-3 Cape Hedge Beach Rp-4 Long Beach Rp-5 Long Beach South/Briar Neck Rp-6 Good Harbor Beach
8	Bv-1	Bv-1 Patch Beach

9	Mb-1	Mb-1 Devereux Beach
10	Nh-3	Sp-1 Palmer Pond/Phillips Beach Nh-1 Nahant Beach Nh-2 Little Nahant Beach Nh-3 Pond Beach Rv-1 Revere Beach Rv-2 Short Beach Wn-1 Short Beach
12	Bt-11	Bt-6 Thompson Island Bt-7 Thompson Island Pond Bt-8 Thompson Island-NW Middle Barrier Bt-9 Thompson Island-SW Middle Barrier Bt-10 Thompson Island South Spit Bt-11 Thompson Island-SE Qc-1 Squantum Marina Spit Qc-2 Wollaston Beach-East
13	Hl-3	Wn-2 Yirrell Beach Bt-1 Great Brewster Island Bt-2 Gallops Island Bt-3 Rainsford Island Bt-4 Bass Point Bt-5 West Head Beach Bt-6 Thompson Island Hl-1 Peddocks Island-West Head Beach Hl-2 Peddocks Island-Prince Head Beach Hl-3 Peddocks Island-Tombolo Hl-4 Telegraph Hill-Allerton Hill Tombolo Hl-5 Hog Island Spit Hl-6 Nantasket Beach Qc-2 Wollaston Beach-East Qc-3 Adams Shore Qc-4 Sea St. Qc-5 Rock Island Qc-6 Gull Point Hn-1 Foley Beach Road Hn-2 Bumkin Island West Spit Hn-3 Worlds End Wm-1 Lower Neck Cove
14	Ct-2	Hl-6 Nantasket Beach Hl-7 Atlantic Avenue Beach Hl-8 Crescent Beach Hl-9 Black Rock Beach Ct-1 Black Rock Beach Ct-2 Sandy Beach St-2 The Glades
16	St-4	St-1 Bassing Beach

		St-2 The Glades St-3 Minot Beach St-4 Mann Hill Beach & Egypt Beach
17	St-10	St-4 Mann Hill Beach/Egypt Beach St-5 Sand Hills St-6 Cedar Point Tombolo St-7 Second Cliffs Barrier St-8 Peggotty Beach St-9 N. Spit, N. River Inlet St-10 Fourth Cliff Inlet Spit St-11 Humarock Beach Mf-1 Rexhame Beach
18	Db-1	Mf-1 Rexhame Beach Mf-2 Sunrise Beach Mf-3 Brant Rock Mf-4 Green Harbor Point Mf-5 Blackmans Point Mf-6 Green Harbor South Spit Db-1 Duxbury Beach Pm-1 Plum Hills Pm-2 Saquish Beach
19	Pm-6	Pm-2 Saquish Beach Pm-3 Saquish Beach Pm-4 Plymouth Beach Pm-5 Cordage Beach Pm-6 Goose Point Spit
20	Pm-8	Pm-4 Plymouth Beach Pm-7 White Horse Beach Pm-8 Manomet Heights Barrier
21	Wh-1	Wh-1 Red Brook
22	Bo-29	Pm-9 Ship Pond Pm-10 Center Hill Pond Pm-11 Black Pond Pm-12 Ellisville Harbor Barrier Bo-29 Sagamore Beach Sd-5 Sagamore Beach
26	Ss-2	Ss-1 Ss-2 Ocean Grove Beach Sm-1 Brayton Point Beach
28	Fh-15	Fh-14 - Fh-16 Pope Beach
29	Mp-18	Mr-11 Ram Island 2

Mr-12 Little Neck
Mr-13 Converse Point
Mr-14 Aucoot Cove
Mp-1 Hiller Cove
Mp-2 Peases Point/Point Connett
Mp-3 Pine Island East Tombolo
Mp-4 Strawberry Point Barrier
Mp-5 Pine Island West Barrier Spit
Mp-6 Crescent Beach
Mp-7 Crescent Beach
Mp-8 Ned Point
Mp-9 Mattapoisett Village/Water St. Spit
Mp-10 Eel Pond Barrier
Mp-11 Sedge Island Spit
Mp-12 Marsch Nerve Road Spit
Mp-13 Shore View Road Spit
Mp-14 Shell Beach North
Mp-15 Shell Beach Middle
Mp-16 Shell Beach South
Mp-17 Bay View Avenue North
Mp-18 Grand View Beach - Barrier
Mp-19 Antassawamock East Spit
Mp-20 Antassawamock West Spit
Mp-21 Antassawamock Brant I. Cove
Mp-22 Mattapoisett Neck
Mp-23 Brant Island West Barrier Spit
Mp-24 Bryant Beach
Mp-26 Shaws Cove
Fh-1 Shaws Cove West

30 Mr-5

Mr-1 Wings Cove #1
Mr-2 Wings Cove #2
Mr-3 Wings Cove #3
Mr-4 Piney Point
Mr-5 Sedge Cove
Mr-6 Kittanset Golf Club
Mr-7 Point Road Beach
Mr-8 Planting Island Causeway
Mr-9 Planting Island Spit
Mr-10 Ram Island 1
Mr-11 Ram Island 2
Wh-2 Peters Neck
Wh-3 Jacobs Neck East
Wh-4 Pleasant Harbor, Inner Barrier
Wh-5 Pleasant Harbor, Southeast
Wh-6 Pleasant Harbor, Bay St.
Wh-7 Onset Island West
Wh-8 Onset Island East
Wh-9 Onset Bay
Wh-10 Shell Point
Wh-11 Hog Neck Tombolo

		Wh-12 Bass Cove, East Marsh
		Wh-13 Bass Cove Middle Salt Marsh
		Wh-14 Bass Cove West Salt Marsh
		Wh-15 Widows Cove
		Wh-16 Widows Cove South
		Wh-17 Seminary Barrier
		Wh-18 Cedar Point North
		Wh-19 Cedar Point South
		Wh-20 Stony Point West
		Wh-21 Little Harbor Beach (Town Beach)
		Wh-22 Bourne Cove Barrier Spit
		Wh-23 Beach Rocks
		Wh-24 Great Neck SW Coast West
		Wh-25 Beach Point
		Wh-26 Wareham River
		Wh-27 Wareham River
		Wh-28 Wareham Small Spit
		Wh-29 Barneys Point
		Wh-30 Swifts Neck (Angelo Road)
		Wh-31 Swifts Neck, E & W Spits
		Wh-32 Swifts Beach West
		Wh-33 Marks Cove
		Wh-34 Cromeset Neck West
		Wh-35 Nobska Point Spit
		Wh-36 Weweantic River
		Bo-4 Tobeys Island
		Bo-12 Wings Neck #1
		Bo-13 Wings Neck #2
		Bo-14 Wings Cove
		Bo-15 Pocasset Harbor
		Bo-16 Bassets Island
		Bo-17 Barlows Landing
		Bo-18 Red Brook Harbor
		Bo-19 Patuisset
		Bo-23 Long Point
		Bo-24 Red Brook Harbor
		Bo-25 Eustis Beach
		Bo-26 The Anchorage
		Bo-27 Meganseit Harbor
		Fm-37 Sandy Beach
		Fm-38 Crow Point/Sandy Beach
		Fm-39 Silver Beach
		Fm-40 Sandy Beach
		Fm-41 Sandy Beach
		Fm-42 Sandy Beach
		Fm-43 Sandy Beach
31	Wp-3	Wp-1 Horseneck Beach
		Wp-2 Horseneck Beach
		Wp-3 Acoxet Barrier Beach
		Wp-4 Cocheast Pond Bay

		Wp-5 Richmond Pond
		Wp-6 Quick Sand Point
		Dm-13 Little Beach
32	DM-6	Dm-1 Padanaram Marsh Barrier
		Dm-2 Smith Neck
		Dm-3 Bare Kneed Rocks
		Dm-4 Round Hill
		Dm-5 Salters Point
		Dm-6 Cow Yard/East
		Dm-7 Cow Yard/Middle
		Dm-8 Cow Yard/West
		Dm-9 Plummer Memorial Bridge South Spit
		Dm-10 Demarest-Lloyd
		Dm-11 Slocum Neck
		Dm-12 Slocum Neck/South
		Dm-13 Little Beach
33	Fh-23	Fh-2 Sconticut Neck
		Fh-3 Summit Drive
		Fh-4 Scpmtocit Neck
		Fh-5 Jeruselum Road
		Fh-6 Round Island Beach
		Fh-7 W. Island Road
		Fh-8 Nelson Beach
		Fh-9 Sconticut Neck West Side
		Fh-10 Sconticut Neck West Side
		Fh-11 Shore Side Drive
		Fh-12 Smugglers Road Barrier
		Fh-13 Briarcliff Road Barrier
		Fh-17 North Point Barrier
		Fh-18 North Point South
		Fh-19 West Island
		Fh-20 West Island
		Fh-21 West Island
		Fh-22 West Island
		Fh-23 West Island
		Mp-20 Antassawamock West Spit
		Mp-25 Ocean View Drive
34	Gn-67	Fm-22 Falmouth Beach
		Fm-23 Oyster Pond
		Fm-24 Quissett Beach
		Fm-25 Noboska Beach
		Fm-26 Penzance Point Causeway
		Fm-27 Flume Pond
		Fm-28 Gunning Point
		Fm-29 Little Sippewisset Barrier Spit
		Fm-30 Saconesset Hills Barrier Spit
		Fm-31 Black Beach
		Fm-32 Chappaquoit Beach

Fm-33 Little Island Road
Fm-34 Nemasket Road
Fm-35 Falmouth Cliffs Beach
Fm-36 Old Silver Beach
Gn-1 Mink Point West
Gn-2 Sheep Pen Harbor/North
Gn-3 Sheep Pen Harbor South
Gn-4 Nonamesset Island North
Gn-5 Nonamesset Island Middle Pond
Gn-6 Nonamesset Island South Pond
Gn-7 Monohansett Island Pond
Gn-8 Monohansett Island South Spit
Gn-58 North Shore Road
Gn-59 North Shore Road Point
Gn-61 North Shore Road East
Gn-62 Naushon Island/Northwest #1
Gn-63 Naushon Island/Northwest #3
Gn-64 Naushon Island/North
Gn-65 Northwest Gutter West
Gn-66 Northwest Gutter East
Gn-67 Uncatena Island North #1
Gn-68 Uncatena Island North #2
Gn-69 Uncatena Island North #3
Gn-70 Jimmy Point
Gn-71 Uncatena Island/Southeast
Gn-72 Bull Island
Gn-73 Nonamesset Island Inner Harbor
Gn-74 Nonamesset Island North #1
Gn-75 Nonamesset Island North #2

35 Fm-14

Fm-1 Washburn Island
Fm-2 Meadow Neck
Fm-3 Squta Spit Quashnet
Fm-4 Quahnet North Spit
Fm-5 Caleb Pond
Fm-6 Whistlers Way
Fm-7 Washburn Island Northeast
Fm-8 Washburn Island East Salt Pond Spit
Fm-9 Washburn Island East Second Barrier
Fm-10 Washburn Island West Spit
Fm-11 Washburn Is/Eel Pond Spit
Fm-12 Eel Pond Inlet West Spit
Fm-13 Bournes Pond Barrier
Fm-14 Green Pond
Fm-15 Great Pond
Fm-16 Mara Vista Spit
Fm-17 Great Bay Avenue Marsh Barrier
Fm-18 Little Pond
Fm-19 Falmouth Inner Harbor East Spit
Fm-20 Palmer Pond Barrier

		Fm-21 Fresh River
		Ms-5 South Cape Beach
		Ms-6 Seconsett Island?
36	Bo-20	Bo-2 Rocky Point Barrier Spit
		Bo-3 Toby's Island #1 Complex Barrier
		Bo-4 Toby's Island #2
		Bo-5 Toby's Island #3
		Bo-6 Toby's Island #4
		Bo-7 Toby's Island #5
		Bo-8 Toby's Island #6
		Bo-9 Bennett's Neck #1 Barrier Spit
		Bo-10 Bennett's Neck #2 Barrier Spit
		Bo-11 Bennett's Neck #3 Barrier Spit
		Bo-20 Hen Cove
		Bo-21 Red Brook Harbor #1
		Bo-22 Red Brook Harbor #2
		Bo-28 Squeteague Harbor #2
		Fm-44 Squeteague Harbor Barrier Beach
37	Sd-3	Sd-1 Sandy Neck Beach
		Sd-2 Scorton Shores
		Sd-3 East Sandwich Beach/Springhill Beach
		Sd-4 Town Neck Beach
38	Ba-23	Ba-12 Shallow Fresh March Barrier
		Ba-13 Eel River
		Ba-14 West Bay East Spitt
		Ba-15 Dead Neck Beach
		Ba-16 Wianno Head North Spit
		Ba-17 Town Landing Spit
		Ba-18 Handy Point Spit
		Ba-19 Tims Cove
		Ba-20 Cotuit Bay
		Ba-21 Bluff Point
		Ba-22 Rushy Marsh Pond North Barrier
		Ba-23 Rushy Marsh Pond South Barrier
		Ba-24 Meadow Point
		Ms-1 Popponesset Beach
		Ms-2 Popponesset Island Spit
		Ms-3 Deans Pond
		Ms-4 Flat Pond
39	Ba-7	Ba-1 Kalmus Park Beach
		Ba-2 Ocean Street Beach
		Ba-3 Hawes Avenue
		Ba-4 Breakwater Shores
		Ba-5 Keyes Memorial Beach
		Ba-6 Squaw Island East Bay Barrier
		Ba-7 Squaw Island West Spit
		Ba-8 W. Hyannisport Spit

		Ba-9 Craigville Beach/Long Beach Ba-10 Dowses Beach Ba-11 Phinneys Bay Ba-25 Harbor Point Spit Ba-26 Bone Hill Barrier Ba-27 Matthias Lane Spit Ba-28 Calves Pasture Point Spit Ba-29 Sandy Neck Ym-5 Great Island Barrier Ym-6 Smith's Point Spit Ym-7 Uncle Robert's Cove Spit Ym-8 Pine Island South Spit Ym-9 Mill Creek Ym-10 Grays Beach Ym-11 Hyannis Park/Algonquin Street Ym-12 Hyannis Park/Baxter Avenue
40	Dn-3	Dn-1 Swan Pond River East Spit Dn-2 Swan Pond River West Spit Dn-3 Bowsprit Lane Dn-4 West Dennis Beach (Davis Beach) Dn-5 Quivett Creek West Spit Dn-6 Coles Pond Dn-7 Quivett Neck Dn-8 Bridge Street Barrier Dn-9 Sesuit Neck Dn-10 Cape Cod Bay Dn-11 Corporation Beach
40b	Ym-4	Ym-1 Davis Beach Ym-2 Crowell Pond Beach Ym-3 Parker River East Spitf Ym-4 Sea Gull Beach Ym-5 Great Island Beach Ym-10 Gray's Beach Dn-12 Chapin Memorial Beach
41	Hw-5	Hw-1 Red River Beach Hw-2 Saquatucket Harbor East Spit Hw-3 Wychmere Harbor East Spit Hw-4 Allen Habor East Spit Hw-5 Herring River East Spit Cm-17 Cockle Cove - Bucks Creek Barrier Cm-18 Mill Creek Spit Cm-19 Forrest Beach Cm-20 Red River East Spit Dn-5 Quivett Creek West Spit Bt-1 Nanskaket East Spit Bt-2 Cape Cod Bay Bt-3 Paine Creek Beach Bt-4 Wings Island Barrier

Cm-2 Monomoy Beach

42 Cm-2

43 Cm-15

Cm-1 Nauset Beach
Cm-2 Monomoy Beach
Cm-3 Strong Island East Spit
Cm-4 Strong Island North Barrier
Cm-5 Strong Island West Spit
Cm-6 Fox Hill
Cm-7 Foreside Harbor Spit
Cm-8 Sedge Lane Beach
Cm-9 Shell Drive
Cm-10 Kendrick Road Barrier
Cm-11 Salt March Way Barrier
Cm-12 Old Harbor Barrier
Cm-13 Tern Island
Cm-14 Morris Island Chatham Habor Spit
Cm-15 Stage Harbor East Spit
Cm-16 Harding Beach
Ol-7 Nauset Beach
Ol-12 Hog Island
Ol-13 The Horseshoe Spit
Ol-14 Davis Road Barrier Spit
Ol-15 Quanset Road/Northeast
Ol-16 Quanset Road/Cranberry Bog
Ol-17 Quanset Pond

44 Ol-9

Ol-1 Little Namskaket Creek East Spit
Ol-2 Skaket Beach/South
Ol-3 Namskaket Beach
Ol-4 Namskaket West Spit
Ol-5 Nauset Harbor South Spit
Ol-6 Orleans Beach
Ol-7 Nauset Beach/North
Ol-8 Cliff Road
Ol-9 Old Field Point
Ol-10 Sampson Island North Barrier
Ol-11 Sampson Island South Spit
Eh-1 Sunken Meadow Spit
Eh-2 First Encounter Beach
Eh-3 Boat Meadow Marsh Barrier
Eh-4 Bridge Road
Eh-5 Rock Harbor North Spit
Eh-6 Coast Guard Beach
Eh-7 Nauset Harbor/South
Bt-1 Namskaket East Spit

45 Wf-18

Wf-1 Duck Harbor Beach
Wf-2 The Gut
Wf-3 Great Island/Great Beach Hill Bay
Wf-4 Jeremy Point Barrier Spit
Wf-5 Great Beach Hill South Harbor Spit

		Wf-6 Great Beach Hill North Harobr Spit
		Wf-7 Great Island South Harbor Spit
		Wf-8 Great Island East Spit
		Wf-9 West Mayo Beach
		Wf-10 Chatham Cove Spit
		Wf-11 Indian Neck Tidal Inlet Barriers
		Wf-12 Field Point
		Wf-13 Hillside Avenue Spit
		Wf-14 Blackfish Creek South Spit
		Wf-15 Old Wharf Point North Spit
		Wf-16 Old Wharf Point South Spit
		Wf-17 Lieutenant Island Logy bay Spit
		Wf-18 Cliff Avenue Bay Barrier
		Wf-19 Lieutenant Island South Spit
		Wf-20 Lieutenant Island South Marsh
		Wf-21 Catboat Road Spit
		Wf-22 Audubon Sanctuary
		Eh-1 Sunken Meadow Spit
		Tr-3 Harbor Bar
		Tr-4 Pamet River South Spit
		Tr-5 Bound Brook Beach
		Tr-7 Ballston Beach
46	Tr-7	Tr-1 Beach Point
		Tr-2 Great Swamp Beach
		Tr-3 Pamet River North
		Tr-6 Head of Meadow Beach
		Tr-7 Ballston Beach
47	Pt-1	Pt-1 Long Point
		Pt-2 Race Point Beach
		Tr-1 Pilgrim Beach
		Tr-6 Head of Meadow Beach
48	Gn-33	Gn-27 South Rock East
		Gn-28 South Rock
		Gn-29 Pasque I/Quicks Hole Small Pond
		Gn-30 Pasque I/Quicks Pond
		Gn-31 Quicks Hole Pond
		Gn-32 Canapitsit Harbor
		Gn-33 Cuttyhunk Pond South Spit
		Gn-34 West End Pond South
		Gn-35 West End Pond Spits
		Gn-36 Fresh Water Pond Marsh
		Gn-37 Cuttyhunk Pond West
		Gn-38 Copicut North
		Gn-39 Copicut Neck spit
		Gn-40 Canapitsit - Small Pond North
		Gn-41 Knox Point Marsh
		Gn-42 Knox Point East
		Gn-43 Rock Island Beach

		Gn-44 Jeep Trail Pond/West of the Neck
		Gn-45 The Neck Tombolo
		Gn-46 North Point/South Beach
		Gn-47 North Rock
		Gn-48 Pasque Island/Westend salt marsh
		Gn-49 Pasque Island/North
		Gn-77 Penikese Island South Spit
		Gn-78 Penikese Island East
49	Ch-15	Gn-9
		Gn-10 Great Swamp North Beach
		Gn-11 Great Swamp Large Pond
		Gn-12 Great Swamp South Pond
		Gn-13 South Bluff West Beach
		Gn-14 South Bluff East Beach
		Gn-15 Tarpaulin Cove Middle Beach
		Gn-16 Tarpaulin Cove Pond
		Gn-17 Tarpaulin Cove South Pond
		Gn-18 Tarpaulin Cove Lighthouse
		Gn-19 Tarpaulin Cove Lighthouse #2
		Gn-20 Tarpaulin Cove Lighthouse #3
		Gn-21 Tarpaulin Cove Lighthouse South
		Gn-22 French Watering Place
		Gn-23 French Watering Place South Beach
		Gn-24 Naushon Point
		Gn-25 Robinsons Hole South
		Gn-26 Pawque I. Southwest Beach
		Gn-49 Pasque Island North
		Gn-50 Pasque Island North Pond Beach
		Gn-51 Robinsons Hole Pond
		Gn-52 West Beach
		Gn-53 Crescent Beach
		Gn-54 Kettle Cove Spit
		Gn-55 Kettle Cove North Beach
		Gn-56 Silver Beach
		Gn-57 Silver Beach East
		Ch-15 Cape Higgon South
		Ch-16 Paint Mill
		Ch-17 Paint Mill #2
		Ch-18 Harlock Pond
		Wt-9 Grey Pond
50	Tb-9	Wt-10 Tisbury Lane #1
		Wt-11 Tisbury Lane #2
		Wt-12 Tisbury Lane #2
		Wt-13 Doggetts Pond
		Wt-14 Cedar Tree Neck
		Wt-15 Lilly Pond
		Wt-16 James Pond
		Wt-17 Lamberts Cove
		Tb-1 Vineyard Haven Harbor Spit

Tb-2 Cedar Neck North Spit
Tb-3 Cedar Neck South Spit
Tb-4 Cedar Neck Bay
Tb-5 Mink Meadows North
Tb-6 Mink Meadows South
Tb-7 Lake Tashmoo East Spit
Tb-8 Fat Point
Tb-9 Lake Tashmoo South
Tb-10 Hillman Point
Tb-11 Lake Tashmoo West Spit
Tb-12 Smith Brook
Tb-13 Norton Point East
Ob-10 Vine Haven Harbor East Spit
Ob-11 Lagoon Pond Inner Barrier Beach
Ob-12 Lagoon Pond Spite #1
Ob-13 Barnes Road-Lagoon Pond Spit

51a Et-36

Ob-1 Joseph Sylvia State Beach Park
Ob-2 Sengekontacket Pond North Spit
Ob-3 Hamlin Pond
Ob-4 Hart Haven Barrier Beach
Ob-5 Oak Bluffs Harbor South Spit
Ob-6 Oak Bluffs Harbor North Spit
Ob-7 Crystal Lake Barrier Beach
Ob-8 Eastville #1
Ob-9 Eastville #2
Ob-11 Lagoon Pond Inner Barrier Beach
Et-1 Edgartown Beach
Et-2 Haystack Point Spit
Et-3 Ocean Heights View Barrier Beach
Et-4 Eagartown Beach South
Et-5 Edgartown Beach Spit
Et-6 Little Beach
Et-7 Inlet to Edgartown Harbor
Et-8 Bankers Way Beach
Et-9 Katama Road Salt Pond
Et-10 Edgartown Bay Road/Salt Pond
Et-11 Bluefish Point
Et-34 Norton Point
Et-35 Edgartown Great Pond Barrier Beach
Et-36 Jobs Neck #1
Et-37 Jobs Neckk Pond Barrier Beach

51b Et-15

Et-13 Bayview Road Barrier Beach
Et-14 Wasque Road/West Beach
Et-15 School Road South Beach
Et-16 Long Point
Et-17 Snow Point Barrier Beach
Et-18 Chappaquiddick Point
Et-19 Chappaquiddick Beach
Et-20 North Neck Road Barrier Beach

		Et-21 North Neck Tombolo
		Et-22 John Oliver Point
		Et-23 Cape Poge Bay #1
		Et-24 Cape Poge Bay #2
		Et-25 Cape Poge Bay #3
		Et-26 Cape Poge Bay #4
		Et-27 Pease Pond Barrier Beach and Spit
		Et-28 Cape Poge Elbow
		Et-29 Shear Pen Pond Barrier Spits
		Et-30 Little Neck Spit
		Et-31 Cape Poge East Beach
		Et-32 Pocha Pond Barrier Beach
		Et-33 Washaqua Hill Barrier Beach
		Et-34 Norton Point
52	Wt-8	Ch-1 Chilmark Pond, Black Pt.
		Ch-2 Chilmark Pond Barrier Beach
		Wt-1 Watcha Pond #1
		Wt-2 Watcha Pond #2
		Wt-3 Watcha Pond #3
		Wt-4 Scubby Neck
		Wt-5 Homer Pond
		Wt-6 Salt Pond at Big Homer's Pond Road
		Wt-7 Long Cove
		Wt-8 Tisbury Great Pond
		Et-37 Jobs Neck Pond Barrier Beach
		Et-38 Pohoganot Road
		Et-39 Paqua Pond
		Et-40 Oyster Pond Barrier Beach
53	Ch-6	Ch-2 Chilmark Pond Barrier Beach
		Ch-3 Chilmark Pond #2
		Ch-4 Stonewall Beach
		Ch-5 Squibnocket Bight
		Ch-6 Squibnocket Beach
		Ch-7 Menemsha Pond #1 Spit
		Ch-8 Nashaquitsa Pond Spit
		Ch-9 Menemsha Pond #1
		Ch-10 Menemsha Pond #2
		Ch-11 Menemsha Pond #3
		Ch-12 Menemsha Pond #4
		Ch-13 Gay Head Coast Guard Station
		Ch-14 Menemsha Beach
		Ch-19 Nomans Land
		Gh-1 Long Beach
		Gh-2 Gay Head Town Beach
		Gh-3 Lobsterville/West Payson Rd. Spit
54	Nt-48	Nt-39 Madaket Point
		Nt-40 Esther Island
		Nt-41 Tuckernuck South Spit

Nt-42 Tuckernuck Northwest Sound
Nt-43 Muskeget Island Barrier Complex
Nt-44 North Pond Small Barrier
Nt-45 North Pond Bay Mouth Barrier
Nt-46 Tuckernuck Island East Pond Spit
Nt-47 Tuckernuck Island Bay Barrier Beach
Nt-48 Tuckernuck Is. Thin Pond Bay Barrier

55 Nt-34

Nt-1 Coatue Point
Nt-2 Brant Point
Nt-3 The Creeks
Nt-31 Miacomet Pond
Nt-32 Mioxes Pond
Nt-33 Reedy Pond
Nt-34 Hummock Pond Bay Mouth Barrier
Nt-35 Clark Cove
Nt-36 Sheep Pond
Nt-37 Long Pond Bay Barrier
Nt-38 Hither Creek
Nt-49 Jackson Point
Nt-50 Jackson Point North
Nt-51 Warren Landing Barrier Beach
Nt-52 Eel Point
Nt-53 Eel Point Road
Nt-54 Capaum Pond
Nt-55 Reed Pond
Nt-56 Jetties Beach

56 Nt-28

Nt-1 Coatue Beach (see above)
Nt-4 Harbor View Road Beach
Nt-5 Pimnys Point
Nt-6 Shimmo Road #1
Nt-7 Shimmo Road #2
Nt-8 Abrams Point Spit
Nt-9 Shawkemo Barier Beach
Nt-10 Shawkemo #2
Nt-11 UMass Research Center/Folgers Marsh
Nt-12 Quaise Road
Nt-13 Quaise Point
Nt-14 Swains Neck
Nt-15 Polpis Harbor
Nt-16 Polpis Harbor #2
Nt-17 Polpis Harbor #3
Nt-18 Pocomo Meadow
Nt-19 Pocomo Road
Nt-20 Pocomo Road #2
Nt-21 Squam Swamp Beach
Nt-23 Wawinet Tombolo
Nt-24 Squam Pond
Nt-25 Squam Road Beach
Nt-26 Seachacha Pond

Nt-27 Tom Nevers Pond Barrier
Nt-28 Forked Pond Valley
Nt-29 Forked Valley West
Nt-30 Madequecham Barrier

57 Nt-23

Nt-22 Great Pond Spit
Nt-23 Wawinet Tombolo

(f= barrier.map)

APPENDIX B

Federal Coastal Barrier Resource System (COBRA) Units in Massachusetts

Federal Coastal Barrier Resource System Units in Massachusetts

Coastal Zone Management Map #	Unit #	Unit Code Name
1	MA-01P	Salisbury Beach
2	MA-02P	Plum Island
3	C00	Clark Pond
	MA-03	Castle Neck
4	MA-03	Castle Neck
	C01	Wingersheek Unit
	C01B	Brace Cove
5	C01A	Good Harbor Beach/Milk Island
6	MA-04	West Beach (2 units)
7	MA-06	Phillips Island
8	MA-08P	Snake Island
	MA-09P	Wallaston Beach
	MA-10P	Merrymount Park
9	C01C	West Head Beach
	MA-11	Peddock/Rainsford Islands
10	MA-12	Cohasset Harbor
	C02	North Scituate
11	C03	Rivermoor
	C03A	Rexhame
12	MA-13	Duxbury Beach (Squash Neck - Standish Shore)
	C04	Plymouth Bay
13	C06	Center Hill (Ship Pond, Salt Pond)
14	MA-14P	Town Neck
	C08	Scorton
15	C09/C09P	Sandy Neck (C09 Mill Creek)

16	C09	Sandy Neck
	MA-15P	Chapin Beach
	MA-16	Nobscusset
	C10	Freemans Pond
17	C11	Namskaket Spits
	C11A-C11AP	Boat Meadow
	MA-20P	Nauset Beach/Monomoy
18	MA-17P	Griffin/Great Islands
	MA-17AP	Lieutenant Island
	MA-18	Pamet Harbor
	MA-18P	Ballston Beach
19	MA-19P	Provincetown
20	MA-19P	Provincetown
21	MA-20P	Nauset Beach/Monomoy
22	MA-20P	Nauset Beach/Monomoy
23	C12	Chatham Roads
24	MA-23P	Davis Beach
	C13/C13P	Lewis Bay
25	C14	Squaw Island
	C15-C15P	Centerville
26	C16	Dead Neck
	C17	Popponesset Spit
27	C18/C18P	Waquoit Bay
	C18A	Falmouth Ponds (Bournes Pond, Green Pond)
28	C19	Black Beach
	MA-24	Naushon Island (2 units)
29	MA-30	Herring Brook
	MA-31	Squeteague Harbor
	MA-32	Bassetts Island
	MA-33	Phinneys Harbor
30	MA-24	Naushon Island (Tarpaulin Cove, French Watering Place, Naushon Pt., West Beach)

31	C31	Elizabeth Islands (West Pond, Cuttyhunk Harbor, Quicks Hole Pond, Pasque Island, Robinson Hole)
	MA-25P	Penikese Island
32	MA-26	Harthaven
	MA-27P	Edgartown Beach
	C26	Eel Pond
	C27	Cape Poge
	MA-28P	Norton Point
	C28	South Beach
33	C28	South Beach
34	C29/C29P	Squibnocket Complex
	MA-29P	Nomans Land
35	C29A	James Pond
	C29B	Mink Meadows
36	C20	Coatue Unit
	C21	Sesachacha Pond
37	C22	Cisco Beach
	C23	Esther Island
38	C24	Tuckermuck Island (North Pond, East Pond)
	C25	Muskeget Island
39	C19A	Buzzards Bay Complex (8 units)
	MA-35	Planting Island
40	C19A	Buzzards Bay Complex
	C31A	West Sconticut Neck (5 units)
41	C31B	Harbor View
42	MA-36	Round Hill
	C32	Mishaum Point
	MA-37P	Demarest Lloyd Park
	C33	Little Beach
43	C33	Little Beach
	C43/C43P	Horseneck Beach (C34 3 units)
	D01	Little Compton Ponds
44	C34A	Cedar Cove

APPENDIX C

Beach Staging Areas for Migratory Shorebirds

Coastal Areas Important as Migratory Shorebird Staging Areas

Data from the Manomet Bird Observatory, Plymouth, MA

Type

GL	Government land, not park or wildlife
X	Not managed for wildlife or parks
SP	State/municipal park
PP	Private conservation land
U	Unknown status
NW	National Wildlife Refuge
ST	Sewage treatment plant
NP	National Park
SW	State wildlife area (refuge, mgt. area)
PW	Private wildlife sanctuary
PSF	Private sodfarm
NSW	National AND State Wildlife Refuge

Site	Type
BARNSTABLE, MILL POND	X
BOSTON, EARHART DAM	GL
EAST BOSTON, BELLE ISLE (2 locations)	GL
BOSTON, MYSTIC PARK	GL
BOSTON, MALDEN RIVER	GL
BOSTON, PINE RIVER (2 locations)	GL
BOSTON, PUTNAM AVE; JUST SW	GL
BOSTON, ROCK ISLAND COVE	GL
BOSTON, SAUGUS MARSH	GL
BOSTON-WINTHROP, SNAKE ISLAND (4 locations)	GL

BOSTON, SEAPLANE BASIN	X
BOSTON, THOMPSON ISLAND	SP
BOSTON, WORLD'S END	PP
BOSTON, WEIR RIVER	U
BREWSTER, PAINE'S CREEK	X
BREWSTER, POINT OF ROCKS	X
BREWSTER, QUIVET CREEK & WING ISLAND BEACH	X
DENNIS, CHAPIN BEACH	X
EASTHAM, FIRST ENCOUNTER BEACH (4 locations)	GL
HULL, GUT	X
MARION, KITANSETT, BUTLER'S POINT	X
MARION SEWAGE TREATMENT	
MONOMOY ISLAND NWR, NO. END (9 locations)	NW
EASTHAM, NAUSET MARSH	NP
ORLEANS, NEW ISLAND	NP
NEWBURYPORT HARBOR (3 locations)	GL
EASTHAM, NAUSET (COAST GUARD BEACH & NEW ISL.) (5 locations)	NP
PARKER RIVER NWR (BEACH, SALT MARSH, IMPS) (3 locations)	NW
PARKER RIVER NWR (PANNES)	NW
REVERE POINT-O-PINES	U

SCITUATE, THIRD CLIFF (5 locations)	X
SQUANTUM	X
FAIRHAVEN, WEST ISLAND	SW
WINTHROP (BREAKWATER)	X
DUXBURY BEACH (3 locations)	PP, X
PLYMOUTH BEACH (4 locations)	GL, X
PLUM ISLAND (2 locations)	NW
BOSTON, UMASS & MORRISSY BLVD	GL, X
NANTUCKET HARBOR FLATS	GL, X
LYNN HARBOR	GL, X
BRIDGEWATER STATE FARM	
ROWLEY	X
MANOMET, MBO BEACH (2 locations)	X
MONOMOY-NORTH AND SOUTH ENDS	NW
BREWSTER, WING ISLAND	X
PLYMOUTH BAY FLATS	X
SCITUATE & MARSHFIELD, NORTH & SOUTH RIVERS	X
WESTPORT	
PLUM ISLAND (REFUGE BEACH)	NW
NEWBURYPORT/PLUM ISLAND (2 locations)	NW

ORLEANS, NAUSET (NORTH BEACH) (3 locations)	NP
HULL, ALLERTON POINT	X
MONOMOY ISLAND NWR, SO. END (2 locations)	NW
BARNSTABLE, SANDY NECK LEAST TERN COLONY AREA	SW
BASS CREEK NEAR GRAYS' BEACH TERN COLONY	X
WELLFLEET BAY WILDLIFE SANCTUARY	PW
MASHPEE, SOUTH CAPE BEACH	X
ALLEN'S POND	PW
ALLEN'S POND, EAST BEACH	X
WESTPORT/DARTMOUTH TOWN LINE	X
DARTMOUTH, LLOYD CENTER	PW
WESTPORT, ACOAXET	X
WESTPORT, GOOSEBERRY ISLAND	SP
WESTPORT, TOWN BEACH/ HORSENECK BEACH	SP
DUXBURY BEACH - SAQUISH	GL, X
STAGE POINT BEACH (ROOST)	X
BARNSTABLE MARSH & BASS CREEK	X
BASS CREEK	X
BARNSTABLE, SANDY NECK TERN POND	SW
BARNSTABLE, SANDY NECK COVE	SW
BASS CREEK & SANDY NECK TERN POND	SW
ALLEN'S POND	

NONQUITT SALT MARSH	
SALTERS POINT	
IPSWICH, CRANES BEACH (AREA A)	P
IPSWICH, CRANES BEACH (AREA B)	
IPSWICH, CRANES BEACH (AREA C)	
MINI-MOY (BETWEEN NO. & SO. MONOMOY)	
CHATHAM, SOUTH BEACH ISLAND	
BARNSTABLE, SANDY NECK	SW

APPENDIX D

Off-Road Vehicles, Recommended Equipment and Suggested Trail and Driving Guidelines

Off-Road Vehicles, Recommended Equipment, and Suggested Trail and Driving Guidelines

(Adapted from The Cape Cod National Seashore Guide)

Where a barrier beach managment plan provides opportunities for off-road vehicle use, the following will serve as recommended guidelines for off-road vehicles and related equipment.

Off-road vehicles should have:

1. Tires that meet minimum standards.
2. Required accessory equipment.
3. Valid state registration and inspection sticker.
4. A valid off road vehicle beach access permit affixed to the vehicle consistent with the vehicle's state registration number.

Operators should:

1. Possess a valid state operator's license.
2. Review educational programs.

Coastal Beach and Dune Driving Guidelines:

1. Avoid access on or over driftline zones or expanding dune edges;
2. Avoid access on or over dunes;
3. Avoid access on or over areas of nesting shore birds, migrating shore bird staging areas and rare, threatened and endangered species' habitat.
4. Avoid driving on wrack line.
5. Follow previously made trails within oversand vehicle corridor;
6. Tire pressure is critical. Tires should be deflated to the point that they will not cause adverse impacts to beach terrain. Friction may cause pressure increase as a vehicle is driven. The vehicle may have to be stopped and pressure reduced again.
7. Check tides before starting since some sections of beach may be impassable at high tide.
8. Don't spin tires or the vehicle will be dug into a hole; a light foot on the accelerator works best.
9. If the vehicle gets stuck check the tire pressure and lower pressure again if necessary; try backing up in the vehicle tracks before moving ahead.
10. Excessive speed endangers drivers, vehicles, other beach users, and wildlife, a slow, steady speed and correct tire pressure is more effective than faster speeds.
11. Tern and plover chicks may hide in vehicle tracks when frightened; always look out for wildlife when driving on the beach.

Driving should not occur on:

1. Foreshore and foredune areas
2. Inner dune routes
3. Posted shorebird nesting areas
4. Beach areas designated for use by pedestrians only
5. Outside of oversand vehicle corridors

Exception: Vehicles may travel the foreshore when passing a beach cut which has eliminated the legal oversand vehicle corridor.

Safety and rights of way:

1. Riding on fenders, tailgate, roof, or any exterior portion of a vehicle not designed to carry passengers should be prohibited.
2. When two vehicles meet on the beach, the operator of the vehicle with the water on the driver's right has the right of way. Self contained recreational vehicles should always have the right of way because of size and weight.

Oversand route maintenance:

1. Tire pressure should be such that no adverse impact is caused to the beach terrain.
2. The operator of a vehicle which becomes stuck in the sand should fill in all ruts or holes and remove any debris used to extricate the vehicle.

Recommended equipment for all vehicles:

1. Shovel -- heavy duty type, equal to or better than a military folding shovel
2. Tow device -- minimum length: 14 feet; minimum diameter:
   5/16 inch (chain), 1/4 inch (cable), 1 inch nylon or polypropylene, 3/4 inch tow strap 1-1/2 inches wide (rope)
3. Jack -- standard size and type provided by manufacturer
4. Jack support board -- minimum size: 10 inches by 12 inches; minimum thickness: 5/8 inch for plywood; 1-1/2 inches for solid wood
5. Tire pressure gauge -- must register to 5 pounds per square inch or lower
6. Fire extinguisher
7. First aid kit
8. Spare tire -- must meet tire standards described below.
9. Minimal tire standards (rim diameter/tire section width in millimeters/tire section width in inches) --
   13/185/7.25
   14/195/7.50
   15+/225/8.75
   All tires should have a minimum profile series of 70.

The above standards are minimum recommended sizes. For efficient beach travel, a tire section width of at least 235 millimeters in a non-aggressive tread design is recommended. "Mud 'N Snow" tires are considered an aggressive tread.

Driver education materials (programs, displays, signs):

1. Describe the values of barrier beach, coastal resources, dune, salt marsh, and tidal flat environments
2. Describe the damage that inappropriate use of an off-road vehicle use can cause to beach, dune, salt marsh, and tidal flat environments

APPENDIX E

Federal, State, Regional and Municipal Laws

Laws That May Have Relevance to Barrier Beach Management

Federal Statutes

Migratory Bird Treaty of 1918	16 U.S. Code 703
Coastal Zone Management Act	16 U.S. Code 1451
Endangered Species Act	16 U.S. Code 1531
Coastal Barrier Resources Act	16 U.S. Code 3502
Rivers & Harbor Act of 1899	33 U.S. Code 401
Water Pollution Control Act (Clean Water Act)	33 U.S. Code 1251
Marine Protection, Research, and Sanctuaries Act	33 U.S. Code 1401
Marine Plastic Pollution Research and Control Act of 1987	33 U.S. Code 1901
National Flood Insurance Act	42 U.S. Code 4001
National Environmental Policy Act	42 U.S. Code 4321
Americans With Disabilities Act	42 U.S. Code 12101

State Statutes, Regulations and Executive Orders

Landowner Liability Limitations	Mass. General Laws Chapter 21, §17c
Coastal Zone Management Act & Regulations	Mass. General Laws Chapter 21A, §4A 301 Code of Mass. Regulations 20.00
CZM Federal Consistency Regulations	301 Code of Mass. Regulations 21.00
Clean Water Act & Regulations	Mass. General Laws Chapter 21, §42 314 Code of Mass. Regulations 1-15.00
Sanitary Code/Title V Regulations	310 Code of Mass. Regulations 15.00
Handicap Access Act & Regulations	Mass. General Laws Chapter 22, §13A 521 Code of Mass. Regulations 2-3.00 (Architectural Access Board)
Mass. Environmental Policy Act & Regulations	Mass. General Laws Chapter 30, §§61-62H 301 Code of Mass. Regulations 11.00
Areas of Critical Environmental Concern Regulations	301 Code of Mass. Regulations 12.00
Motor Vehicles Act & Regulations	Mass. General Laws Chapter 90 540 Code of Mass. Regulations 1-19.00
Motorboats & Other Vessels Act & Regulations	Mass. General Laws Chapter 90B 323 Code of Mass. Regulations 1-5.00
Public Waterfront Act & Regulations	Mass. General Laws Chapter 91 310 Code of Mass. Regulations 9.00
Marine Fish & Fisheries Act & Regulations	Mass. General Laws Chapter 130 322 Code of Mass. Regulations 1-12.00
Coastal Wetlands Restriction Act & Regulations	Mass. General Laws Chapter 130, §105 302 Code of Mass. Regulations 4.00
Inland Fisheries, Game & Other Natural Resources Act & Regulations	Mass. General Laws Chapter 131 321 Code of Mass. Regulations 1-9.00

Wetlands Protection Act & Regulations	Mass. General Laws Chapter 131, §40 310 Code of Mass. Regulations 10.00
Endangered Species Act & Regulations	Mass. General Laws Chapter 131A 321 Code of Mass. Regulations 10.00
Ocean Sanctuary Act & Regulations	Mass. General Laws Chapter 132A 302 Code of Mass. Regulations 5.00
Pesticide Control Act & Regulations	Mass. General Laws Chapter 132B 333 Code of Mass. Regulations 1-11
Building Standards & Regulations	Mass. General Laws Chapter 143 248 Code of Mass. Regulations (Plumbing) 521 Code of Mass. Regulations 2-3.00 (Architectural Access Board) 780 Code of Mass. Regulations 1-34.00 (Building Code, includes floodplain)
Mass. Historic Commission Regulations	950 Code of Mass. Regulations 70-71.00
Crimes Against the Person	Mass. General Laws Chapter 265
Crimes Against Property	Mass. General Laws Chapter 266
Crimes Against Public Health	Mass. General Laws Chapter 270

Executive Order No. 181: Barrier Beaches (1980)

Executive Order No. 190: Regulation of Off-Road Vehicle Use on Public Lands Containing Coastal Wetlands Resources (1980)

Regional/County

Cape Cod Commission Act	Chapter 716 of the Acts and Resolves of 1989; Chapter 2 of the Acts and Resolves of 1990; Regional Policy Plan
Martha's Vineyard Commission Act	Chapter 831 of the Acts and Resolves of 1977

Local

Ordinances/Bylaws, Regulations, Rules, Policies and Guidelines

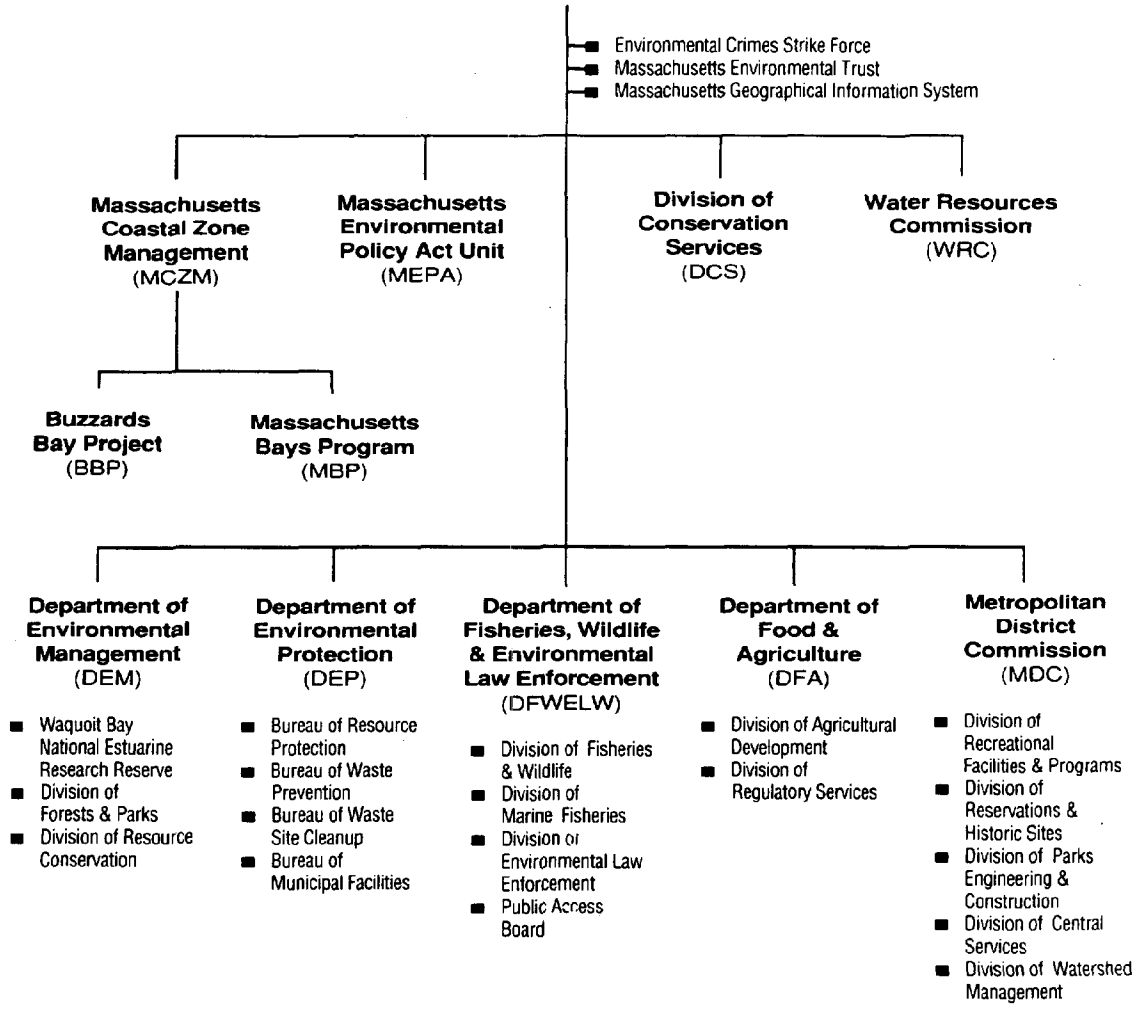
Examples:
- Zoning
- Wetlands
- Waterways
- Animal Control
- Loitering
- Health

See the local city or town clerk for copies or further information.

APPENDIX F

State Environmental Agency Contacts

Executive Office of Environmental Affairs



State Environmental Agency Contacts
relevant to the managment of barrier beaches

Executive Office of Environmental Affairs: (617) 727-9800
This is the Governor's cabinet level agency. See the flow chart on the facing page for the bureaucratic breakdown. Coastal Zone Managment also has a "Coastal Brief" which briefly explains the functions of the Commonwealth's environmental departments, bureaus, divisions, offices and programs with telephone numbers and addresses; call Mass. Coastal Zone Management at (617) 727-9530 for a copy.

(All numbers are in the 617 area except as noted)
Mass. Coastal Zone Management: 727-9530.
Mass. Environmental Policy Act Unit: 727-5830.
Department of Environmental Managment's Division of Forests and Parks: 727-3180 (includes Department owned public barrier beaches).
Department of Environmental Managment's Division of Resource Conservation: 727-3160.
Department of Environmental Protection has a Bureau of Resource Protection under which falls the Division of Wetlands and Waterways: 292-5695 (administers the Mass. Wetlands Protection and Waterways programs).
Department of Fisheries, Wildlife and Environmental Law Enforcement's Division of Fisheries and Wildlife: 727-3151 (this Division includes the states' Natural Heritage and Endangered Species Program: 727-9194); the Division of Marine Fisheries: 727-3193; the Division of Law Enforcement: 727-9905; and a HOTLINE: 1-800-632-8075.
Metropolitan District Commission: 727-5215 (the Commission owns metropolitan area public recreational barrier beaches).

APPENDIX G

Glossary

Glossary

A-Zone: flood zone subject to still water flooding during a storm with a 100 year recurrence interval, as defined and mapped by Federal Emergency Management Agency.

accretion: may be either natural or artificial. Natural accretion is the buildup of land, solely by the action of the forces of nature, on a beach by deposition of water or airborne material. Artificial accretion is a similar buildup of land by reason of an act of man, such as the accretion formed by a groin, breakwater, or beach fill deposited by mechanical means.

aeolian: on barrier beaches, features caused by the winds; wind-blown.

backshore: zone of the shore or beach lying between the foreshore and the coastline comprising the berm or berms and acted upon by waves only during severe storms, especially when combined with exceptionally high water. Also backbeach.

barrier beach: a narrow low-lying strip of land consisting of beach and dunes extending parallel to the trend of the coast and separated from the mainland by a fresh, brackish or salt water body or marsh. Resource Area protected under the Wetlands Protection Act and Regulations (See 310 Code of Mass. Regulations 10.29).

barrier island: a barrier beach that is unconnected to the mainland.

barrier lagoon: a bay roughly parallel to the coast and separated from the open ocean by barrier islands. Also, the body of water encircled by coral islands and reefs, in which case it may be called an atoll lagoon.

barrier spit: a barrier beach that is connected at one end to upland and unconnected at the other end.

bay barrier: a barrier beach that is connected at both ends to upland.

beach: unconsolidated sediment subject to wave, tidal and coastal storm action which forms the gently sloping shore of a body of salt water and extends from the mean low waterline (including tidal flats) landward to the duneline, coastal bankline or the seaward edge of coastal engineering structures. Coastal beaches are a Resource Area protected under the Wetlands Protection Act and Regulations (See 310 Code of Mass. Regulations 10.27).

beach nourishment: the process of replenishing a beach or dune with material (usually sand) obtained from another location, by mechanical or hydraulic 8means.

berm: a nearly horizontal upper part of the beach or one sloping away from the ocean.

breakwater: a linear mound-like coastal engineering structure constructed offshore, typically parallel to the shoreline; designed to protect landward property, a harbor or anchorage from storm waves.

coastal bank: the seaward face or side of any elevated landform, other than a coastal dune, which lies at the landward edge of a coastal beach, land subject to tidal action, or other wetland. Coastal banks are a Resource Area protected by the Wetlands Protection Act and Regulations (See 310 Code of Mass. Regulations 10.30) and may be significant to storm damage prevention or flood control as a vertical buffer or as a sediment source for beaches, dunes or barriers. Coastal bank differs from a coastal dune by the fact that it has been glacially deposited. Top of coastal bank is defined in the Wetlands Protection Program Policy 92-1.

coastal beach: see "beach."

coastal dune: see "dune."

cobble: rocks larger than pebbles and gravel but smaller than boulders; generally around 3 inches (76 millimeters) in diameter.

conservation restriction: a legal agreement, either voluntary or involuntary, designed to restrict use of privately owned land for conservation purposes.

current, longshore: the littoral current in the breaker zone moving essentially parallel to the shore, usually generated by waves breaking at an angle to the shoreline.

downdrift: in the direction of the predominant movement of sediment along the shore.

dredging: the removal of sediment or excavation of tidal or subtidal bottom to provide sufficient depths for navigation or anchorage.

drift: see "wrack"

dune: any natural hill, mound, or ridge of sediment landward of a coastal beach deposited by the wind or storm overwash; sediment deposited by artificial means and serving the purpose of storm damage prevention and flood control. Coastal dunes are a Resource Area protected under the Wetlands

Protection Act and Regulations (See 310 Code of Mass. Regulations 10.28).

endangered: species threatened with imminent extinction, as defined by the state and federal Endangered Species Acts.

entrapment capacity: when the updrift side of a groin or jetty is filled completely with beach sediment.

eolian sands: sediments of sand size or smaller which have been transported by winds. They may be recognized in marine deposits off desert coasts by the greater angularity of the grains compared with waterborne particles.

erosion: the wearing away of land by the action of natural forces. On a beach, the carrying away of beach material by wave action, tidal currents, littoral currents, or by deflation.

estuary: a semi-enclosed body of water with an open connection to the sea that is measurably diluted by freshwater drainage.

floodplain: the area of shorelands extending inland from the normal yearly maximum stormwater level to the highest expected stormwater level in a given period of time (i.e. 5, 50, 100 years).

foredune: the first dune or dune ridge landward of the beach.

foreshore: the part of the shore, lying between the crest of the seaward berm (or upper limit of wave wash at high tide) and the ordinary low-water mark, that is ordinarily traversed by the uprush and backrush of the waves as the tides rise and fall.

glacial till: deposits of rock matter carried by the glacial ice.

gravel: rounded rock particles with diameters from 2 to 75 millimeters (1/6 to 3 inches.)

groin: a narrow elongated coastal engineering structure constructed on the beach perpendicular to the trend of the beach; its intended purpose is to trap longshore drift to build up a section of beach.

headland (head): a high, steep-faced promontory extending into the sea

high water line: in strictness, the intersection of the plane of mean high water with the shore. The shoreline delineated on the nautical charts of the National Ocean Service is an approximation of the high water line. For specific occurrences, the highest elevation on the shore reached during a storm or rising tide, including meteorological effects.

hurricane: an intense tropical cyclone with winds which move counterclockwise around a low pressure system; maximum winds exceed 75 miles per hour.

intertidal zone (littoral zone): generally considered to be the zone between mean high-water and mean low-water levels.

invertebrate: an animal without a backbone. Insects and mussels are invertebrates.

jetty: a coastal engineering structure constructed perpendicular to the shoreline at inlets; designed to prevent longshore drift from filling the inlet and to provide protection for navigation.

littoral drift: the sedimentary material moved in the littoral zone under the influence of waves and currents.

littoral processes: the movement of sediment, including sand, gravel, or cobbles along the coast caused by waves or currents.

littoral transport: the movement of littoral drift in the littoral zone by waves and currents. Includes movement parallel (longshore transport) and perpendicular (on-offshore transport) to the shore.

marsh: a treeless form of wetland, often developing in shallow ponds or depressions, river margins, tidal areas, and estuaries. Marshes may contain either salt or fresh water. Prominent among the vegetation of marshes are grasses and sedges.

mean high water: the average height of all of the high waters recorded at a given place over a 19 year period.

mean low water: the average height of all of the low waters recorded at a given place over a 19 year period.

mean sea level: the average height of the surface of the sea at a given place for all stages of the tide over a 19 year period.

mean tide level: a plane midway between mean high water and mean low water. Not necessarily equal to mean sea level. Also half-tide level.

northeaster: a large asymmetrical low pressure storm system that produces counterclockwise winds from 30 to 70 miles per hour which strike northeast facing coastal areas.

overwash: the uprush and overtopping of a coastal dune by storm waters. Sediment is usually carried with the overwashing water and deposited as a washover fan on the landward side of the dune or barrier.

peat: partly decayed organic matter formed in boggy areas where high acidity and a lack of oxygen limits decomposition.

perched barrier: a barrier beach where beach and dune deposits overlie irregular glacial surfaces, whereas the underlying glacial surface extends to a maximum elevation of mid-tide.

profile, beach: the intersection of the ground surface with a vertical plane; may extend from the top of the dune line to the seaward limit of sand movement.

revetment: an apron-like sloped coastal engineering structure constructed on a bank or fronting a seawall; designed to dissipate the force of storm waves and prevent erosion or undermining of a seawall.

salt marsh: a marsh periodically flooded by salt water. Salt marshes are protected under the Wetlands Protection Act and Regulations (See 310 Code of Mass. Regulations 10.32).

sand: loose material which consists of grains of rock material ranging between 0.0625 and 2.0 millimeters in diameter.

scour: removal of underwater material by waves and currents, especially at the base or toe of a shore structure.

seawall: a vertical wall-like coastal engineering structure constructed parallel to the beach and usually located at the base of a coastal bank.

sediment: solid fragmental material that originates from weathering of rocks and is transported or deposited by air, water, or ice. Essentially all unconsolidated materials.

storm ridge: a low ridge of coarse gravel, cobbles and/or boulders piled up by storm waves; located at the inner margin of the beach and not reached by average waves or spring tides.

succession: the gradual replacement of one biotic community by another, eventually leading to a more or less stable community.

tidal flats: marshy or muddy land areas which are covered and uncovered by the rise and fall of the tide. Protected under the Wetlands Protection Act and Regulations (See 310 Code of Mass. Regulations 10.27).

tidal inlet: a breach in a coastal barrier generally opened by a major storm and maintained by tidal flow.

tombolo: a barrier beach that connects an island to the mainland or to another island.

updrift: the direction opposite that of the predominant movement of sediment along the shore.

upland: a general term for high land or ground that is elevated above the floodplain.

velocity zone (V-zone): flood zone subject to velocity water flooding during a storm with a 100 year recurrence interval, as designated and mapped by the Federal Emergency Management Agency.

washover fan: see "overwash."

wrack line: a line generally defining the landward limit of high tide or storm wave uprush typically consisting of seaweed, shells and other submerged organisms that have died.

Definitions developed from sources including: Barrier Island Handbook (Leatherman, 1979); Guide to the Coastal Wetlands Regulations (Massachusetts Coastal Zone Managment, 1978); and Shore Protection Manual (US Army Corps of Engineers, 1984).

APPENDIX H

Mass. Division of Fisheries and Wildlife

Guidelines for Managing Recreational Use of Beaches to Protect Piping Plovers, Terns and Their Habitats in Massachusetts

Commonwealth of Massachusetts

Division of Fisheries & Wildlife

Wayne F. MacCallum, *Director*

April 21, 1993

Dear Beach Manager:

The attached guidelines were developed by the Division of Fisheries and Wildlife to help managers and property owners comply with regulations pursuant to the Massachusetts Endangered Species Act and Massachusetts Wetlands Protection Act pertaining to the protection of piping plovers, terns, and their habitats.

These guidelines have evolved through numerous discussions and consultations with other state and federal resource management agencies, private conservation groups, wildlife biologists, beach managers, beach users, and town conservation commissions. Through these guidelines, we are seeking to provide necessary protection to piping plovers and terns without unnecessarily restricting appropriate access to Massachusetts' beaches.

Please contact the staff of our Natural Heritage and Endangered Species Section at 508-792-7270 if you have questions about these guidelines or would like to discuss specific issues of rare species management on your beaches.

Sincerely,

Wayne F. MacCallum,
Director

encl.

Division of Fisheries & Wildlife
Leverett Saltonstall Building,
Government Center 100 Cambridge Street, Boston, MA 02202 (617) 727-3151
An Agency of the Department of Fisheries, Wildlife & Environmental Law Enforcement

GUIDELINES FOR MANAGING RECREATIONAL USE OF BEACHES TO PROTECT PIPING PLOVERS, TERNS, AND THEIR HABITATS IN MASSACHUSETTS

Massachusetts Division of Fisheries and Wildlife
Natural Heritage and Endangered Species Program
Field Headquarters, Rt. 135
Westborough, MA 01581

21 April 1993

I. INTRODUCTION

The Massachusetts Division of Fisheries and Wildlife (the Division) has developed the following guidelines to assist beach managers and property owners with protecting piping plovers, least terns, common terns, roseate terns, arctic terns, and their habitats. Implementing these guidelines will help beach managers and property owners avoid potential violations of the Massachusetts Endangered Species Act (MGL c. 131A) and its implementing regulations (321 CMR 10.00) involving recreational use of beaches used by piping plovers and terns for breeding and nesting habitat.

The Division intends to apply these guidelines in its review of Notices of Intent, pursuant to the Massachusetts Wetlands Protection Act regulations (310 CMR 10.37), for vehicular use of beaches where piping plovers and terns occur.

The Department of Environmental Protection has developed a set of recommended conditions for barrier beach management to be used by municipal conservation commissions in drafting Orders of Conditions. In addition, the Massachusetts Barrier Beach Task Force, coordinated by the Office of Coastal Zone Management, has developed a comprehensive set of guidelines covering the full range of barrier beach management issues. The following guidelines should be read and applied in conjunction with these other documents.

Users of these piping plover and tern guidelines are advised that they do not supersede any law, regulation, or official policy of this or any other agency. Rather, these guidelines are intended to complement other regulatory review processes regarding recreational activities on beaches by providing a standard set of scientifically based management recommendations.

This document contains five sections: 1) an introduction, 2) summaries of life histories of these species and threats to their continued existence in the state, 3) a summary of pertinent laws and regulations, 4) guidelines for managing and protecting plovers, terns, and their habitats, and 5) literature cited.

In these guidelines, the Division has sought to provide the necessary protection to piping plovers and terns without

unnecessarily restricting appropriate access along all of the state's beaches. The Division has a long history of promoting the rights of citizens to enjoy a variety of outdoor pursuits, provided that they do not jeopardize the state's wildlife resources. The Division has worked to facilitate fishing and hunting access statewide and has supported the common law right of access to the shorelines of the coast and "Great Ponds" for the purposes of fishing and fowling. Although these guidelines make it clear that it will be necessary at times to restrict vehicular access temporarily on beaches where and when piping plovers and terns are present, the Division will only support such restrictions when it is necessary to protect the habitat, nests, and unfledged chicks of plovers and terns. The Division will continue to seek and consider management measures that offer maximum flexibility in balancing recreational use with protection of rare species and their habitats. Even when vehicular access is restricted, the Division will normally support continued access to beaches for fishermen and other recreational users by foot and by boat.

II. SPECIES STATUS, LIFE HISTORY, AND THREATS

Piping Plover

Piping plovers are small, sand-colored shorebirds that nest on sandy, coastal beaches from South Carolina to Newfoundland. The U.S. Atlantic coast population is listed as "Threatened" by the U.S. Fish and Wildlife Service under provisions of the U.S. Endangered Species Act of 1973 (U.S. Fish and Wildlife Service 1988), and was estimated at 790 pairs in 1992 (U.S. Fish and Wildlife Service 1992). In Massachusetts, the piping plover is also listed as "Threatened" by the Massachusetts Division of Fisheries and Wildlife under provisions of the Massachusetts Endangered Species Act. In 1992, 213 pairs of piping plovers nested on Massachusetts beaches (Melvin 1992).

Piping plovers nest on coastal beaches above the high-tide line, sand flats at the end of sand spits, gently sloping foredunes, and in blow-outs or washover areas between or behind coastal dunes. They may also nest where sandy dredged material has been deposited. Nests are simple scrapes in the sand or mixtures of sand, gravel, and shells. Nests are placed on open sand or in patches of sparse to moderately dense beach grass and other dune vegetation. Piping plovers depend on natural processes of beach erosion and accretion through wind and wave action to maintain suitable nesting habitat.

Piping plovers return to nesting beaches in Massachusetts

from mid-March to early May. Males establish and defend territories and court females. Nesting may occur from mid-April through late July. Clutch size is usually four eggs, and eggs are usually incubated for 27-28 days before hatching. Piping plovers fledge only a single brood per season, but may renest several times if previous nests are lost. Chicks are precocial and able to move about within hours after hatching. They may move hundreds of yards from the nest site during their first week of life. Chicks remain together with one or both parents until they fledge (are able to fly) at 25 to 35 days of age. Depending on date of hatching, unfledged chicks may be present from late May until mid-August, although most fledge by the end of July. Adults and chicks feed on amphipods, marine worms, flies, and other invertebrates. The most important feeding habitats for both adults and chicks are intertidal areas and wrack (seaweed, vegetation, shells, and other organic debris deposited on the beach by tides and storms) (Gibbs 1986, Goldin et al. 1990, Hoopes et al. 1992).

Sandy beaches that provide nesting habitat for piping plovers are also attractive recreational habitats for people and their pets. Human recreational activities can be a source of both disturbance and direct mortality to piping plovers (Blodget 1990, Melvin et al. 1991). People on beaches may inadvertently crush eggs, cause nests to be abandoned, and disturb or displace unfledged chicks. Unleashed dogs may chase adults, kill chicks, and eat eggs. Kites and fireworks are highly disturbing to piping plovers (Hoopes et al. 1992; Howard et al. 1993).

Unrestricted use of motorized vehicles on beaches is a serious threat to piping plovers and their habitats. Vehicles can crush both eggs and chicks (Burger 1986, Patterson 1988, Strauss 1990, Melvin et al. 1991). In Massachusetts, biologists documented 7 incidents in which 9 chicks were killed by vehicles between 1989 and 1992 (Melvin et al. 1993). Many biologists that monitor and manage piping plovers believe that many more chicks are killed by vehicles than are found and reported. On sections of Massachusetts beaches used by vehicles during nesting and brood-rearing periods, breeding plovers are generally either absent or less abundant than expected given available nesting and feeding habitat. In contrast, plover abundance and productivity has increased on beaches where vehicle restrictions during chick-rearing periods have been combined with protection of nests from predators.

Typical behaviors of piping plover chicks increase their vulnerability to vehicles (Melvin et al. 1993). Chicks frequently move between the upper berm or foredune and feeding habitats in the wrack line and intertidal zone. These movements place chicks in the paths of vehicles driving along the berm or

through the intertidal zone. Chicks stand in, walk, and run along tire ruts, and sometimes have difficulty crossing deep ruts or climbing out of them. Chicks sometimes stand motionless or crouch as vehicles pass by, or do not move quickly enough to get out of the way. Wire fencing placed around nests to deter predators is ineffective in protecting chicks from vehicles because chicks typically leave the nest within a day after hatching and move extensively along the beach to feed.

Vehicles also degrade piping plover habitat by crushing wrack into the sand and making it unavailable as cover or a foraging substrate, by creating ruts that may trap or impede movements of chicks, and by causing disturbance that may prevent plovers from using habitat that is otherwise suitable (Goldin et al. 1990, Strauss 1990, Melvin et al. 1993).

Least Tern

Least terns are small, white and black seabirds that nest along Atlantic coast beaches from southern Maine to Florida. The least tern is listed as a "Species of Special Concern" by the Division of Fisheries and Wildlife under provisions of the Massachusetts Endangered Species Act. An estimated 2,642 pairs nested at 51 sites in Massachusetts in 1992 (Blodget 1992).

Least terns nest in habitats that are similar to those of the piping plover, and the two species often nest near each other. Least terns arrive in Massachusetts in early May, engage in elaborate courtship rituals, mate, and quickly establish nesting colonies. Actual nesting occurs from about the third week of May to mid-July. Nesting colonies range in size from several pairs to over 500 pairs. Nests are shallow "scrapes" in the sand, usually in sandy areas devoid of vegetation, but sometimes in areas of sparse beach grass, beach pea, and other dune vegetation. Least terns, like piping plovers, have nested along the Atlantic coast for thousands of years and depend on natural processes of beach and dune erosion and accretion to maintain their habitats.

Clutches consist of 1-3 eggs and incubation averages 21 to 23 days. Least terns are single-brooded, but will renest multiple times if previous nests are lost. Chicks are precocial and may move considerable distances along the beach before fledging, which occurs after 20-22 days. Adults deliver fish caught in the surrounding waters to chicks. Soon after chicks are able to fly, least terns gather in pre-migratory flocks and depart southward; most are gone before the end of August.

Least terns are vulnerable to disturbance from humans, pets,

and vehicles during periods of courtship and egg-laying in May and June. Similar to piping plovers, incubating least tern adults, eggs, and chicks are extremely cryptic. Prolonged or repeated disturbance at colonies can lead to egg and chick loss from exposure, predation, or abandonment. Least tern chicks are also vulnerable to mortality caused by off-road vehicles, and may stand or crouch in or walk and run along vehicle ruts.

Common, Roseate, and Arctic Terns

These three similar species of white and black seabirds nest together in mixed-species colonies. All are slightly larger than the least tern. The common tern is indeed the most "common" of the group. In 1992, 8,600 pairs were estimated at 35 sites in Massachusetts, although only 9 of those colonies exceeded 100 pairs (Blodget 1992). The arctic tern, at the southern edge of its natural range in Massachusetts, has been declining since the 1950's and reached an all-time low of only 8 pairs in 1992. Both of these species are listed by the Massachusetts Division of Fisheries and Wildlife as "Species of Special Concern" under provisions of the Massachusetts Endangered Species Act.

The Northeastern population of the roseate tern is listed as "Endangered" by both the U.S. Fish and Wildlife Service under the U.S. Endangered Species Act of 1973 (U.S. Fish and Wildlife Service 1989), and the Massachusetts Division of Fisheries and Wildlife under provisions of the Massachusetts Endangered Species Act. Of an estimated 1,412 pairs in Massachusetts in 1992, 1,375 pairs (97%) nested on Bird Island in Buzzards Bay (Blodget 1992). The rest were scattered among large colonies of common terns.

These three species of larger terns prefer to nest on offshore islands and remote tips of barrier beaches. Unfortunately, gulls have usurped most optimal nesting sites since the 1950's, forcing terns to nest at a limited number of secondary inshore sites where they are more exposed to human disturbance and a host of land-based predators.

The life histories of these three species of terns are generally similar. Exemplifying the three, common terns select dune areas with moderate to dense stands of beach grass and other dune vegetation. Birds arrive from the south in early May and select colony sites before the end of May. Ritualized courtship and pair formation occur on the beach and sandflats adjacent to the colony site. Nesting colonies range from a few to over 4,000 pairs. Nests are usually scrapes in the sand lined with beach grass and seaweed. Clutches of 2-3 eggs are laid and both parents share incubation duties for about 23 days. Young are precocial but are fed and brooded by adults. Diets of these

terns are almost exclusively fish. As the young approach fledging at about 28 days, they congregate in rearing or "nursery" areas on broad expanses of beach and sand flats, where they loaf and are fed by adults. At some sites, thousands of young terns may be present in these nursery areas from late July through mid-August. After mid-August, most terns have fledged and all three species gather at staging areas prior to departing for winter quarters by the end of August.

Prolonged or repeated disturbance at nesting colonies or nursery areas of common, arctic, or roseate terns can lead to egg and chick loss from exposure, predation, or abandonment. Eggs and young chicks tend to be less subject to mortality from vehicles because they occur more often in dune areas, but older chicks are sometimes run over when they move onto the outer beach prior to fledging. Older chicks have also been found dead, tangled in kite string.

III. MASSACHUSETTS LAW

This section is provided to give a brief overview of provisions of the Massachusetts Wetlands Protection Act and Endangered Species Act that are pertinent to the management of piping plovers, terns, and their habitats. The reader is strongly advised to read the official texts of the current laws and regulations cited below.

Massachusetts Wetlands Protection Act (MGL c. 131 s. 40)

The Natural Heritage and Endangered Species Program of the Massachusetts Division of Fisheries and Wildlife (the Program) acts as the scientific authority to determine what is actual habitat and to provide an opinion about whether proposed activities subject to the Wetlands Protection Act will have adverse effects on rare wetlands wildlife habitat. Opinions issued by the Program are presumed to be correct, although this presumption is rebuttable and may be overcome upon a clear showing to the contrary.

Massachusetts Endangered Species Act (MGL c. 131A)

The Massachusetts Endangered Species Act (MESA) and regulations (321 CMR 10.00) are administered by the Massachusetts Division of Fisheries and Wildlife. The Act prohibits the "taking" of any species of animal or plant listed as

"Endangered", "Threatened", or "Species of Special Concern" in Massachusetts. For animals, "taking" is defined as: "to harass, harm, pursue, hunt, shoot, hound, kill, trap, capture, collect, process, disrupt the nesting, breeding, feeding, or migratory activity or attempt to engage in any such conduct, or to assist such conduct". Regulations implementing the Act state further that: "All state agencies shall utilize their authorities in furtherance of the purposes of MESA and these regulations; review, evaluate and determine the impact on Endangered, Threatened and Special Concern species or their habitats of all works, projects, or activities conducted by them; and use all practicable means and measures to avoid or minimize damage to such species or their habitats." This includes "any work, project, or activity either directly undertaken by a state agency, or if undertaken by a person, which seeks the provision of financial assistance by an agency or requires the issuance of permits by an agency".

IV. MANAGEMENT GUIDELINES

VEHICLE MANAGEMENT

Protection of Nests and Nesting Habitat

On beaches where vehicles will be driven, all areas of suitable piping plover nesting habitat, as determined by the Division, should be identified and delineated with posts and warning signs or symbolic fencing on or before April 1 each year. Suitable nesting habitat for all species of terns should be identified and so delineated on or before May 15 each year.

All vehicular access into or through delineated nesting habitat should be prohibited. However, prior to hatching, vehicles may pass by such areas along designated vehicle corridors established along the outside edge of plover and tern nesting habitat. Vehicle may also park outside delineated nesting habitat, if beach width and configuration and tidal conditions allow. Vehicle corridors or parking areas should be moved, constructed, or temporarily closed if territorial, courting, or nesting plovers or terns are disturbed by passing or parked vehicles, or if disturbance is anticipated because of unusual tides or expected increases in vehicle use during weekends, holidays, or special events.

Protection of Chicks and Chick Habitat

Sections of beaches where unfledged piping plover or tern chicks are present should be temporarily closed to all vehicles not deemed essential. (See the provisions for essential vehicles below.)

When unfledged plover chicks are present, vehicles should be prohibited from all dune, beach, and intertidal habitat within 100 yards of either side of a line drawn through the nest site and perpendicular to the long axis of the beach. The resulting 200 yard-wide area of protected habitat for plover chicks should extend from the ocean-side low water line to the bay-side low water line or to the farthest extent of dune habitat if no bay-side intertidal habitat exists. However, vehicles may be allowed to pass through portions of the protected area that are considered inaccessible to plover chicks because of steep topography, dense vegetation, or other naturally-occurring obstacles. If unfledged plover chicks move outside the original 200 yard-wide area of protected habitat, then the boundaries of the protected area should be adjusted to provide at least a 100 yard buffer between chicks and vehicles.

When unfledged least tern chicks are present, vehicles should be prohibited from all dune, beach, and intertidal habitat within 100 yards of either side of lines drawn through the outermost nests in the colony and perpendicular to the long axis of the beach. The resulting area of protected habitat for least tern chicks should extend from the ocean-side low water line to the bay-side low water line, or to the farthest extent of dune habitat if no bay-side intertidal zone exists. If unfledged chicks move outside the original protected area, then the boundaries of the protected area should be adjusted to provide at least a 100 yard-wide buffer between unfledged chicks and vehicles. However, vehicles may pass through any portions of the protected area considered inaccessible to least tern chicks because of distance, steep topography, dense vegetation, or other naturally-occurring obstacles. Because least tern chicks disperse from nests shorter distances and at older ages than piping plover chicks, under some circumstances it may be possible to allow passage of vehicles through portions of protected least tern chick habitat if, in the opinion of the Division, this can occur without substantially increasing threats to least tern chicks or their habitats.

Timing of Vehicle Restrictions in Chick Habitat

Restrictions on use of vehicles in areas where unfledged plover or tern chicks are present should begin on or before the

date that hatching begins and continue until chicks have fledged. For purposes of vehicle management, plover chicks are considered fledged at 35 days of age or when observed in flight, whichever occurs first. Tern chicks are considered fledged when they are capable of flight.

When piping plover nests are found before the last egg is laid, restrictions on vehicles should begin on the 26th day after the last egg is laid. This assumes an average incubation period of 27 days, and provides a 1 day margin of error.

When plover nests are found after the last egg has been laid, making it impossible to predict hatch date, restrictions on vehicles should begin on a date determined by 1 of 3 scenarios:

1) If a plover nest found with a complete clutch is monitored twice per day, at dawn and dusk (before 0600 hrs and after 1900 hrs), vehicle use may continue until hatching begins. Nests should be monitored at dawn and dusk to minimize the time that hatching may go undetected if it occurs after dark. Whenever possible, nests should be monitored from a distance with spotting scope or binoculars to minimize disturbance to incubating plovers.

2) If a plover nest is found with a complete clutch before May 22 (the earliest recorded hatch date for piping plovers in Massachusetts), and is not monitored twice per day, at dawn and dusk, then restrictions on vehicles should begin May 22.

3) If a plover nest is found with a complete clutch on or after May 22, and is not monitored twice per day, at dawn and dusk, then restrictions on vehicles should begin immediately.

If hatching occurs earlier than expected, or chicks are discovered from an unreported nest, restrictions on vehicles should begin immediately.

If, in the opinion of the Division, ruts are present that are deep enough to restrict movements of plover chicks, or vehicle impacts on wrack are so severe that wrack must be allowed to accumulate naturally prior to hatching, then restrictions on vehicles should begin at least 5 days prior to the anticipated hatching date of plover nests. If a plover nest is found with a complete clutch, precluding estimation of hatching date, and availability of wrack has been substantially reduced by vehicle passage, or deep ruts have been created that could reasonably be expected to impede chick movements, then restrictions on vehicles should begin immediately.

Restrictions on use of vehicles in least tern chick habitat should begin as soon as hatching begins (as early as June 12). Restrictions may begin later if, in the opinion of the Division, tern chicks are not endangered by vehicles because of distance or intervening steep terrain, dense vegetation, or other naturally-occuring barriers.

Areas of dune, beach, or intertidal habitat used as nursery areas by unfledged or recently fledged tern chicks, as identified by the Division, should be delineated with posts, warning signs or symbolic fencing no later than June 21. All access by vehicles into posted tern nursery areas should be prohibited while unfledged or recently-fledged tern chicks are present in these areas, until it is determined that use of nursery areas by young terns has ended (i.e. young terns are no longer being fed by adult terns).

Essential Vehicles

Essential vehicles, as defined by municipal conservation commissions pursuant to the Guidelines for Barrier Beach Management in Massachusetts developed by the Massachusetts Barrier Beach Task Force, should only travel on sections of beaches where unfledged plover or tern chicks are present if such travel is absolutely necessary and no other reasonable travel routes are available. Essential vehicles should travel through chick habitat areas only during daylight hours, except in emergencies, and should be guided by a qualified monitor who has first determined the location of all unfledged plover and tern chicks. All steps should be taken to minimize number of trips by essential vehicles through chick habitat areas. Use of open, 3 or 4-wheel motorized all-terrain vehicles (ATVs) or non-motorized all-terrain bicycles is recommended whenever possible for monitoring and law enforcement because of the improved visibility afforded operators. Homeowners should consider other means of access, e.g., by water, or shuttle services, during periods when chicks are present. A log should be maintained by the beach manager of the date, time, vehicle number and operator, and purpose of each trip through areas where unfledged chicks are present. Personnel monitoring plovers and terns should maintain and regularly update a log of the numbers and locations of unfledged plover and tern chicks on each beach. Drivers of essential vehicles should review the log each day to determine the most recent number and location of unfledged chicks.

Travel by essential vehicles should avoid the wrack line and should be infrequent enough to avoid creating deep ruts that could impede chick movements. If essential vehicles are substantially reducing availability of wrack or are creating ruts

that could impede chick movements, use of essential vehicles should be further reduced and, if necessary, restricted to only emergency vehicles.

MANAGEMENT OF OTHER RECREATIONAL USES

The activities discussed in this section are not subject to the jurisdiction of the Wetlands Protection Act because they are not considered to be alterations of wetland resources areas. The following guidelines should only be applied in reference to the Massachusetts Endangered Species Act.

On beaches where pedestrians, joggers, sun-bathers, picnickers, fishermen, boaters, horseback riders or other recreational users will be present in numbers that could harm or disturb incubating plovers or terns their eggs, or chicks, refuge areas of at least 50 yard-radius around nests and above the high tide line should be delineated with warning signs and symbolic fencing. Only persons engaged in rare species monitoring, management, or research activities should enter refuge areas. Refuge areas should remain fenced as long as viable eggs or unfledged chicks are present.

Refuge areas around nests should be expanded if a 50 yard-radius is deemed inadequate to protect incubating adults or unfledged chicks from harm or disturbance. This may include situations where plovers or terns and especially intolerant of human presence, or where a 50 yard-radius refuge provides insufficient escape cover or alternative foraging opportunities for plover chicks. If nests are discovered outside fenced areas, fencing should be extended to create a sufficient buffer to prevent harm or disturbance to incubating adults, eggs, or unfledged chicks. On some beaches where plovers and terns have traditionally nested or where suitable habitat occurs, it may be necessary to symbolically fence portions of habitat during March or April, prior to plover nesting, or during May, prior to tern nesting, if, in the opinion of the Division, failure to do so could discourage plovers or terns from nesting as a result of disturbance from human use.

Rearing or nursery areas used by unfledged or recently fledged tern chicks, as identified by the Division, should be delineated with posts, warning signs, or symbolic fencing not later than June 21. Only persons engaged in rare species monitoring, management, or research should enter posted or fenced tern nursery areas while unfledged tern chicks or tern chicks being fed by adult terns are present, although individuals may pass by outside these areas. Such nursery areas may be re-opened

when all tern chicks have fledged and are not being fed by adult terns.

Pets should be leashed and under control of their owners at all times from April 1 to August 31 on beaches where piping plovers or terns are present or have traditionally nested. Pets should be prohibited on these beaches from April 1 through August 31 if, based on observations and experiences, pet owners fail to keep pets leashed and under control.

Kite flying should be prohibited within 200 yards of nesting or territorial adult or unfledged juvenile piping plovers or terns from April 1 to August 31.

Fireworks should be prohibited on beaches where plovers or terns nest from April 1 to August 31.

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APPENDIX I

Massachusetts Department of Environmental Protection
Recommended Conditions for Barrier Beaches

Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Protection

William F. Weld
Governor
Daniel S. Greenbaum
Commissioner

June 30, 1993

RE: Wetlands Act Review for Activities on Barrier Beaches

Dear Interested Party:

The Secretary of Environmental Affairs established the Barrier Beach Task Force, chaired by the Massachusetts Coastal Zone Management Office (MCZM), to identify issues of major concern and develop recommendations for managing these sensitive coastal areas in the face of competing interests and uses. In conjunction with this effort, the Department of Environmental Protection (DEP) has developed the attached "Recommended Conditions for Activities on Barrier Beaches" as guidance to conservation commissions, beach managers, and other interested parties in filing notices of intent and issuing orders of conditions under the Wetlands Protection Act (MGL c 131 § 40). We believe that these conditions offer appropriate protection for the public interests associated with barrier beaches while balancing the needs of competing users.

Purpose of this Guidance

Barrier beach systems are dynamic land forms that undergo constant change and provide a variety of public benefits, including recreation, fishing, and important wildlife habitat. Accordingly, the Department recommends that barrier beach management plans be adopted to protect and manage these important values. As a result of the work of the Barrier Beach Task Force, MCZM is now finalizing "Guidelines for Barrier Beach Management in Massachusetts" to assist in the development of such plans.

A number of beach owners and managers have developed, or are in the process of developing, management plans and filing notices of intent, as maybe appropriate, for certain activities on barrier beaches. Others have not yet begun the process. The attached conditions are being issued in advance of the forthcoming Barrier Beach Task Force guidance document in order that those already in the permit process may be aware of the standards the Department would expect to be incorporated in orders of conditions. Our goal is to ensure that when orders of conditions are needed, work can be approved quickly and that ongoing activities are not unnecessarily disrupted by the regulatory review process.

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DEP has worked closely with interested groups to address the conflicts that can arise from competing demands on barrier beach resources. It became apparent through these discussions that communication, coordination, and cooperation can resolve most conflicts. However, the effort to reconcile the use of off-road vehicles (ORVs) with the protection of rare and endangered wildlife species and their habitats continues to generate debate. Sound barrier beach management plans will help balance these interests. All parties have expressed a desire to be as flexible as possible to allow ORV and other uses while avoiding impacts to wildlife and habitats. Still, specific situations may arise where ORV use will have to be limited or prohibited at certain times - when wildlife and their habitats are vulnerable during critical periods in their life cycles. The attached conditions reflect the need to achieve such a balance.

Activities to be Regulated Under the Wetlands Protection Act

In cooperation with CZM and the Barrier Beach Task Force, DEP has reviewed the types of activities that occur on barrier beaches and has determined that, while it is important to include a broad range of activities in barrier beach management plans, not all of these activities are subject to the Wetlands Protection Act. DEP recommends that the following activities and projects be included in notices of intent (NOIs) as well as management plans because they are appropriate for review under the Wetlands Protection Act (MGL c 131 § 40) and its regulations (310 CMR 10.00):

- construction of buildings, walkways, roads, parking areas, and other facilities;
- ORV use and access to Barrier Beaches (310 CMR 10.29), which generally include Coastal Dunes (310 CMR 10.28) and Coastal Beaches (310 CMR 10.27);
- beach nourishment and dune construction or restoration projects; and
- beach cleaning activities involving heavy equipment (e.g. tractor).

A number of other activities that take place on barrier beaches and which may be included in barrier beach management plans may not be appropriate for review under the Wetlands Protection Act. These generally are "passive" recreational activities that are not likely to alter barrier beaches. They are managed best by the communities and beach managers who have first hand knowledge of local conditions and interests. Examples of activities that do not, in DEP's opinion, require the filing of an NOI are: foot traffic, boating and horseback riding. While DEP recognizes that concentrated or excessive use of a particular area has the potential to adversely affect part of a barrier beach, the general experience has been that these activities do not have adverse impacts and therefore are not subject to review under the Wetlands Protection Act.

One activity not specifically addressed in the attached recommendations is aquaculture activities. Efforts to evaluate environmental impacts and consolidate permitting for coastal aquaculture are ongoing. When these initiatives have been more fully developed, supplemental conditions will be issued that cover aquaculture activities as they relate to a number of regulatory programs.

DEP defers to the scientific opinions of the Natural Heritage and Endangered Species Program (NHESP) in determining the location and extent of actual habitat of state-listed rare species. DEP also relies on NHESP to determine whether a proposed activity will have an adverse effect, whether short- or long-term, on the habitat of the local rare species population. NHESP's opinion is presumed to be correct and may be overcome only upon a clear showing to the contrary.

Barrier beach management plans may require modifications from time to time in order to protect these sensitive areas adequately as conditions change or when an unforeseen impact occurs. Plans should be adopted, reviewed, and modified based on input from a variety of local and state interest groups to ensure that all viewpoints are represented.

I encourage you to review the attached information when developing and implementing barrier beach management plans and in filing and reviewing notices of intent for certain activities conducted under such plans. If you have any questions or need assistance on these matters, please contact Robert Golledge, Wetlands Protection Program Chief in the Division of Wetlands and Waterways at 617-292-5695.

Sincerely,

Daniel S. Greenbaum
Commissioner

c.c. Christy Foote-Smith, Director
Division of Wetlands and Waterways

Jeff Benoit, Director
Massachusetts Coastal Zone Management

Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Protection

William F. Weld
Governor
Daniel S. Greenbaum
Commissioner

RECOMMENDED CONDITIONS FOR ACTIVITIES ON BARRIER BEACHES
June 1993

The best approach for writing an order of conditions for a particular barrier beach is to look to the performance standards of the Wetlands Protection Regulations (310 CMR 10.00) for each of the wetland resource areas found on that barrier beach and make sure the order of conditions addresses those performance standards.

For additional information on the background of the following recommended conditions, please refer to the "Guidelines For Barrier Beach Management In Massachusetts" published by the Massachusetts Coastal Zone Management Office.

I. Recommended Conditions for Vehicle Management

A. Protection of Nests and Nesting Habitat

1. On beaches where vehicles will be driven, all areas of suitable piping plover nesting habitat, as determined by the Natural Heritage and Endangered Species Program (NHESP), shall be identified and delineated with posts and warning signs or symbolic fencing on or before April 1 of each year. Suitable nesting habitat for all species of terns shall be identified and so delineated on or before May 15 of each year.

2. All vehicular access into or through delineated nesting habitat shall be prohibited except as provided elsewhere in these Conditions. Prior to hatching, vehicles may pass by such areas along designated vehicle corridors established along the outside edge of plover and tern nesting habitat. Vehicles also may park outside delineated nesting habitat, if beach width and configuration and tidal conditions allow. Vehicle corridors or parking areas shall be moved, constricted, or temporarily closed if territorial, courting, or nesting habitat are disturbed by passing or parked vehicles, or if disturbance is anticipated because of unusual tides or expected increases in vehicle use during weekends, holidays, or special events.

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B. Protection of Piping Plover or Tern Chick Habitat

1. Sections of beaches where unfledged piping plover or tern chick habitat exists shall be closed temporarily to all vehicles not deemed essential.

2. When unfledged plover chick habitat exists, as determined by NHESP, vehicles shall be prohibited from all dune, beach, and intertidal habitat within one hundred (100) yards of either side of a line drawn through the nest site and perpendicular to the long axis of the beach. The resulting two hundred (200) yard-wide area of protected habitat for plover chick habitat should extend from the ocean-side mean low water line to the bay-side mean low water line, or to the farthest extent of dune habitat if no bay-side intertidal habitat exists. However, vehicles may be allowed to pass through portions of the protected area that do not serve as actual habitat, as determined by NHESP, due to site-specific conditions such as steep topography, dense vegetation, or other naturally-occurring obstacles. The boundaries of the protected habitat shall be adjusted periodically to provide at least a one hundred (100)-yard buffer between actual habitat and vehicles unless site specific conditions allow for a reduction in this distance.

3. When unfledged least tern chicks occupy their habitat, vehicles shall be prohibited from all dune, beach, and intertidal habitat within 100 yards of either side of lines drawn through the outermost nests in the colony and perpendicular to the long axis of the beach, unless site specific conditions allow for a reduction in this distance. The resulting area of protected habitat for least tern chicks shall extend from the ocean-side low water line to the bay-side mean low water line, or to the farthest extent of dune habitat if no bay-side intertidal zone exists. If unfledged chicks move outside the identified habitat, then the boundaries of the protected area shall be adjusted to provide at least a one hundred (100) yard-wide buffer, as determined by NHESP, between unfledged chick habitat and vehicles. However, vehicles may pass through any portions of the actual habitat that are considered inaccessible as outlined above.

C. Timing of Vehicle Restrictions in Piping Plover or Tern Chick Habitat

1. Restrictions on use of vehicles in actual habitats where unfledged plover or tern chicks are present shall begin on or before the date that hatching begins and continue until chicks have fledged. For purposes of vehicle management, plover chicks are considered fledged at 35 days of age or when observed in flight, whichever occurs first. Tern chicks are considered fledged when they are capable of flight.

2. When piping plover nests are found before the last egg is laid, restrictions on vehicles shall begin on the 26th day after the last egg

is laid. This assumes an average incubation period of 27 days and provides a 1 day margin of error.

3. When plover nests are found after the last egg has been laid, making it impossible to predict hatch date, restrictions on vehicles shall begin on a date determined by 1 of 3 scenarios:

(a) If a plover nest found with a complete clutch is monitored twice per day, at dawn and dusk (before 6:00 a.m. and after 7:00 p.m.), vehicle use may continue until hatching begins. Nests should be monitored at dawn and dusk to minimize the time that hatching may go undetected if it occurs after dark. Whenever possible, nests should be monitored from a distance with a spotting scope or binoculars to minimize disturbance to incubating plovers.

(b) If a plover nest is found with a complete clutch before May 20 (the earliest recorded hatch date for piping plovers in Massachusetts) and is not monitored twice per day, at dawn and dusk (before 6:00 a.m. and after 7:00 p.m.), then restrictions on vehicles should begin on May 20.

(c) If a plover nest is found with a complete clutch on or after May 20 and is not monitored twice per day, at dawn and dusk (before 6:00 a.m. and after 7:00 p.m.), then restrictions on vehicles should begin immediately.

4. If hatching occurs earlier than expected or chicks are discovered from an unreported nest, restrictions on vehicles shall begin immediately.

5. If NHESP issues a notice that ruts have developed that may adversely affect the actual plover habitat, or that vehicle impacts on wrack are so severe that wrack must be allowed to accumulate naturally prior to hatching, then restrictions on vehicles shall begin at least 5 days prior to the anticipated hatching date of plover nests. If a plover nest is found with a complete clutch, precluding estimation of hatching date, and if availability of wrack has been substantially reduced by vehicle passage or if deep ruts have been created that reasonably could be expected to impede chick movements, then restrictions on vehicles shall begin immediately.

6. Restrictions on the use of vehicles in least tern chick habitat shall begin as soon as hatching begins (as early as June 12). Restrictions may begin later if, upon notice from NHESP, tern chick habitat is not adversely affected by vehicles because of distance or naturally-occurring barriers such as intervening steep terrain, or dense vegetation.

7. Areas of dune, beach, or intertidal habitat used as nursery areas by unfledged or recently fledged tern chicks, as identified by

NHESP, should be delineated with posts, warning signs, or symbolic fencing not later than June 21. All access by vehicles into posted tern habitat shall be prohibited while unfledged or recently-fledged tern chicks are present in these areas, until it is determined that use of habitat by young terns has ended (i.e., young terns are no longer being fed by adult terns).

D. Essential Vehicles

1. Essential vehicles, as defined by the Conservation Commission pursuant to "Guidelines For Barrier Beach Management In Massachusetts" published by the Massachusetts Coastal Zone Management Office, shall travel on sections of beaches where unfledged plover or tern chicks are present only if such travel is absolutely necessary and no other reasonable travel routes are available.

2. Essential vehicles should travel through chick habitat areas only during daylight hours, except in emergencies, and should be guided by a qualified monitor who first has determined the location of all unfledged plover and tern chicks.

3. All steps should be taken to minimize the number of trips made by essential vehicles through chick habitat areas.

4. Use of open, 3- or 4-wheel motorized all-terrain vehicles (ATVs) or non-motorized all-terrain bicycles is recommended whenever possible for monitoring and law enforcement because of the improved visibility afforded operators. Homeowners should consider other means of access, e.g., by foot, water, or shuttle services, during periods when chicks are present.

5. A written log should be maintained by the beach manager of the date, time, vehicle number and operator, and purpose of each trip through areas where unfledged chicks are present. Personnel who monitor plovers and terns should maintain and regularly update a log of the numbers and locations of unfledged plover and tern chicks on each beach. Drivers of essential vehicles should review the log each day to determine the most recent number and location of unfledged chicks.

6. Travel by essential vehicles should avoid the wrack line and should be infrequent enough to avoid creating deep ruts that could impede chick movements. If essential vehicles are substantially reducing availability of wrack or are creating ruts that could impede chick movements, use of essential vehicles should be further reduced and, if necessary, restricted to only emergency vehicles.

II. **Beach and Dune Restoration**

RECOMMENDED CONDITIONS for BARRIER BEACHES (cont.)

1. There shall be no removal of existing sediment from, or regrading of, coastal beaches (including tidal flats) for the purposes of beach or dune restoration.

2. In order to protect the barrier's ability to migrate landward, sediment deposited through the overwash process shall not be removed from the overwash fans located on salt marsh areas (see Storm Damage Restoration Part V).

3. Where dune reconstruction occurs proximate to salt marsh, siltation fencing shall be deployed and maintained at the work limit to contain fill. Disturbance beyond the work limit will not be permitted.

4. Storm wrack shall not be deposited on a salt marsh.

5. Only indigenous plants and appropriate plant material shall be used.

6. During beach cleaning activities, the applicant shall leave sufficient wrack to provide a seed source for the beach and to protect the wildlife habitat feeding function that the wrack provides to a variety of shorebirds. Beach cleaning should be accomplished using a rake in such a manner as to preserve the existing form, volume, and grain size distribution.

III. Construction of Boardwalks And Elevated Walkways

1. Boardwalks and walkways should be elevated a minimum of 2 feet from grade with spacing in-between the planking sufficient to allow the passage of sunlight, but not to inhibit, where designated and appropriate, handicap access.

2. Access for the construction of boardwalks and walkways shall be provided in a location and manner that will not result in additional alterations to wetland resources. The access route and method of construction shall be as shown on the plan of record.

3. For piers, walkways, or necessary equipment in any marsh:

(a) No creosote-treated timber shall be used.

(b) To the extent possible, piling shall be driven. If jetting is required, displaced sand shall be raked smooth.

(c) Crane mats shall be used for any heavy equipment traversing the marsh for construction purposes.

(d) No dredging material shall be placed on the marsh except for material deposited for salt marsh restoration activities.

IV. **Dredging**

1. There shall be no openings allowed through barrier beaches except for those projects that fall within the provisions and guidelines provided in the Department of Environmental Protection's Wetlands Protection Program Interim Policy 91-2, entitled "Criteria for Evaluating and Permitting Openings of Salt Ponds In Order to Manage, Maintain or Enhance Marine Fisheries."

V. **Storm Damage Restoration**

1. All storm restoration activities shall have no adverse impact on actual Rare Species Habitat, as determined by NHESP, in foredune and overwash areas. Replanting, installation and other restoration activities in Rare Species Habitat shall be done in consultation with NHESP.

2. The excavation of coastal beach (including the intertidal area) for replacement of sand in a dune or any other Resource Area is prohibited.

3. When off-site sediment is used for storm damage restoration, a sediment grain-size analysis of the proposed off-site material shall be submitted to the Conservation Commission and DEP for review and approval prior to construction and deposition. This analysis shall be performed by a qualified professional. This off-site material shall be of a grain size compatible to the existing sediment on the dunes and beach.

4. Sediment deposited through overwash process onto the back side of the barrier shall not be removed from the overwash area except where necessary to address public safety. In all cases sediments shall remain within the barrier beach system.

VI. **Construction of Structures/Buildings**

1. All habitable buildings shall be elevated above the one hundred (100) year floodplain on pile foundations and in accordance with the State Building Code (780 CMR 100.00) and Federal Emergency Management Agency regulations.

2. All buildings on barrier beaches shall be constructed on pile foundations at a minimum of two (2) feet above existing grade to allow the movement of sand and sediments due to wave and wind action.

APPENDIX J

Massachusetts Department of Environmental Protection

Wetlands Protection Program Interim Policy 91-2

"Criteria for Evaluating and Permitting
Openings of Salt Ponds in Order to
Manage, Maintain or Enhance Marine Fisheries"

Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Protection

Daniel S. Greenbaum
Commissioner

Wetlands Protection Program Interim Policy 91-2

Criteria for Evaluating and Permitting Openings of Salt Ponds In Order to Manage, Maintain or Enhance Marine Fisheries

PURPOSE

The purpose of this policy is to clarify the Department's position concerning when salt pond openings to the ocean may be allowed pursuant to G.L. c. 131 §40, the Wetlands Protection Act (the "Act"), and to give guidance to the issuing authority by providing a process for the evaluation of a pond opening proposal. This is an interim policy and is intended to allow the Department to gather information and further evaluate the effects of pond openings.

REGULATORY STANDARDS

A salt pond opening is subject to the Act because it involves activities which will alter, dredge, fill or remove resource areas subject to protection under the Act. 310 CMR §10.33(3) provides, generally, that projects in and around salt ponds may not have an adverse effect on the marine fisheries or wildlife habitat of the pond. However, 310 CMR §10.33(4) provides that "Notwithstanding the provisions of 10.33(3), activities specifically required and intended to maintain the depth and the opening of the salt pond to the ocean in order to maintain or enhance the marine fisheries or for the specific purpose of fisheries management, may be permitted." This provision evidences an intent on the part of the Department to allow projects "specifically required and intended" to maintain a salt pond opening necessary to manage, maintain or enhance marine fisheries.

310 CMR §10.33(4) is silent concerning its interaction with the performance standards established under 310 CMR §§ 10.27, 10.28, 10.29, 10.32 and 10.55 for resource areas typically encountered around salt ponds. When the performance standards for these resource areas are read literally it is difficult, if not impossible, for pond opening projects to satisfy the applicable performance standards.

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ANALYSIS

As "activities specifically required and intended to maintain the depth and opening of a salt pond" must necessarily include the breaching of the pond's associated barrier beach (when the opening is presently closed) and would result in impacts to adjacent resource areas, it is the Department's interpretation that the openings may be allowed under limited, controlled conditions when certain prerequisites are satisfied.

When the alteration of inland resource areas will result from a salt pond opening undertaken in accordance with this policy, such alteration may be permitted under 310 CMR §10.53(4). The issuing authority may exercise its judgment to determine that a project to manage, enhance or maintain marine fisheries, conditioned in accordance with this policy, may improve the area's natural capacity to protect the interests identified in the Act.

In order to give full meaning and effect to all regulatory provisions, while protecting the interests of the Act, the Department concludes that salt pond openings may be authorized by the issuing authority when:

a. the applicant demonstrates that the opening is necessary to manage, maintain or enhance an existing or historically viable marine fisheries and

b. conditions are imposed that prevent or minimize adverse effects to Coastal Beaches, Coastal Dunes, Barrier Beaches and any affected inland resource area to the greatest extent possible. "Minimize", as used in this policy, has the same definition as found at 310 CMR §10.23.

If the issuing authority concludes that such conditions cannot be developed, then it must deny the project.

The Department has determined that since salt marshes have a high level of functional value, as recognized by the level of protection afforded this resource area under the regulations, Pond opening projects must satisfy the standards at 310 CMR §10.32(3).

Under no circumstances may a project be permitted which will have any adverse effect on the specified habitat site of rare species as identified pursuant to 310 CMR §§10.37 and 10.59.

REQUIREMENTS FOR PROJECT REVIEW AND CONDITIONING

A. Applicant Must Show That Opening Is For An Approvable Purpose

When the outlet of a salt pond which has supported a viable marine fisheries becomes closed (either because the outlet becomes filled in or its position shifts along the barrier beach), it may be desirable to periodically open the outlet artificially in order to manage, maintain or enhance the fishery. The threshold finding the issuing authority must make is whether the applicant has demonstrated that the primary purpose of the pond opening is to manage, maintain or enhance marine fisheries. An applicant may propose activities to maintain the depth and opening of an existing opening, or activities to re-open a closed pond; provided the applicant demonstrates that the pond has been opened in the past as a result of natural or man-made causes, *and* that a viable fisheries in the pond presently exists or existed in the past.

The existence of a "viable fisheries" shall be determined by the issuing authority using best professional judgment (after consultation with the Division of Marine Fisheries and the local shellfish constable) and shall be based upon submitted information. The existence of a viable marine fisheries and of prior openings may be demonstrated by reliable, credible information. The applicant may submit historical records, including photographic evidence, or if no records exist, he/she may submit an affidavit of one or more individuals made upon personal knowledge.

If an applicant cannot demonstrate an approvable purpose, enabling the issuing authority to make this threshold finding, the issuing authority must deny the project. For example, when the intended purpose of a salt pond opening is to control eutrophication, or to reduce odor, the project would fall outside of this policy and would not be allowed unless it met all of the applicable performance standards of the regulations.

B. Permit Conditions Must Minimize Adverse Impacts

If an applicant demonstrates an approvable purpose, the issuing authority may permit the activity, provided conditions can be imposed that will prevent or minimize adverse effects to resource areas (except salt marshes) in and around the pond to the greatest extent possible. If conditions adequate to prevent or minimize adverse effects cannot be imposed, an Order of Conditions allowing the opening should not be issued.

Proposed salt pond openings for which the applicant has demonstrated an approvable purpose should be evaluated in the

following manner:

1. Assess all impacts to affected resource areas and their respective protected interests;
2. Develop conditions to prevent or minimize adverse effects to existing resource areas to the greatest extent possible, in accordance with the applicable regulatory provisions; and
3. Allow the opening if the project: a) does not have unacceptable adverse effects upon any interests of the Act, and b) maximizes fisheries resource maintenance, enhancement or management and c) prevents or minimizes adverse effects so that the project, overall, contributes to those interests.

INFORMATION REQUIREMENTS

The Notice of Intent (NOI) should document that the project is necessary to manage, maintain or enhance marine fisheries; and provide baseline information on all resource areas which will be affected by the project. The information provided should be sufficient to allow the issuing authority to assess impacts to these resource areas. Each proposed opening is unique and the level of information required to assess impacts and impose appropriate conditions necessarily will vary. The issuing authority should require the level of information appropriate to the particular project.

At a minimum, the applicant should submit information:

a. describing the history of pond openings and its use as a fishery, and the proposed plan for fisheries resource management, enhancement, or maintenance;
b. delineating all affected resource areas and identifying short- and long-term impacts to affected resource areas and their affected interests.
c. describing the location of, and impacts on, public and private water supplies in the pond's vicinity;
d. assessing wildlife habitat, including the presence of rare species habitat in accordance with the applicable procedures at 310 CMR §§10.37, 10.59 and 10.60; and
e. describing the history of storm events in the immediate area of the pond and impacts of the events on existing resource areas.

In certain instances, the information presented will indicate that no number of conditions will adequately prevent or minimize adverse effects so as to adequately protect the interests of the Act. For example, salt water intrusion may contaminate water

supplies to unacceptable levels and no alternative source may be available. It may not be possible to condition a project so that there will be no adverse effect of specified habitat sites of rare species. In such instances, the project should be denied.

MINIMUM CONDITIONS

Certain conditions will always be necessary to prevent or minimize adverse effects. For example, material excavated from the channel opening should not be removed from the barrier beach. Material should be stockpiled on site and placed, within the barrier beach system as appropriate . Any sediment lost due to excavation and scouring should be replenished to the barrier beach system. A time schedule for pond openings should be included in any Order of Conditions. The schedule should take into account tide fluctuations, impacts on wildlife habitat of fluctuating water levels and exposure in inclement weather, storm forecasts and the potential presence of rare or endangered species in the area. Disturbance of vegetation should be minimized to protect dune stability. Replication of any Bordering Vegetated Wetlands altered directly or by vegetative dieback should be required where possible, particularly within the area exposed by pond lowering, if the area does not naturally revegetate after two growing seasons. Conditions protective of actual or potential water supplies should be incorporated.

Specific monitoring provisions should be incorporated into the Order of Conditions to track the impacts of the opening on the interests of the Act. Reports on all monitoring should be submitted to the conservation commission and the Department and reviewed by the issuing authority to determine whether any change in conditions and methods of data collection is warranted to protect the interests of the Act. Conditions should include a provision authorizing the discontinuation of the pond openings, if necessary, to protect the interests of the Act.

Finally, note that projects permitted under this policy may still need to obtain a license pursuant to G.L. c. 91, the Waterways Act, and remain subject to applicable terms of any restriction order adopted under G.L. c. 131 §40A, Protection of Inland Wetlands, and G.L. c. 130 §105, Protection of Coastal Wetlands.

Christy Foote-Smith Date: March 28, 1991

Christy Foote-Smith, Director
Division of Wetlands and Waterways
Department of Environmental Protection

APPENDIX K

Access for the Physically Challenged

Access for the Physically Challenged

Applicable laws and regulations include the federal Americans with Disabilities Act of 1990, the Uniform Federal Accessibility Standards at 40 Code of Federal Regulations 101-196, and the corresponding state laws, Mass. General Laws Chapter 22, §13A and its regulations 521 Code of Massachusetts Regulations. The Architectural Access Board has the responsibility for enforcing the Americans With Disabilities Act at the state level. The Massachusetts Office on Disability has the responsibility to provide technical assistance and guidance for compliance with the Americans With Disabilities Act at the state level. Outdoor recreation facilities at barrier beaches should, where practical, be designed to be accessible to the greatest number of people as possible.

Definition

The federal government defines accessibility as: "Accessible programs or facilities must offer the person with disability an opportunity to achieve experiences similar to those offered others. Consideration should include persons with mobility, visual, hearing, speech, and/or developmental impairments. Facilities must be designed so that they can be approached, entered, and used by persons with disabilities. An accessible facility must provide the person with a disability a place to park, accessible routes, entrance to buildings, restrooms, water and the services offered other visitors. Newly constructed or renovated facilities must comply with the "Uniform Federal Accessibility Standards," 41 Code of Federal Regulations 101-196.

Programs and services should be offered to the widest range of visitors, including disabled persons, within an integrated setting. This should include vendor services, interpretive programs, publications and educational signage and brochures.

To ensure accessibility, provide:

1) Diversity of recreational experience to varying skill levels;
2) Involve persons with disabilities in planning and design;
3) Achieve the optimal mix of facilities and services appropriate to the geographic area;
4) Provide an integrated access setting; and
5) For federally funded projects, research and comply with the appropriate accessibility standards which are the Uniform Federal Accessibility Standards, the Americans with Disabilities Act Accessibility Guidelines, and the rules and regulations of the Mass. Architecture Access Board. This applies to all new construction, alteration, and reconstruction.

Strategic Approach to Planning and Design

Principles to Guide the Development of a Handicap Access Plan include:

1) Preserve natural integrity of site;
2) Provide optimal access for site;
3) Develop holistic access plan;
4) Integrate disabled and fully mobile access where possible;
5) Use a participatory design process;
6) Use common signage based on level of accessibility;
7) Use common sense;
8) Identify and meet your legal requirements; and
9) Get a good legal definition of disabled.*

* The Americans With Disabilities Act, section 3 defines "disability" as: *"a) a physical or mental impairment that substantially limits one or more of the major life activities of such individuals; b) a record of such on impairments; or c) being regarded as having such an impairment."*

Steps to Guide the Development of Handicap Access Design

In steps 1 and 2 of this approach you are characterizing your beach in terms of appropriate access sites. In some cases, areas of special environmental concern may also be developed. In these cases the site must be made accessible to the extent it does not further endanger the site.

1) Identify key characteristics and areas of special environmental concern on the beach, such as:
   - High Energy Zones
   - Habitat for Endangered Species
   - Repeat Overwash Areas
   - Topography
2) Define sites on the barrier beach according to the level of human modification:
   - **Developed** - includes public structures, and open areas, administration, parking, interpretive and visitor services. These sites must be built or renovated to accommodate persons with disabilities.
   - **Undeveloped** - no deliberate alteration. These sites will not normally be changed and no special facilities be provided for the sole purpose of access for disabled persons.
   - **Threshold** - these areas include overlooks, trails, exhibits and special features reached by short trails from developed to undeveloped

areas. These areas should be judged on a case-by- case basis considering topography, environmental sensitivity, degree of development and alternative recreational experiences.

3) With both 1 and 2 identified at each potential site then determine what level of accessibility is appropriate at the site;

- **Accessible** - Meets or exceeds Uniform Federal Accessibility Standards requirements. All programs and services are fully accessible for the majority of disabled persons.
- **Challenge Level 1** - More difficult but generally meets federal requirements. Parking, and all other facilities and interpretive programs are fully accessible. Grades and surfaces may be more challenging. Some assistance to the disabled may be necessary.
- **Challenge Level 2** - Most difficult. Buildings should be accessible. Grades and surfaces have not been severely altered in order to preserve natural setting. Safety features are part of the design. Limited mobility persons may need assistance and severely disabled persons would not be encouraged to use facilities without assistance.

4) Once natural features, development and level of accessibility for each site is determined then the appropriate architectural standards can be applied. Comprehensive standards can be found in the Uniform Federal Accessibility Standards. Here is a brief overview of features of accessibility which have specific architectural standards:

- **Parking** including spaces, access aisles, ramps;
- **Access Routes** - from parking to facilities, within facilities, connecting accessible sites, widths, turning areas, passing areas, surfaces;
- **Entryways** - connected by accessible routes, to public transportation, parking. New construction requires at least one principal entrance at grade level should be accessible. In altered buildings at least one entryway should be made accessible. A building serving a variety of transportation modes should provide one accessible entryway for each. It is preferable for emergency purposes that all entryways be accessible;
- **Ramps** - Accessible: ramp required if slope is steeper than 1:20 (5%), Maximum ramp slope 1:12 (8.3%) with a five foot level rest area every 30 feet. Challenge Level 1: ramp required if slope is steeper than 1:12 (8.3%), flatter preferred. Challenge Level 2: ramps generally not used at this level. Slopes greater than 1:12 are generally not usable for persons in wheel chairs without assistance;
- **Trails** - no specific standards, only recommendations, including the following considerations: slope, surface, signage, passing space, and rest areas;
- **Signage** - all directional, interpretive and educational signage shall consider all types of disabilities.

5) Maintenance and Operations Plan - develop seasonal maintenance schedule - monitor sites to ensure accessibility.

Sample Activity: swimming - to take place on beach and shore - issues

you should address include, access to place and the waters edge.

- **Pathway from Parking to Beach over Dune** - Provide a firm stable path such as wood plank 4-5 ft. wide. Ramps to go over dunes should meet all ramp requirements for slope, not greater than 1:12, rest areas, turning, rails etc. An appropriate minimum height above dune grade for disabled persons ramps is at least 2' with greater heights possible where extended ramps can be accommodated. Spacing between planks should be no greater than 1/2". All structures should meet Federal Emergency Management Agency and State Building Codes.
- **Provide a 4' X 4' leisure area** - stabilize sand with wood planking and provide pathway to the area.
- **Pathway from beach to water** - Stabilized sand or wood plank minimizes impact to beach while still providing good access. A wooden boardwalk built in sections can be used seasonally.
- **Entering the Water** - Provide handrails 30-34" high and sloped curb along edge of platform to gently stop wheelchairs. A rubber mat on sand can improve access.

Contacts

For more information on handicapped access requirements, contact:

U.S. Architectural & Transportation Barriers Compliance Board
1111 18th Street, N.W., Suite 501
Washington, D.C. 20036-3894
(202) 653-7834 v/TDD
(202) 653-7863 FAX

Architectural Access Board
Room 1310
One Ashburton Place
Boston, MA 02108
(617)727-0660, voice or TDD
1-800-828-7222

Massachusetts Office on Disability
Room 1305
One Ashburton Place
Boston, MA 02108
(617)727-7440

References

Americans with Disabilities Act
Accessibility Guidelines for Buildings and Facilities
Publication No. 17174-87-500-8/92

Document A117.1-1980
Design Standards American National Standards Institute
1430 Broadway
N.Y.,N.Y. 10018

Design Guide for Accessible Outdoor Recreation
Interim DRAFT for Review
U.S. Forest Service
Auditors Building
201 14th Street, S.W. at Independence Ave., S.W.
Washington, DC 20250
Attention: Access Coordinator, Recreation Staff

APPENDIX L

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APPENDIX M

Matrix

Coastal Resource Areas and Recommended Management Measures

ACTIVITY	LAND UNDER OCEAN	COASTAL BEACHES INC. TIDAL FLATS	COASTAL DUNES	SALT MARSHES	LAND UNDER SALT PONDS	LAND CONTAINING SHELLFISH	RARE SPECIES HABITAT	STATE ESA	FED ESA
1. Armoring Structures	page(s) 57, 110	40, 110	45, 110	49, 110	55, 110	51, 110	60, 110	66, 110	64, 110
2. Beach Cleaning	57, 112-114, 131	40, 112-114, 131	45, 112-114, 131	49, 112-114, 131			60, 112-113, 131	66, 112-113, 131	64, 112-113, 131
3. Camping/Fires		40, 77	45, 77				60, 77	66, 77	64, 77
4. Construction of Public Facilities ▲ Boardwalks ▲ Parking lots/roads ▲ Buildings ▲ Human control structures ▲ Handicapped access	57, 119-121	40, 119-121	45, 119-121	49, 119-121	55, 119-121	51, 119-121	60, 119-121	66, 119-121	64, 119-121
5. Dredging/Beach Nourishment	57, 100-105	40, 100-105	45, 100-105	49, 100-105, 118	55, 100-105,	51, 100-105,	60, 100-105,	66, 100-105,	64, 100-105,
6. Dune Restoration ▲ Snow fencing ▲ Christmas trees ▲ Regrading		40, 100-105, 112	45, 100-105, 112	49, 100-105, 112	55, 100-105, 112	51, 100-105, 112	60, 100-105, 112	66, 100-105, 112	64, 100-105, 112
7. Fireworks		40, 84	45, 84				60, 84	66, 84	64, 84
8. Harvesting/Gathering (plant material, seed)		40,81	45,81	49,81					
9. Horseback Riding/ Non-motorized Transport		40, 82-83	45, 82-83	49, 82-83		51, 82-83	60, 82-83	66, 82-83	64, 82-83
10. Hunting		40, 72-75	45, 72-75	49, 72-75	55, 72-75	51, 72-75			
11. Kite-flying							60, 76	66	64
12. Off-road Vehicles ▲ Recreational day use/ chase vehicles ▲ Recreational overnight (self-contained campers) ▲ Shellfishing ▲ Cottage access ▲ Official/special use ▲ Finfishing		40, 87-95	45, 87-95	49, 87-95		51, 87-95	60, 87-95	66, 87-95	64, 87-95
13. Pedestrian Recreation (hiking, birding, picnicking, swimming, finfishing)			45, 73-76	49, 73-76			60, 73-76	66, 73-76	64, 73-76
14. Nuisance Control ▲ Insects ▲ Invasive exotic plants				49, 122-123	55, 122-123	51, 122-123	60, 122-123	66, 122-123	64, 122-123
15. Pets		40, 75	45, 75	49, 75			60, 75	66, 75	64, 75
16. Planting ▲ Exotics ▲ Nonexotics	57, 125-126, 106-108	40, 125-126, 106-108	45, 125-126, 106-108			51, 125-126, 106-108	60, 125-126, 106-108		
17. Shellfishing ▲ Commercial ▲ Recreational ▲ Aquaculture	57, 76	40, 76		49, 76	55, 76	51, 76	60, 76	66, 76	64, 76
18. Watercraft ▲ Jetskis ▲ Motorized boats ▲ Sailboards/surf boards ▲ Misc. personal flotation devices		40, 79-80	45, 79-80	49, 79-80	55, 79-80		60, 79-80	66, 79-80	64, 79-80

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