A Guide to the Coastal Wetlands Regulations

of the Massachusetts Wetlands Protection Act (G.L. 131, s.40)

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Division of Wetlands
Department of Environmental Quality Engineering
100 Cambridge Street
Boston, Massachusetts 02202
Telephone: (617) 727-9706

Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Coastal Zone Management Office

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CZM

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TABLE OF CONTENTS

INTRODUCTION 1

HOW TO USE THIS GUIDEBOOK 4

CHAPTER 1 — COASTAL RESOURCE AREAS: THEIR IDENTIFICATION AND ROLE IN COASTAL PROCESSES:

1. Land Under The Ocean (Section 25) 9
2. Designated Port Areas (Section 26) 13
3. Coastal Beaches (Section 27) 21
4. Coastal Dunes (Section 28) 25
5. Barrier Beaches (Section 29) 28
6. Coastal Banks (Section 30) 31
7. Rocky Intertidal Shores (Section 31) 34
8. Salt Marshes (Section 32) 36
9. Land Under Salt Ponds (Section 33) 39
10. Land Containing Shellfish (Section 34) 41
11. Fish Runs (Section 35) 44

CHAPTER 2 — REGULATED COASTAL ACTIVITIES:

A. General Introduction 51
B. Complex Activities 54
C. Large and Small Projects 55
D. Specific Coastal Activities

1. Dredging 56
2. Disposal of Dredged Materials 65
3. Fill 68
4. Grading and Raking 76
5. Removal 82
6. Seawalls, Revetments, Bulkheads 84
7. Breakwaters 94
8. Groins 97
9. Jetties 102
10. Boardwalks, Stairs, Pathways, and Trails 107
11. Piers, Docks, Wharves, Floats, Piles, Dolphins 117
12. Tidal Gates, Dams 127
13. Culverts 130
14. Septic Systems 132
15. Point Discharges 133

CHAPTER 3 — COMMENTS ON GENERAL PROVISIONS (REGULATION 24): 139

APPENDICES

A. General Overview of Physical and Biological Processes in Coastal Wetlands 144
B. Approximate Spawning Times for Anadromous/Catadromous Fish 149
C. Sources of Maps and Aerial Photographs 150
D. Selected References Annotated 152
E. Other Legislation Applicable to Resource Areas 154

GLOSSARY 155

LETTER OF INTRODUCTION

December 31, 1978

Dear Reader,

The Department of Environmental Quality Engineering (DEQE), with the assistance of the Massachusetts Coastal Zone Management Office, has developed and promulgated a comprehensive set of Regulations to protect coastal wetlands. These Regulations, which became effective on August 10, 1978, set forth detailed performance standards for the design and location of projects in or near coastal wetlands.

The coast is a complex physical and biological environment, and consequently, the Regulations to protect it are at times complex and technical. The purpose of this book is to guide coastal conservation commissions, applicants, and other interested citizens when applying the coastal wetland regulations to specific sites and projects.

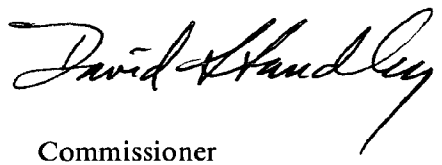
This Guide sets forth DEQE policy concerning the implementation of the Regulations. It should be used as a general indicator of how DEQE interprets the Regulations. However, the complexity of the coastal environment and the variety of coastal activities make it impossible to more than summarize the situations, impacts, and design/engineering solutions which may be proposed, evaluated, and conditioned under the Wetlands Protection Act procedures. Therefore, while conformance with the measures spelled out in this Guide will generally mean that a project is acceptable, each proposed project must be designed, reviewed, and conditioned with respect to its particular location and adverse impacts.

DEQE is not bound exclusively to the interpretations contained herein, but will use this book as a framework within which to make decisions on a case-by-case basis.

I urge applicants to carefully review the specific location and design of their projects to ensure that they conform to the performance standards of the regulations before they are formally proposed. I also urge conservation commissions to carefully review each Notice of Intent, and where necessary, to impose conditions to ensure that proposed projects meet the performance standards.

I believe that if both applicants and coastal conservation commissions work cooperatively and follow the letter and the spirit of the Regulations and this Guide, appropriate construction may proceed in the coastal zone which will not adversely effect our valuable and fragile coastal environment.

Sincerely,



Commissioner

INTRODUCTION

"The edge of the sea is a strange and beautiful place. All through the long history of Earth it has been an area of unrest where waves have broken heavily against the land, where the tides have pressed forward over the continents, receded, and then returned. For no two successive days is the shore line precisely the same. Not only do the tides advance and retreat in their eternal rhythms, but the level of the sea itself is never at rest. It rises or falls as the glaciers melt or grow, as the floor of the deep ocean basins shifts under its increasing load of sediments, or as the earth's crust along the continental margins warps up or down in adjustment to strain and tension. Today a little more land may belong to the sea, tomorrow a little less. Always the edge of the sea remains an elusive and indefinable boundary . . ."

"The shore is an ancient world, for as long as there has been an earth and sea there has been this place of the meeting of land and water. Yet it is a world that keeps alive the sense of continuing creation and of the relentless drive of life. Each time that I enter it, I gain some new awareness of its beauty and its deeper meanings, sensing that intricate fabric of life by which one creature is linked with another, and each with its surroundings . . ."

"There is a common thread that links these scenes and memories — the spectacle of life in all its varied manifestations as it has appeared, evolved, and sometimes died out. Underlying the beauty of the spectacle there is meaning and significance. It is the elusiveness of that meaning that haunts us, that sends us again and again into the natural world where the key to the riddle is hidden. It sends us back to the edge of the sea, where the drama of life played its first scene on earth and perhaps even its prelude; where the forces of evolution are at work today; as they have been since the appearance of what we know as life; and where the spectacle of living creatures faced by the cosmic realities of their world is crystal clear."

The Edge of the Sea
Rachel Carson

Coastal wetlands are critically important natural resources in need of protection and conservation for this and future generations. Salt marshes, land under the ocean, salt ponds, tidal flats and fish runs are components of a complex natural system important for maintaining marine productivity. Coastal beaches, coastal dunes, coastal banks and barrier beaches play a crucial role in buffering inland property against the destructive forces of coastal storms.

Coastal wetlands provide citizens of the Commonwealth with irreplaceable benefits. Man made structures, regardless of design or cost, cannot improve upon or even match the functions of natural systems.

These valuable coastal wetlands have been encroached upon and altered by the activities of man over the centuries, to the point where their value to finfish and shellfish productivity and storm damage protection has diminished. The Massachusetts legislature recognized the danger of inappropriate development on coastal wetlands in the mid 1960's and began enacting laws to protect wetlands. Massachusetts has led the nation in this effort; the Commonwealth's landmark wetlands legislation has served as a model for many states.

The Wetlands Protection Act, G.L. Chapter 131, s. 40 (the Act), requires that any person who wishes to "fill, dredge, remove, or alter" a wetland must first file a Notice of Intent with the conservation commission in the city or town in which the project is to be located. In turn, the conservation commis-

sion is obligated to impose conditions on the proposed project which will contribute to the protection of seven public benefits provided by wetlands: flood control, storm damage prevention, public or private water supply, groundwater supply, prevention of pollution, protection of fisheries and protection of land containing shellfish. The basic underlying purpose of the Act is to ensure that wetlands will continue to provide those seven benefits to people, and to prevent projects proposed in or near wetlands from causing adverse effects to any of these interests.

The Massachusetts Coastal Zone Management Office is a federally funded program to aid the Commonwealth in protecting and enhancing coastal resources. An important aspect of this program has been to work with DEQE to develop a comprehensive set of regulations under the Act to improve the protection of coastal wetlands. These Regulations apply to Land Under the Ocean, Coastal Beaches, Coastal Dunes, Barrier Beaches, Salt Marshes, Coastal Banks, Rocky Intertidal Shores, Land Under Salt Ponds and Anadromous/ Catadromous Fish Runs.

The Regulations provide performance standards for all activities regulated by the Act in coastal wetlands. These performance standards provide criteria which must be met by any proposed project. They do not require that certain specific measures or designs be used; rather, they allow for considerable flexibility by the applicant to propose any design or activity as long as it meets the performance standard. For example, as long as a pier on a beach is properly designed, it can be built. The underlying principle behind the performance standards is quite simple: if a project is to be built in a coastal wetland, it must be built in a way which respects the environment in which it is located and does not destroy the public value of the coastal wetland. The application of this principle is advantageous both to the applicant and to the public — it protects the applicant's long term investment and the public's right to protection from unwise and inappropriate development.

The Massachusetts coastal zone consists of a variety of interrelated and interdependent coastal ecosystems. Activities in one area of the coast may impact wetland features and resources elsewhere along the coast. The Act seeks to maintain the physical and biological coastal processes.

The geology of the coast is active. The constantly rising sea level and the consequent landward movement of coastal features, and the constant interaction between the land and the sea means that coastal features are in constant movement. The process of formation and reformation of coastal features protects the land from the forces of the sea. The coastal regulations therefore seek to protect coastal landforms from adverse effects which may be caused directly by filling, dredging or removal, or indirectly by altering the processes which create and maintain coastal landforms (land under the ocean, coastal beaches, coastal dunes, barrier beaches, rocky intertidal shores and coastal banks) which play a role in storm damage prevention and flood control.

The biological ecosystems of the Massachusetts coastal zone are among the most productive on earth and support extensive populations of finfish and shellfish. The coastal ecosystems consist of complex biological communities and coastal habitats, and must be maintained to protect the future productivity of valuable fisheries resources. The Act and the Regulations seek to protect biologically productive areas (land under the ocean, coastal beaches including tidal flats, salt marshes, rocky intertidal shores, land under salt ponds and anadromous/catadromous fish runs) from adverse effects which may be caused directly by filling, dredging or removal, or indirectly by alterations in water quality, the food chain and habitat.

The purpose of this Guide is to assist applicants in the design of projects in and near coastal wetlands and to assist conservation commissions in the review and conditioning of those projects so that such projects will conform to the performance standards.

INTRODUCTION

Conservation commissions will find the technical guidance provided in this book will make their task of identifying coastal wetlands, reviewing Notices of Intent and plans and preparing Orders of Conditions more systematic, more uniform and less subject to misinterpretation.

Applicants who use this Guide will have a better idea of what standards are expected by conservation commissions and DEQE and should expect a fair and timely review of their proposals if they are located and designed in accordance with the Regulations as interpreted in the Guide.

Many of the words used in this Guide are relatively technical in order to be scientifically accurate. Many of these terms are defined in a glossary in the back of the book to help familiarize readers with what may be a new vocabulary.

Finally, readers should carefully review the coastal regulations in their entirety, in addition to using the Guide. Copies of the regulations are available from:

Secretary of State: Book Section
State House
Room 116
Boston, MA 02133
Ask for the regulations promulgated under G.L. c.131, s. 40.

How To Use This Guide:

This Guide has been designed as a working reference document and tool. It explains how to prepare/review an application for a "wetlands permit" under the Wetlands Protection Act (MGL c. 130, s 40). It has three chapters, plus supporting appendices.

Chapter One contains a detailed definition and explanation of the eleven resource areas identified in the Regulations which are to be protected in the coastal zone. This chapter explains how to establish the boundary for a resource area, the importance of each resource area and a summary of the major physical and biological processes at work.

Chapter Two concerns regulated coastal activities. Fifteen common activities which are included under the general terms stated in the Act, "dredging, filling, removal and altering," are identified and defined. The chapter includes a description of the adverse impacts these fifteen activities are likely to have on the interests of the Act, and indicates in which resource area they are or are not likely to be acceptable. If the acceptability threshold is passed, the Guide explains how the activity can be designed and conditioned to meet the performance standards of the regulations. The purpose of this chapter is to indicate what these standards mean in terms of the location, design and acceptability of specific types of activities which may be proposed along the coast.

Chapter Three concerns Regulation Section 24.

Before an applicant begins to design a project or the conservation commission begins its review, it is useful to think through the design/review process and identify the steps involved. This is where the Guide serves as a useful planning tool. If the general steps outlined below are thoughtfully and carefully followed, both applicants and conservation commissions will find compliance with the Wetlands Protection Act simpler and less time consuming. The systematic approach outlined here draws upon the Guide as a resource to clarify the details of the Act and the Regulations. Improved planning and experience over time will help expedite projects and project reviews in the coastal zone.

Step 1 — Identify the Resource Area: The Resource Area(s) in which the proposed project is to be constructed should be identified. Chapter One defines and illustrates each of the eleven Resource Areas listed in the Regulations and explains how to determine their boundaries. The applicant should prepare a map showing each Resource Area at and adjacent to the site.

This step is important because the performance standards and the measures required to meet them vary according to the Resource Area within which the proposed project is located.

Step 2 — Identify Each Proposed Activity: Each activity involved in the proposed project and its location in the Resource Areas should be identified. Chapter Two lists and describes the most common activities likely to be proposed in or near a coastal wetland.

Most projects will involve several activities; for example, a marina may involve dredging, fill, seawall and piers. (See section on complex activities, page 54.) Each activity should be listed, including those involved in the site preparation, construction, use and maintenance of the project.

Step 3 — Identify Project Constraints:

An acceptability table at the beginning of each activity section in Chapter Two indicates whether or not a proposed activity is likely to be permitted in a particular Resource Area. If the table indicates a project is likely to be permitted, then the applicant and conservation commission can turn to the appropriate chart to determine how it should be designed or conditioned.

If the table indicates that a project is not likely to be permitted, the applicant should seriously consider whether or not to proceed with designing the project and filing a Notice of Intent. If a Notice of Intent is filed, the conservation commission, in turn, should review such a project with extreme care to see if it conforms to the performance standards.

Step 4 — Identify Adverse Impacts: The particular impacts of each activity in a Resource Area should be identified and listed. The charts in Chapter Two indicate the likely impacts of each activity on a given Resource Area. This step involves interpreting the general information in the Guide as it applies to the particulars of the proposed activity and site.

Step 5 — Identify Measures to Meet Performance Standards: The measures to meet the performance standards in each Resource Area should be identified and listed.

In certain areas, applicants must use "best available" measures to reduce adverse impacts in order for their projects to be acceptable. Under other circumstances, "best practical" measures must be employed. In still others, such measures must result in "no adverse effects" on the resource area. The different circumstances for these three tests are spelled out in the regulations. The tables in Chapter Two identify and list the measures to meet the performance standards in each Resource Area.

These lists should be used as a guide to the measures the applicant might propose, or the conservation commission might require. However, the details of each measure will vary according to the circumstances at the site and the proposed project; nevertheless, the basic measures in the tables, or their equivalent should be followed in most cases.

Step 6 — Design the Project / Prepare an order of Conditions: The applicant should design the proposed project, using the suggested measures or their equivalent, to meet the performance standards for each Resource Area involved, and should be prepared to show the conservation commission exactly how the proposed project will, in fact, satisfy the performance standards.

The conservation commission, after reviewing the plans and any other available information, must determine whether or not the proposed project is properly designed to meet the performance standards. If the applicant follows the design/construction measures suggested in this Guide, in most cases the performance standards will have been met. The Order of Conditions should cite the plans and, if any, other appropriate documents.

The tables are intended to be used as a guide, and not as an absolute directory. The Order should incorporate the general sense of the measures listed in the tables, but sufficient detail must be added to tailor the order to the specific location and project.

If the plans do not meet the performance standards, the conservation commission must decide whether to deny the project on that basis or to impose conditions so that the project will be in compliance. This decision is a judgment call and will depend upon the severity of the proposed project's impacts and the amount of redesign required to make the project conform to the performance standards. In general, the conservation commission should not be in the position of totally redesigning a project; however, it should inform the applicant of why the project is unacceptable and give the applicant an opportunity to meet the objections. ■

CHAPTER 1

Resource Areas: Definition, Identification and Role in Coastal Processes

RESOURCE AREAS
Introduction

The Regulations list eleven Resource Areas which are to be protected in the coastal zone. They are: Land Under the Ocean, Designated Port Areas, Coastal Beaches, Coastal Dunes, Barrier Beaches, Coastal Banks, Rocky Intertidal Shores, Salt Marshes, Land Under Salt Ponds, Land Containing Shellfish and Fish Runs.

The role of these Resource Areas, their critical characteristics and their definition are briefly discussed in the "Preamble" and "Definition" sections of the Regulations. The purpose of this chapter is to expand upon the information provided in the Regulations.

Each Resource Area is defined and identified, and a boundary description presented. This information is intended to provide a guide to applicants, conservation commissions and others to more easily identify each Resource Area and its boundaries.

The role of each Resource Area and its characteristics in the overall coastal physical and biological system is also explained. This serves as a summary of the major physical and biological processes at work in each Resource Area.

More detailed information may be found in the publications listed in the annotated bibliography in the Appendix. Even with the information in the Guide, it still may be necessary to seek expert assistance in identifying wetlands and their boundaries.■

LAND UNDER THE OCEAN
Section 25

The Regulations define Land Under the Ocean as follows:
Section 25 (2) (a) "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.

Section 25 (b) "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 (west of a line between West Chop, Martha's Vineyard and Nobska Point, Falmouth), 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.

"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.

An important subcategory of land under the ocean is the nearshore areas, which are those lands under the ocean closest to land. The seaward boundary of nearshore areas is generally where the ocean is 80 feet deep at mean low water, but no further seaward than the municipality's jurisdiction. Note the following exceptions to the 80 foot rule, where, due to variations in wave exposures, the nearshore area extends to a shallower depth.

1. For the towns of Tisbury (excluding Vineyard Haven Harbor), West Tisbury, Chilmark, Gayhead, Falmouth (excluding the southern shore east of Nobska Point), Gosnold, Bourne, Wareham, Marion, Mattapoisett, Fairhaven, Acushnet, New Bedford, Dartmouth and Westport (excluding the shore west of Gooseberry Neck), the nearshore area extends only to the 30 foot depth contour at mean low water.
2. For the bay side of the Town of Provincetown, the nearshore area extends only to the 40 foot depth contour at mean low water.
3. For the bay side of the Towns of Truro and Wellfleet, the nearshore area extends only to the 50 foot depth contour at mean low water.

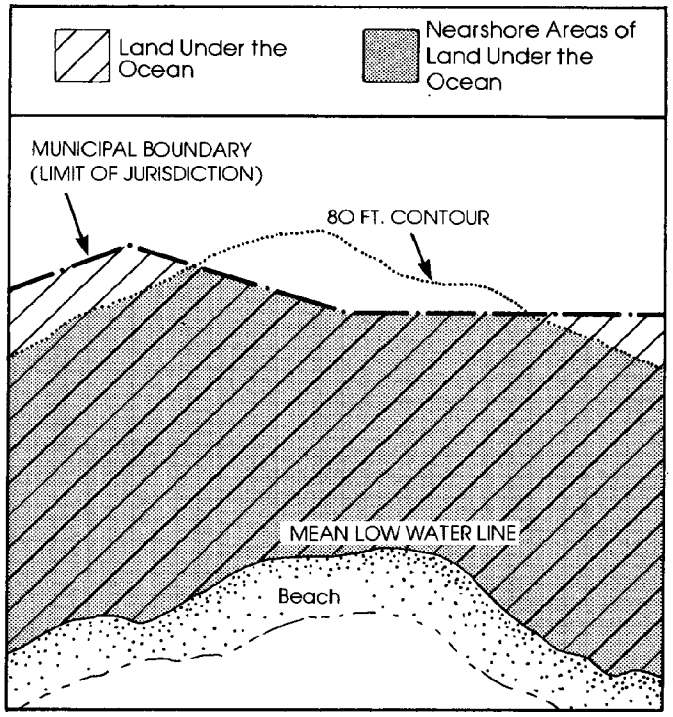


Illustration 1: Land under the ocean

Identification Illustration 1 shows the location of land under the ocean related to other coastal features.

LAND UNDER THE OCEAN
Section 25

The nautical charts issued by the National Ocean Survey of NOAA (National Oceanic and Atmospheric Administration) serve as an important source of information concerning land under the ocean. The dividing line between land and water on these charts represents the mean high water line, and the mean low water line is shown as the seaward edge of the olive green color. Nautical soundings are measured in feet below mean low water. Although the scale of the charts may be small, they can give an indication of the mean low water line which can then be supplemented with actual observation. These charts are generally available from marine supply dealers throughout the Commonwealth. A listing of NOAA-authorized nautical chart agents for these and related maps and publications of the National Ocean Survey is provided in the Appendix.

Illustration 2 shows a black and white reproduction of a portion of Chart #13245 with mean high and mean low water lines indicated.

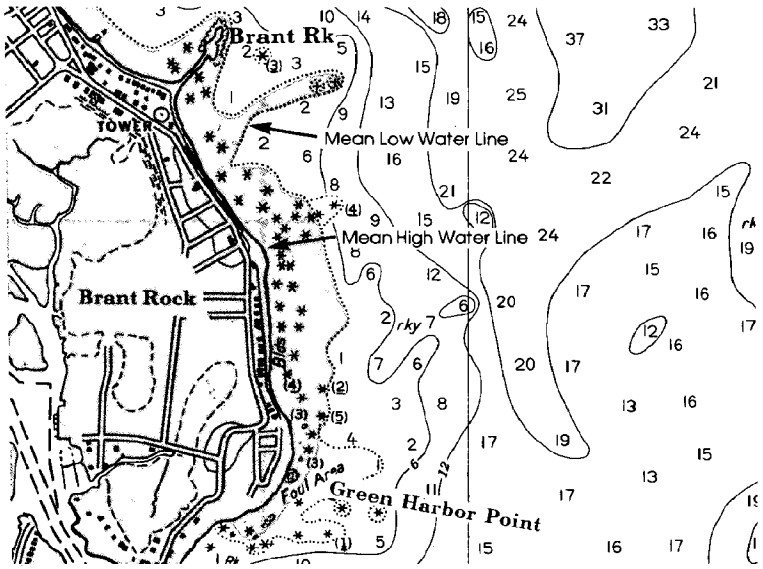


Illustration 2: A section of Nautical Chart #13245

The National Ocean Survey also publishes tide tables which include sea level elevations for selected localities. These are available from many marine supply dealers.

For small projects a simple and convenient way to estimate the elevation of mean low water at a particular site is to observe the tides for three or four days and mark each low tide, and then determine the mean low water line based on the markers.

For larger projects, a survey by a registered land surveyor or registered professional engineer may be required in order to more accurately determine the location of the mean low water contour on the site.

The location of the 80 foot depth contour can be inferred from the nautical charts or more accurate bathymetric maps published by NOAA. Free bathymetric map indexes showing available coverage and prices may be obtained from

National Ocean Survey Distribution Division (C44)
6501 Lafayette Avenue
Riverdale, Maryland 20840 ■

Resource Functions and Critical Characteristics

Physical Processes – Nearshore Areas of Land Under the Ocean Nearshore areas of land under the ocean play an important role in storm damage prevention and flood control. The characteristic of nearshore areas which is critical to these two interests of the Act is the bottom topography.

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.

Refraction refers to the bending of a wave as it moves into shoaling water. As waves move into nearshore areas, their speed is reduced as the water becomes shallower. When dif-

ferent parts of the same wavefront encounter water of different depths in nearshore areas, the wavefront bends. The portion of the wave in deeper water travels faster and is bent relative to the shallower portion of the same wavefront. Thus, refraction tends to cause the wavefronts to "swing" or become more nearly parallel to bottom contours. Refraction also causes a stretching or divergence of wave crests in some areas which reduces wave height. In other areas, a shrinking or convergence increases wave height. Because refraction changes the direction and height of waves, it is a very important factor in the distribution of the wave energy on the shoreline.

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, 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.

Finally, when waves enter water approximately as deep as the wave is high, the waves become unstable and "break." In the process of breaking, part of the wave energy is dissipated as heat by the turbulence produced by the break, part is transmitted seaward as a reflected wave, and part continues to travel landward.

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) Land under the ocean, which includes estuaries and tidal rivers, plays an important role in maintaining shellfish and marine fisheries. Such land is a 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

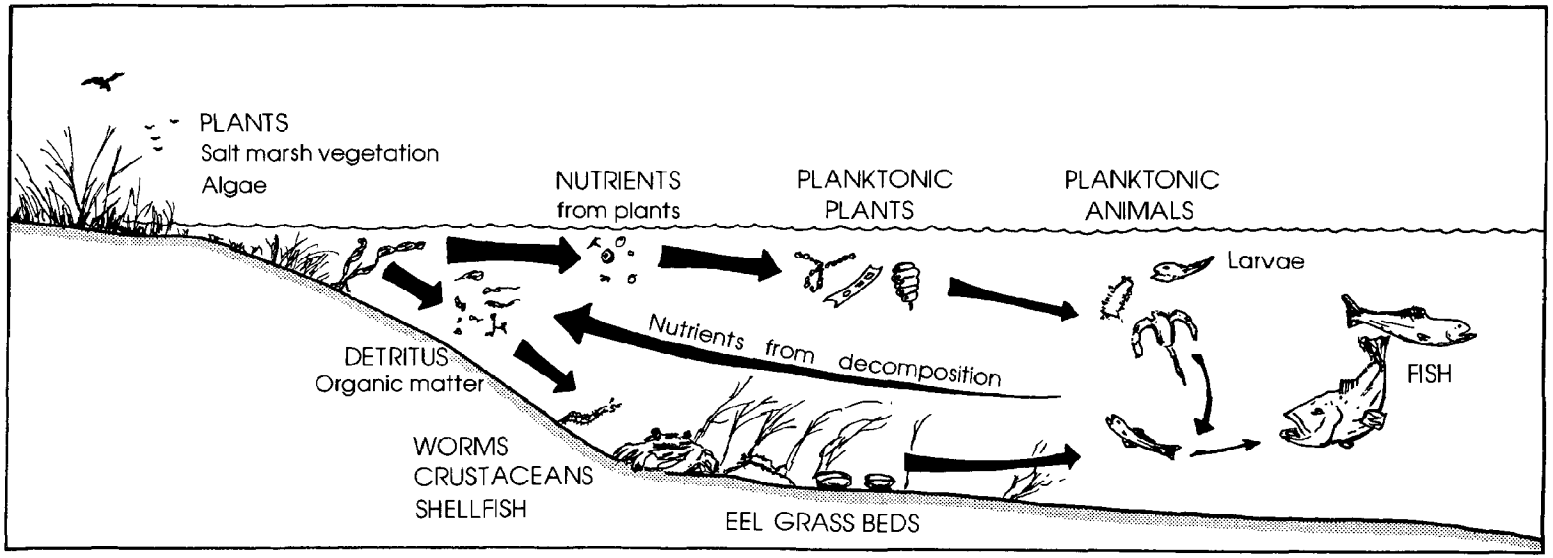


Illustration 3: The food cycle for land under the ocean

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. Illustration 3 shows the food cycle for land under the ocean.

The characteristics of land under the ocean which are critical to the protection of marine fisheries are: (1) water circulation, (2) distribution of sediment grain size, (3) water quality, and (4) finfish habitat.

Water Circulation — Water circulation helps maintain the temperature regime needed by organisms living on land under the ocean and within overlying waters. It also ensures the movement of nutrients and removes pollutants and metabolic waste products, thereby helping to reduce any accumulation of noxious substances.

Distribution of Sediment Grain Size — Many marine organisms have become adapted to grow best in areas with particular sediment grain sizes. Sediment grain size influences the establishment of young invertebrates and the success of adults, as well as the distribution and abundance of bottom dwelling organisms and plant life. For example, eelgrass beds flourish only in areas with a muddy-sand substrate.

Water Quality — The quality of water helps determine what types of marine life may survive in a particular area. Dissolved oxygen, temperature, turbidity, and pollution are four important aspects of water quality.

(1) Many benthic marine organisms need high levels of dissolved oxygen to survive. If dissolved oxygen levels are reduced only the low oxygen tolerant members of the community will survive. As a result, species diversity will decline.

(2) Different benthic organisms also have various, specific water temperature requirements. Temperature affects reproduction, mortality and growth.

(3) Abnormally high levels of turbidity may affect the water pumping and filtration mechanisms of benthic invertebrates, such as clams. Chronic levels of high turbidity will also decrease the depth that light penetrates the water. This will reduce the production of plant material that is used as food by fish and plankton. Turbid conditions may also be hazardous to fish eggs, since the resultant clogging by the sediment may interfere with the respiration of the embryo.

(4) The addition of pollutants into the marine environment may have acute lethal and long-term sublethal effects on organisms found on land under the ocean. Substances such as oil, heavy metals or synthetic chemicals can produce changes in physiological or behavioral processes that will ultimately reduce the populations of marine organisms.

Finfish Habitat — Land under the ocean provides a variety of habitats for finfish. For example, bottom level communities in the subtidal zone are utilized by adult crustaceans and molluscs, as well as other organisms that are food for coastal finfish. Eelgrass beds are valuable habitats for young fish, scallops and crustaceans, and produce large quantities of detritus and nutrients which fertilize the waters of the coastal zone. ■

DESIGNATED PORT AREAS
Section 26

The Regulations define Designated Port Areas as follows: **Section 26(2)** "Designated Port Areas" means those areas designated in **Sections 24(2)-24(3)** of the regulations of the Department adopted pursuant to the Waterways Law, G.L. c. 91.

"Designated Port Areas" are almost completely developed areas where few or no natural land forms or vegetation remain. They tend to be paved, bulkheaded, and used for heavy industry so that they have virtually no significance to the interests of the Act, except for land under the ocean, as explained below.

The Regulations presume that only land under the ocean in a designated port area is significant to the interests of the Act. Therefore, only projects which are on, or which will affect, such land under the ocean are subject to the performance standards in Sections 26(3) and 26(4). Other portions of designated port areas, such as a coastal bank or beach remain subject to the Act's jurisdiction, but they are presumed to be not significant to any of the interests of the Act. This means that projects on these presumed insignificant portions of designated port areas will require the filing of a Notice of Intent and a public hearing, but unless the conservation commission or other party proves the area is significant to one or more of the interests of the Act, such work will not require the imposition of an Order of Conditions. (The Act requires such a hearing, at which the public may present evidence as to the significance or non-significance of a particular site to the interests of the Act.)

Identification The twelve areas listed below were named as designated port areas, effective September 15, 1978. Other areas may be designated in the future.

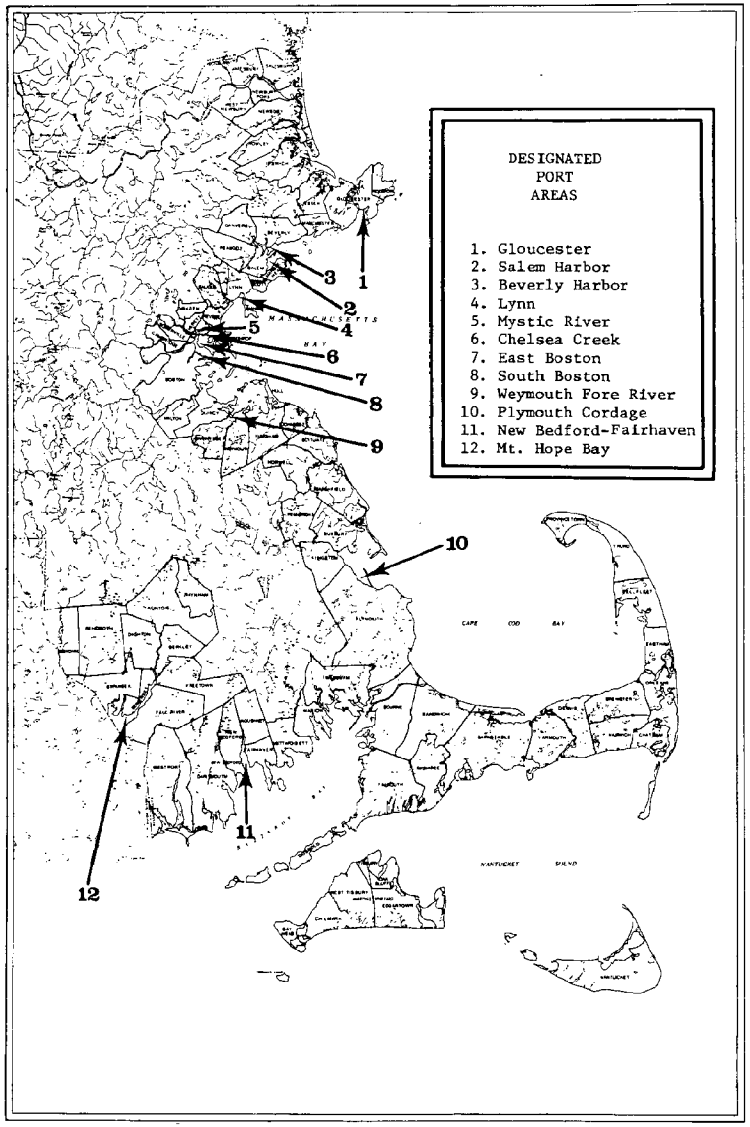
Gloucester	East Boston
Salem Harbor	South Boston
Beverly Harbor	Weymouth Fore River
Lynn	Plymouth Cordage
Mystic River	New Bedford-Fairhaven
Chelsea Creek	Mt. Hope Bay

The boundaries of the 12 ports already designated are shown on the following illustrations. ■

Resource Functions and Critical Characteristics

Land under the ocean in designated port areas plays a similar role in flood control, storm damage prevention, and the protection of marine fisheries, as land under the ocean which is not in designated port areas. The major addition is that land under the ocean in designated port areas also provides support for coastal engineering structures, such as bulkheads, seawalls, revetments, and solid fill piers. This support contributes to its value for flood control and storm damage prevention. ■

DESIGNATED PORTS
Section 26



Designated Port Area:
GLOUCESTER INNER HARBOR

DESIGNATED PORT AREA CONSISTS OF:

Selected area within those waters subject to Waterways license jurisdiction (seaward of mean high water mark)

Priority area for state and federal funding (landward of mean high water mark)

NOAA National Ocean Survey Nautical Chart #13281, Mar. 1975

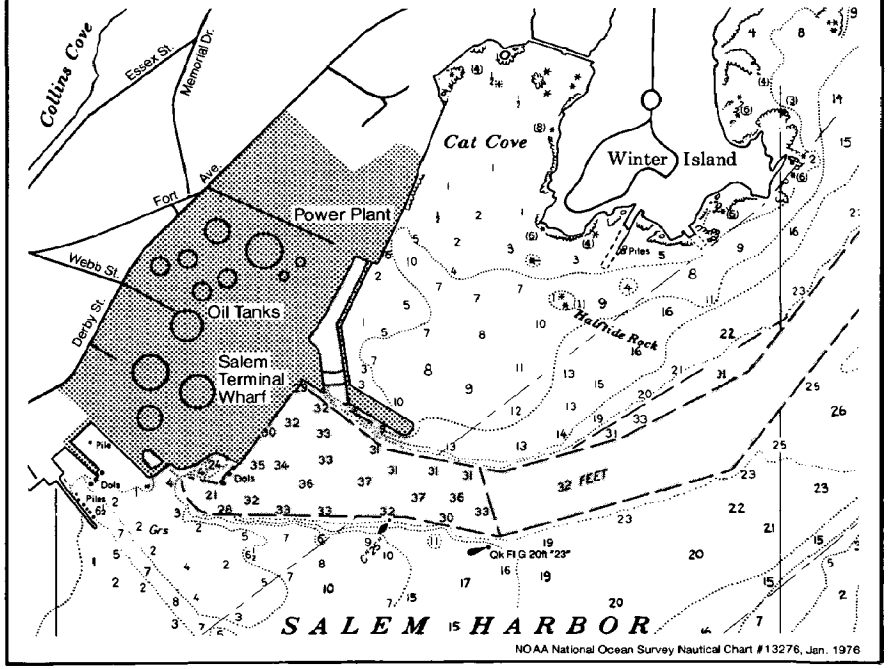
Designated Port Area:
SALEM HARBOR

DESIGNATED PORT AREA CONSISTS OF:

Selected area within those waters subject to Waterways license jurisdiction (seaward of mean high water mark)

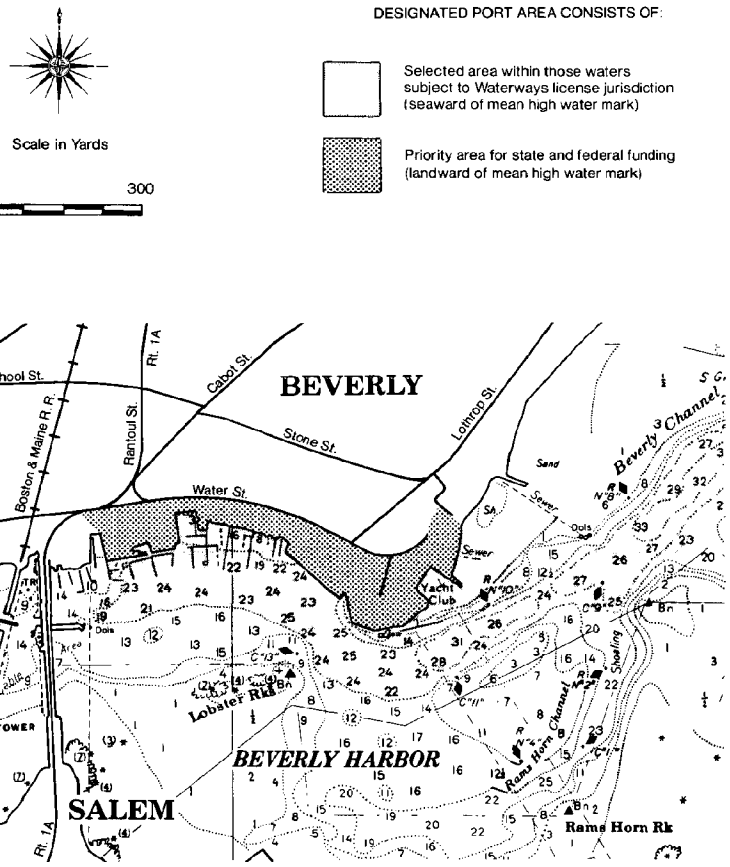
Priority area for state and federal funding (landward of mean high water mark)

Scale in Yards
0
300



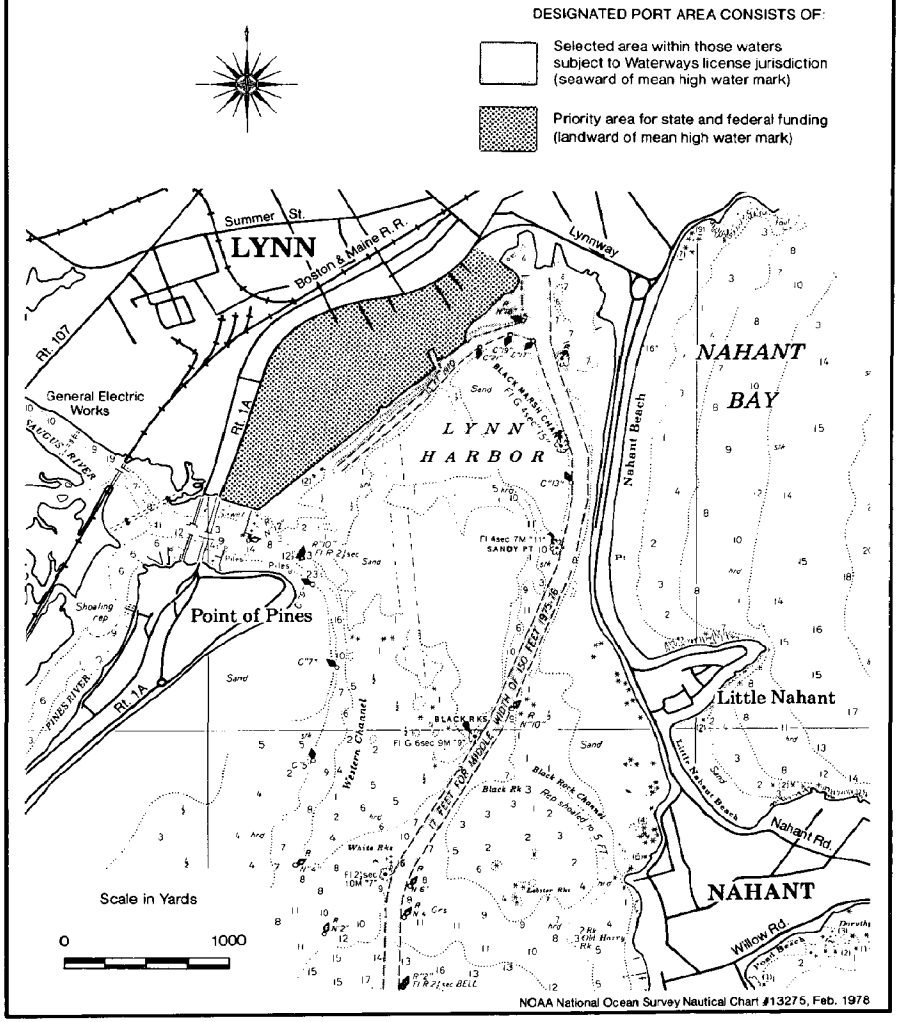
NOAA National Ocean Survey Nautical Chart #13276, Jan. 1976

Designated Port Area:
BEVERLY HARBOR



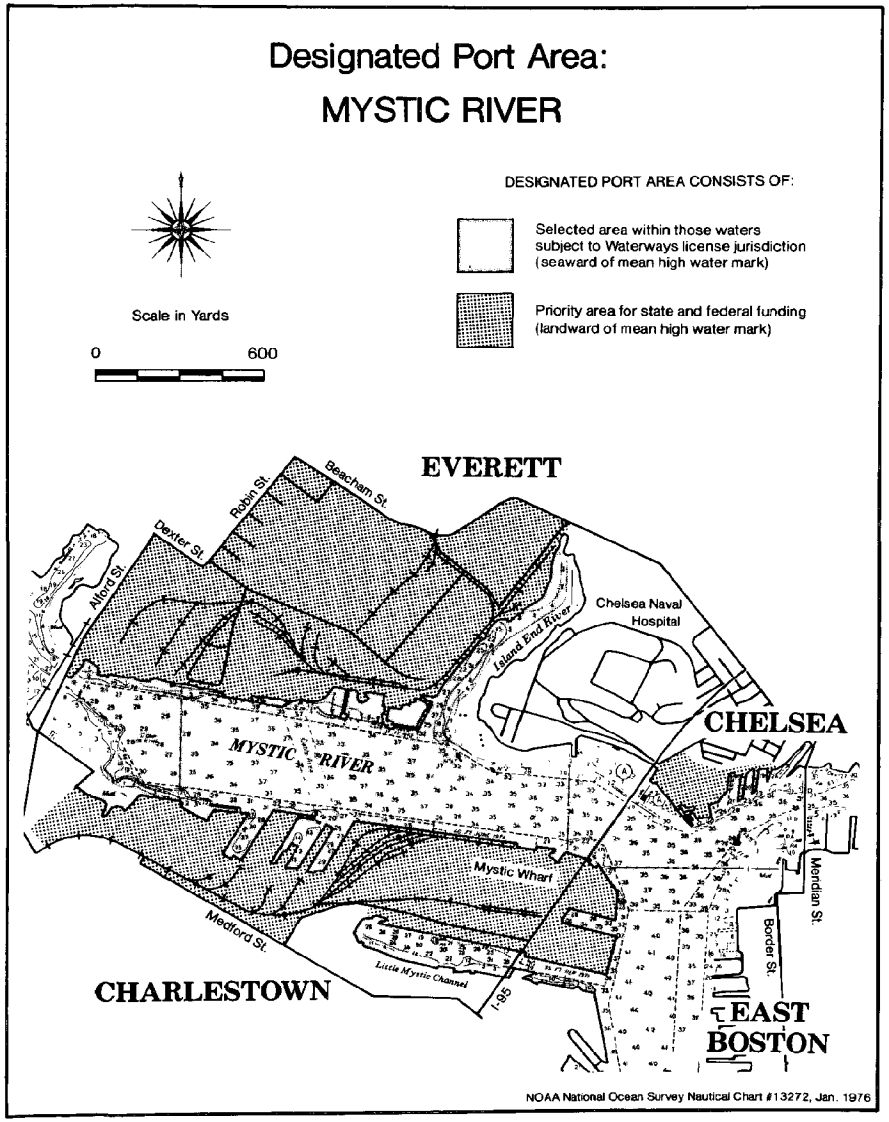
NOAA National Ocean Survey Nautical Chart #13276, Jan. 1978

Designated Port Area: LYNN

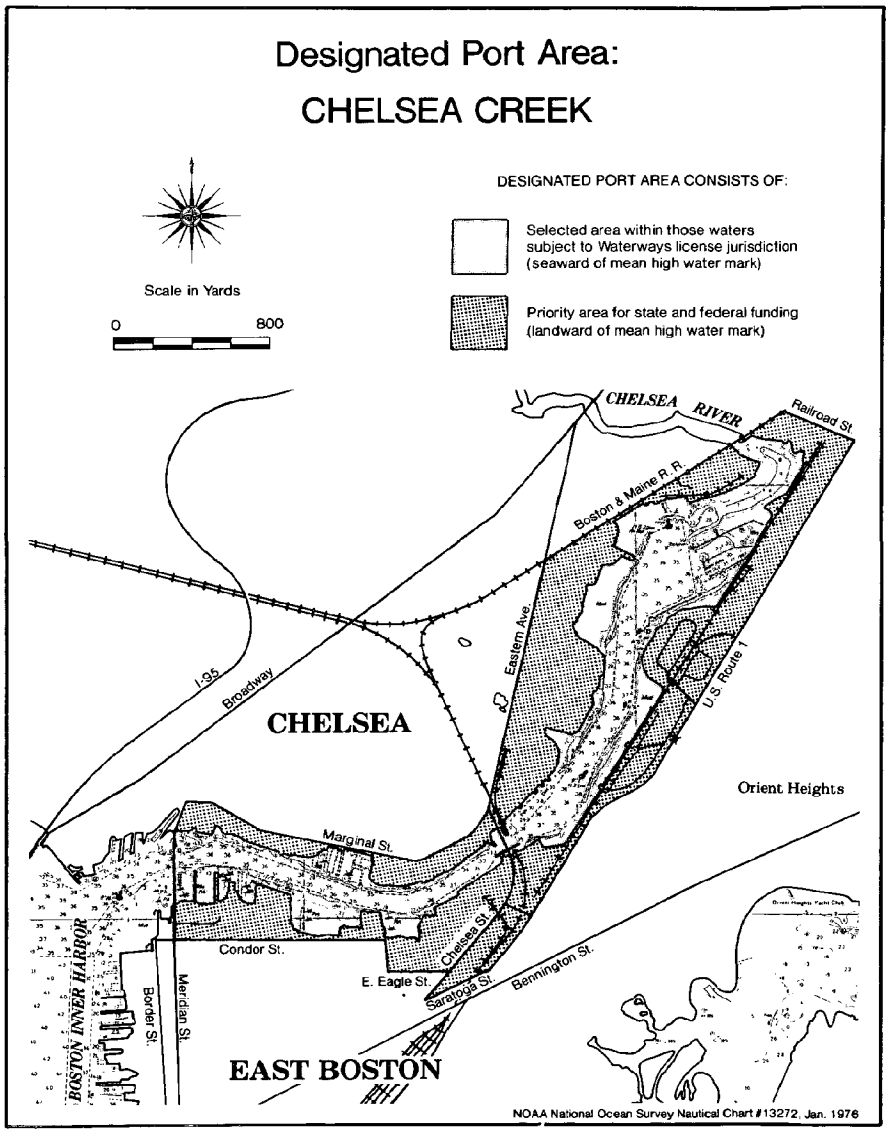


NOAA National Ocean Survey Nautical Chart #13275, Feb. 1978

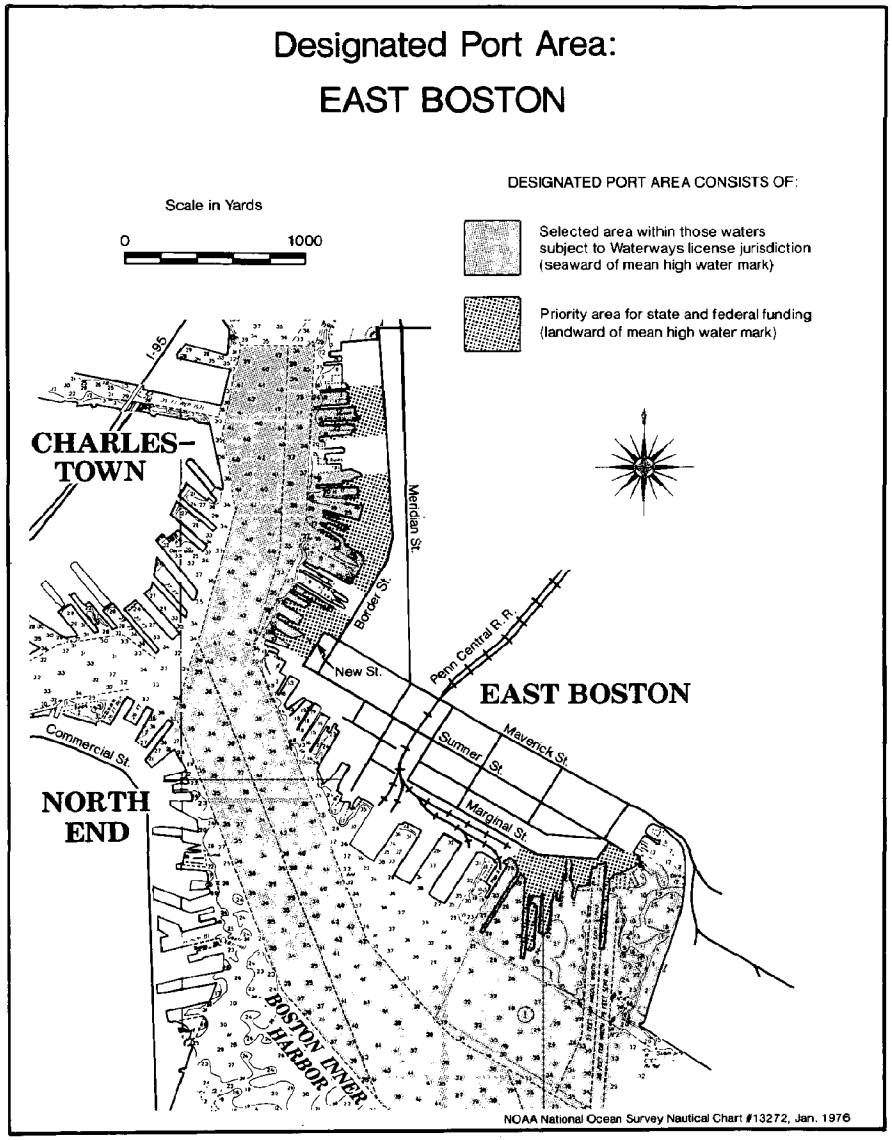
Designated Port Area:
MYSTIC RIVER



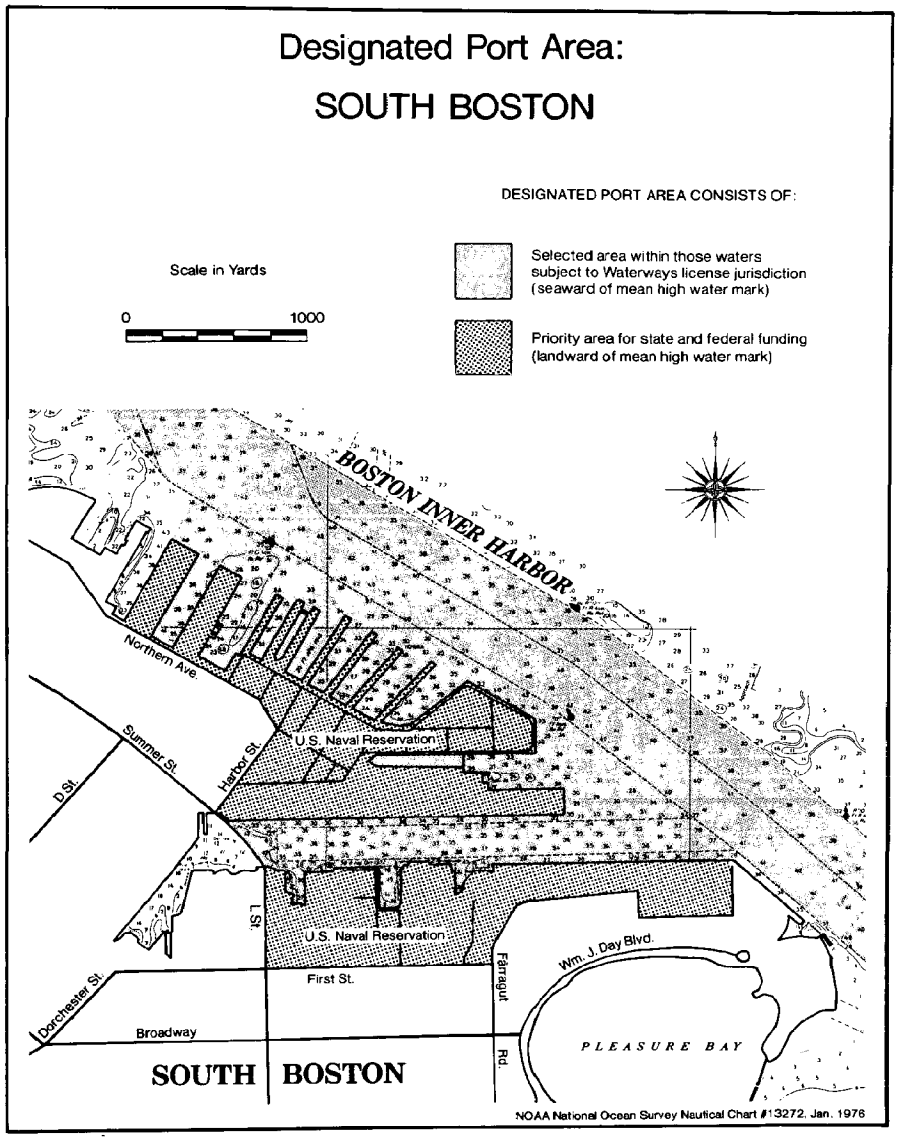
Designated Port Area:
CHELSEA CREEK



Designated Port Area:
EAST BOSTON



Designated Port Area:
SOUTH BOSTON



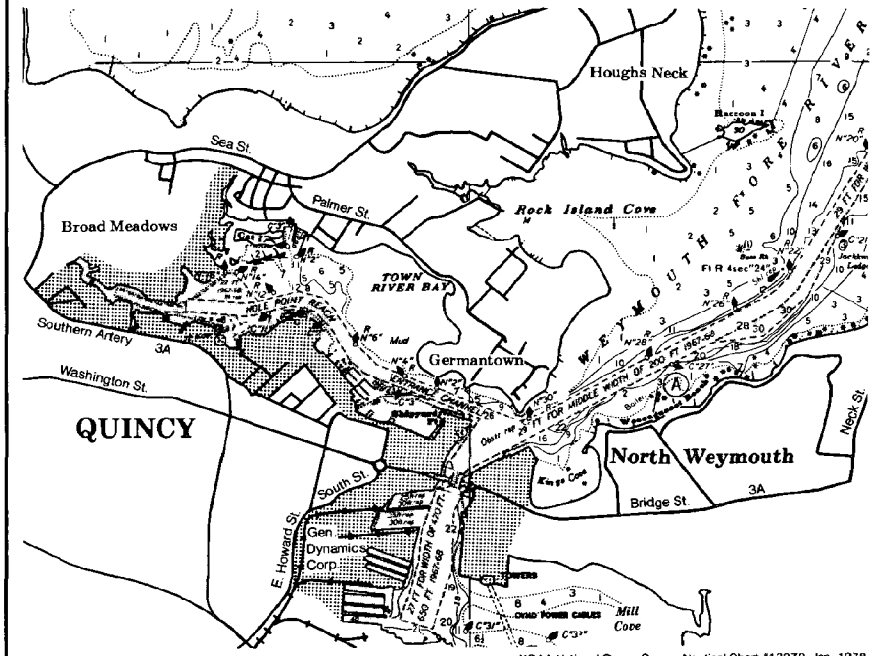
Designated Port Area:
WEYMOUTH FORE RIVER

Scale in Yards
0 1000

DESIGNATED PORT AREA CONSISTS OF:

Selected area within those waters subject to Waterways license jurisdiction (seaward of mean high water mark)

Priority area for state and federal funding (landward of mean high water mark)



NOAA National Ocean Survey Nautical Chart #13270, Jan. 1978

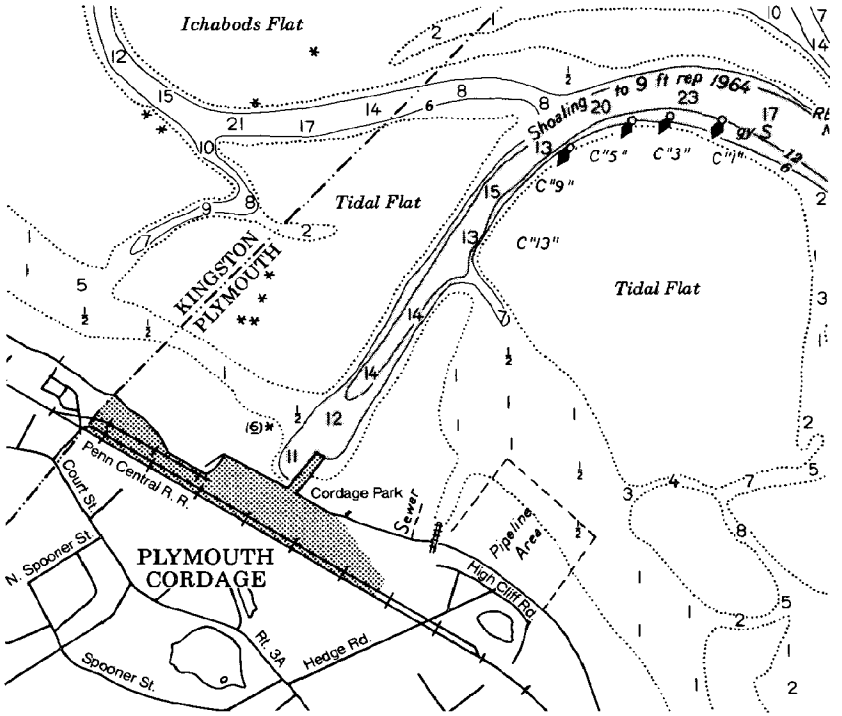
Designated Port Area:
PLYMOUTH CORDAGE

Scale in Yards
0 500

DESIGNATED PORT AREA CONSISTS OF:

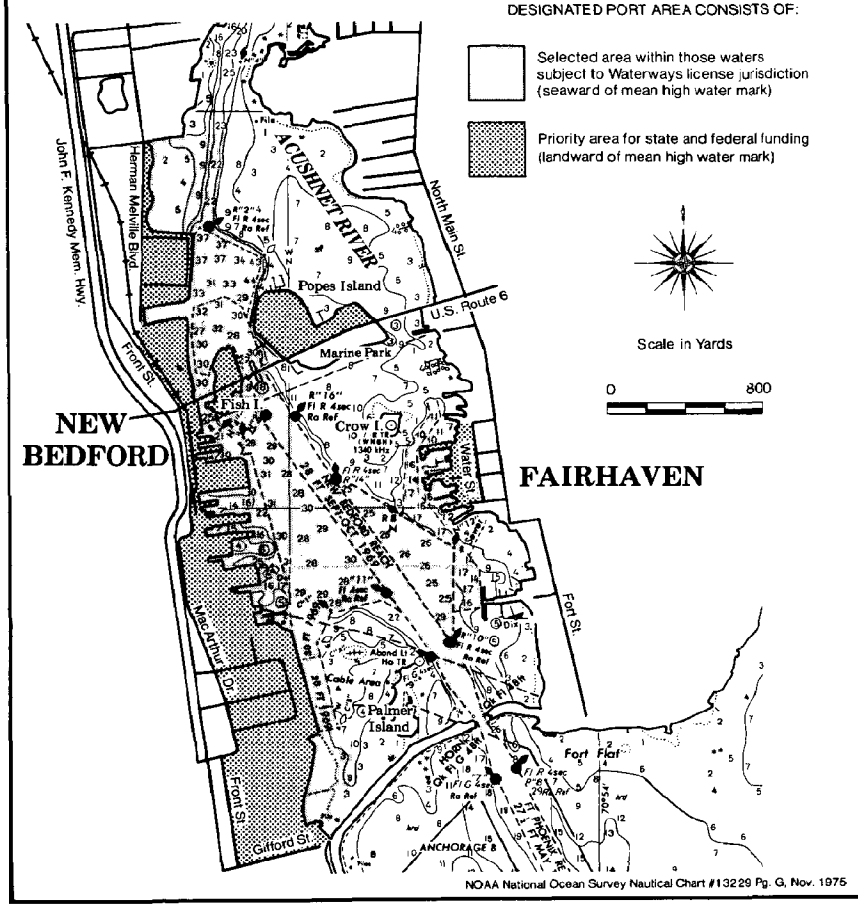
Selected area within those waters subject to Waterways license jurisdiction (seaward of mean high water mark)

Priority area for state and federal funding (landward of mean high water mark)



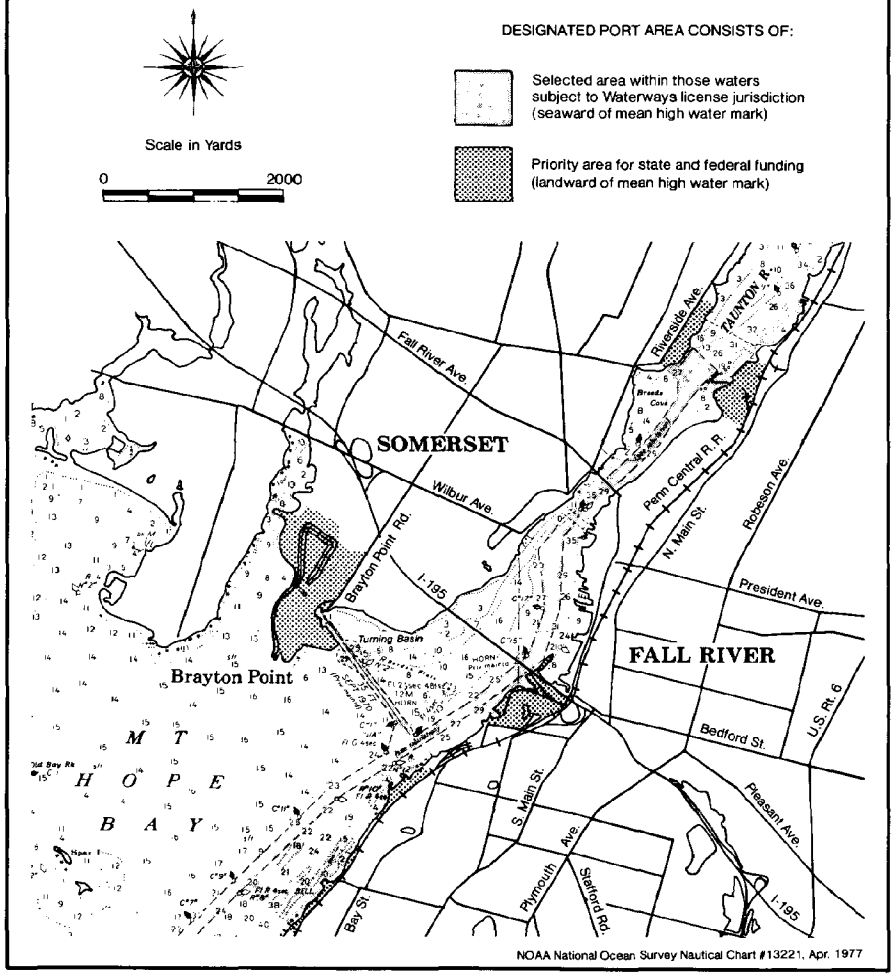
NOAA National Ocean Survey Nautical Chart #13253, Apr. 1977

Designated Port Area:
NEW BEDFORD-FAIRHAVEN



NOAA National Ocean Survey Nautical Chart #13229 Pg. G, Nov. 1975

Designated Port Area:
MT. HOPE BAY



NOAA National Ocean Survey Nautical Chart #13221, Apr. 1977

COASTAL BEACHES
Section 27

The Regulations define Coastal Beaches as follows:

Section 27(2)(a) "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.

Section 27(2)(b) "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.

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 a coastal beach.

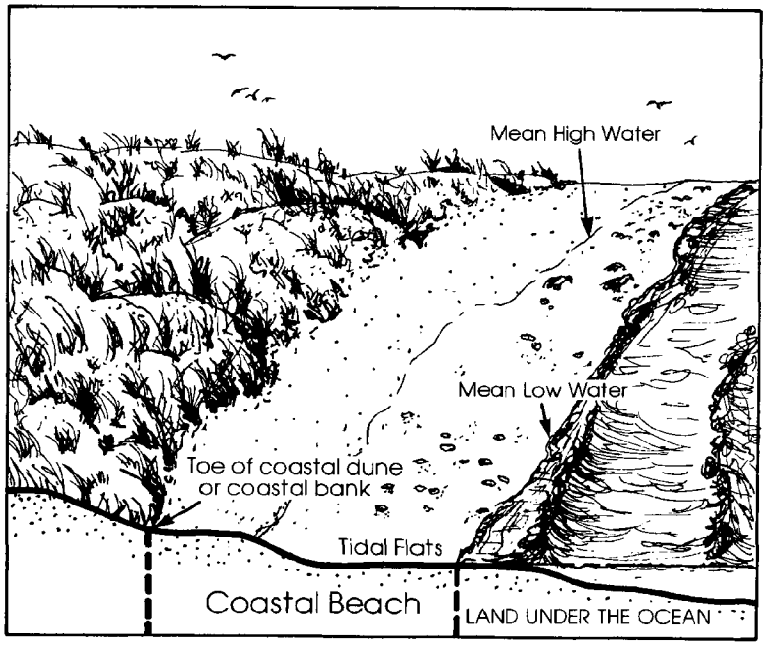


Illustration 4: Coastal beach cross section

Identification Illustration 4 shows the location of coastal beaches relative to other coastal landforms.

Coastal beaches, and their boundaries, can often be determined by careful observation if the applicant or conservation commission is familiar with the area and the boundaries are fairly obvious. Some useful tools for determining the boundaries of coastal beaches are:

- The United States Geological Survey's 7½ minute series topographic quadrangles, commonly referred to as "topo sheets." On such maps contour lines indicating land elevations are measured in feet above mean sea level and are set at 10 foot intervals. The line dividing land from water represents the approximate line of mean high water. The seaward boundary of coastal beaches (mean low water line) is indicated as the seaward edge of tidal flats, which are symbolized with a black dot pattern. The mean low water line represents the value of zero (0) feet, and all nautical soundings are measured in feet below this line. The landward edge of coastal beaches is usually identifiable where the contour lines indicate abrupt changes in topography relative to the beach. These abrupt changes are apt to be the edge of a dune or coastal bank but may indicate the man-made coastal engineering structures that replace dunes or coastal banklines. When consulting a topo sheet, however, be sure that the map is the most recent one available. Illustration 5 is a typical section of a U.S.G.S. topo sheet with important features indicated. It should be noted that an original topo sheet is printed in color and thus is much easier to read than this illustration.

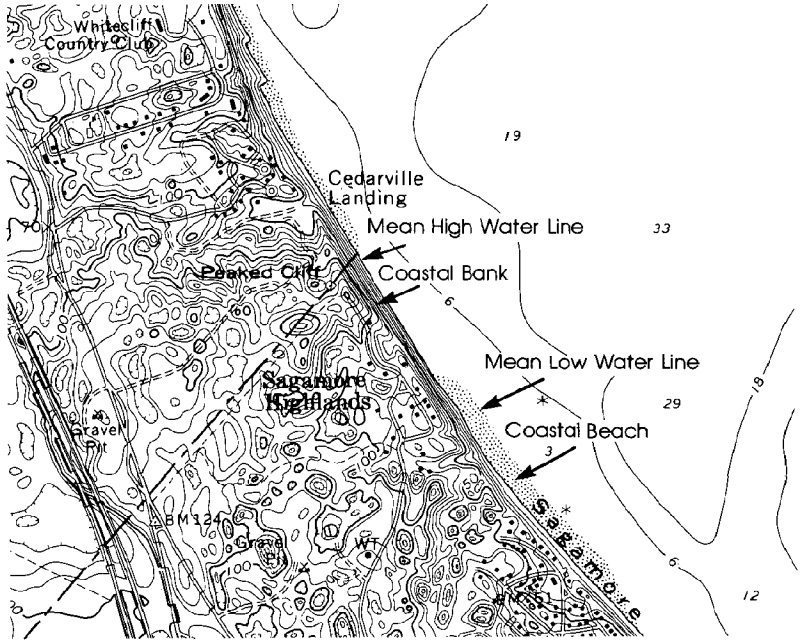


Illustration 5: Section of typical U.S.G.S. topo sheet

■ The approximate seaward boundary of coastal beaches is clearly shown on the NOAA nautical charts as the seaward extent of tidal flats (mean low water), and nautical soundings are measured in feet below mean low water. The landward edge of coastal beaches is, however, more accurately identifiable on the U.S.G.S. topo maps, which stress land information more than nautical information. Likewise, the nautical charts are more reliable for identifying the seaward boundaries because these charts focus upon water information moreso than topo sheets. See Illustration 2 in Section 25 for an example of a nautical chart.

■ In addition to nautical and topographical maps, surficial geologic maps are helpful for coastal beach boundary determination. These maps, also prepared by the United States Geological Survey, are especially helpful in determining whether a coastal beach borders a dune or a coastal bank. They can be very useful in identifying coastal beaches and, in general, in obtaining a better understanding of coastal processes.

■ Aerial photography, when available, is useful in determining the presence of a coastal beach.

Such sources of information will be most useful if supplemented with actual site visits to the areas under consideration.

Since existing data, such as a topo sheet or a nautical chart, is not always accurate or up-to-date, applicants will often have to supply their own survey map of the area proposed to be altered. The map should indicate: elevation contour lines measured in feet above mean sea level, the mean high water contour, the mean low water contour, and one foot contour lines between mean high and mean low water, accurate to tenths of feet.

Conservation commissions and applicants should become familiar with how to identify the dune-line or bank-line which indicates the landward edge of a coastal beach. The following illustrations indicate typical beach/dune and beach/bank edge situations. ■

Illustration 6: Coastal beach/coastal dune edge

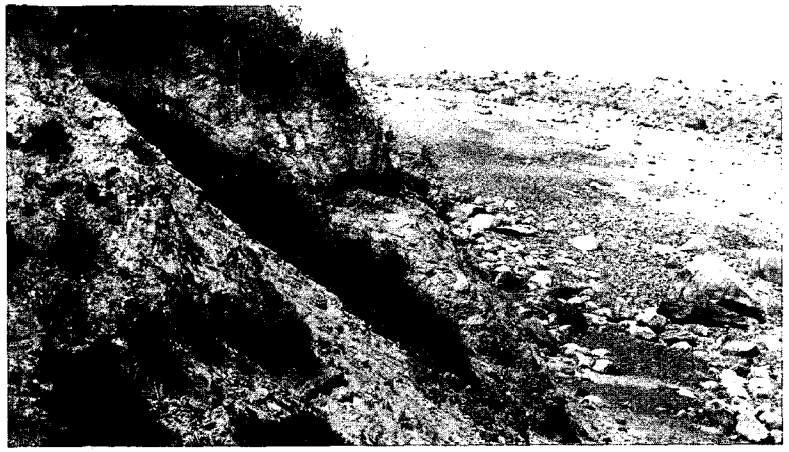


Illustration 7: Coastal beach/coastal bank edge

Resource Functions and Critical Characteristics

Physical Processes Coastal beaches play an important role in storm damage prevention and flood control.

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 and form of the beach.

Wave action is the principal agent responsible for the transport of beach sediment. The oblique approach of waves moves the sediment alongshore in the general direction of wave travel. The net rate of alongshore beach sediment transport depends upon the angle of wave approach, the wave energy, and the wave steepness — that is, the ratio of wave height to wave length. The characteristics (sizes) of the sediment being transported, as well as the form of the beach, also affect the rate of alongshore sediment transport. This transport of sediment alongshore is called littoral drift.

Coastal beaches serve as a sediment source for coastal beaches down the shore and for dunes and subtidal areas. Sediments move from subtidal areas to beaches to dunes and back again, in a constant shifting of sediment caused by wind and waves. Steep storm waves cause beach sediment to move offshore to subtidal areas, resulting in a reduced coastal beach volume and a gentler slope, thereby reducing the energy of storm waves. The shape of a beach is actually changed during a storm in such a way that wave energy is reduced. See Illustration 8 and Illustration 9.

Following storms, less steep waves return sediment landward and the coastal beaches can recover to approximate pre-storm conditions, thereby again changing their shape in such a way that future storm wave energy will be dissipated.

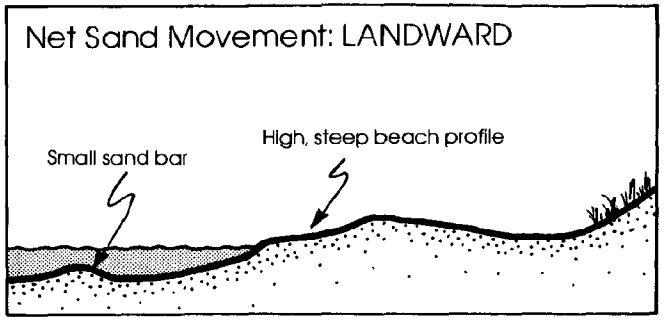


Illustration 8: Low wave energy beach profile

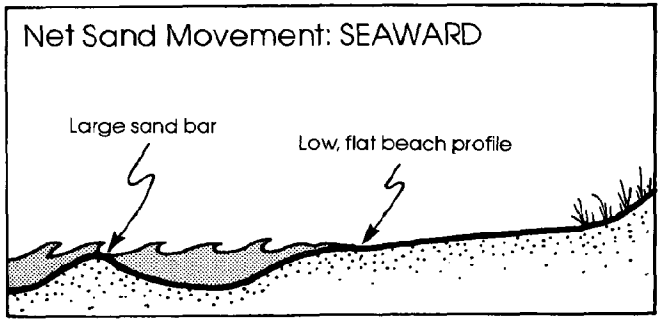


Illustration 9: Storm wave beach profile

Biological Processes Tidal flats are valuable habitats for many invertebrates, including a variety of polychaete worms and bivalve and gastropod molluscs. These organisms play an important role in coastal marine systems by utilizing plankton and microalgal-produced nutrients and detritus and contributing extraordinary numbers of larvae to the food web. These larvae provide a valuable food source for the young stages of commercial fish and crustaceans.

Adult invertebrates are also important since a variety of species, including the commercially valuable winter flounder and crustaceans, feed on them.

The characteristics of the tidal flat portion of coastal beaches that are significant to the protection of marine fisheries or to land containing shellfish are similar to those for land under the ocean. These are water circulation, distribution of sediment grain size, water quality, and relief and elevation. The first three are discussed in the section on land under the ocean, and these comments apply to tidal flats as well. The relief and elevation of tidal flats affect how long the flats will be exposed to the air during low tide. Organisms inhabiting the flats are adapted to specific exposure periods (within ranges), so that unnatural changes to relief and elevation may affect the survival of shellfish and other tidal flat inhabitants. ■

COASTAL DUNES
Section 28

The Regulations define Coastal Dunes as follows:

Section 28(2) "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.

Illustration 10: Coastal dune

Identification The location of a coastal dune relative to other shoreline land forms is shown in Illustration 11.

Although many people can easily recognize a coastal sand dune when they see one, its exact "starting" line and "ending" line are sometimes hard to determine, especially when a coastal dune slopes very gradually from a coastal beach.

It is easy to confuse coastal beach berms with coastal dunes. Berms, usually devoid of vegetation, are fairly flat terraces on the upper beach and are part of the natural form of the coastal beach. The difference between a coastal beach berm and a coastal dune is indicated in Illustration 11.

Some guidelines useful in identifying the location of the seaward edge of a coastal dune are:

1. Where a clear, abrupt change of topography occurs on the landward edge of a coastal beach.

2. Coastal dunes are not usually reached by normal high tides, so the "startling line" is landward of the usual high tide line.

3. Where the familiar "dune-grass" vegetation begins. (However, it should be noted that some dunes are not vegetated.)

Illustration 11 shows the application of these guidelines:

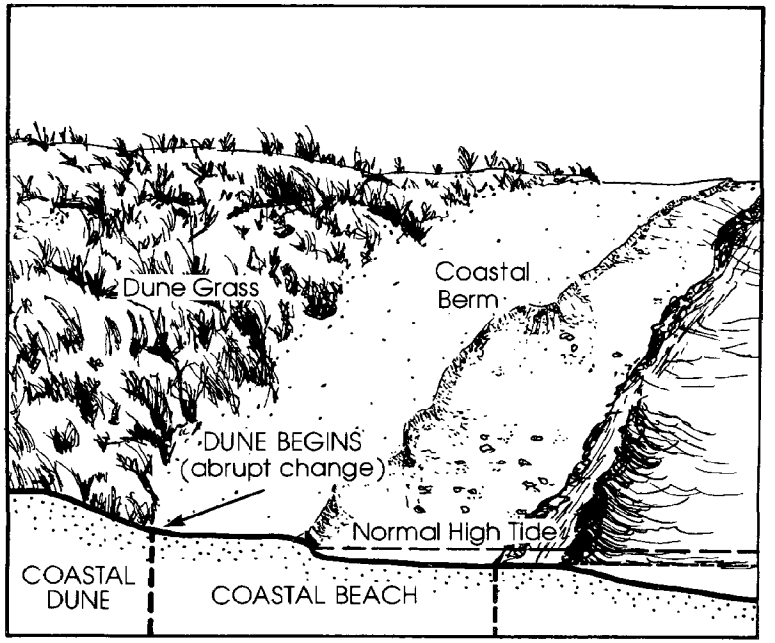


Illustration 11: Coastal dune characteristics

Coastal dunes play an important role in storm damage prevention and flood control. It should be noted that the 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 in Section 28. The dunes behind the one or two rows of dunes closest to the beach may be significant, but are less likely to be than the front dunes, except on barrier beaches.

The landward extent of coastal dunes is the landward edge of the sediment deposited by wind or storm wave overwash. This is usually marked by a change in vegetation from dune-type vegetation such as dune grass, beach pea, rosa rugosa, or beach plum to upland plants such as pine or hardwoods.■

Resource Functions and Critical Characteristics

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. The volume and height provide a buffer from storm waves and elevated sea levels for landward properties and landward coastal wetlands.

The characteristics of coastal dunes which are likely to be significant to storm damage prevention and flood control are:

■ 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. This sand helps maintain or increase the volume of the coastal beach as it loses sand during storms to nearshore areas of the ocean. Without the supply of sand from coastal dunes, beaches will gradually be depleted of sediment and disappear. (The sand which moves from the dune to the beach originally was carried by wind from the beach to the dune).

■ Coastal Dune Form and Volume — The volume (height and width) and form of coastal dunes provide a buffer which resists the wave uprush during storms and retards stormline retreat. (See Appendix A for a discussion of shoreline retreat.) Coastal dune form and volume are the result of a combination of factors, the most important of which are wind and vegetation. Natural waters flow, which comes in the form of storm overwash, is also an important process in controlling the coastal dune form and volume, because through this mechanism, sand is carried landward to initiate dune formation. (RFCC Dunes)

■ Vegetative Cover — Vegetation contributes to the growth and stability of coastal dunes by providing conditions favorable to sand deposition. Coastal dunes often originate along the strand line of the beach. "Wrack" material, such as beachgrass stems, is carried to the strand line by wind and wave activity where it accumulates and is often buried by sand blowing from the coastal beach. Seeds of many plants become mixed with these materials and subsequently germinate. This is seen in Illustration 13. As the strand line plants grow and begin trapping more sand, the strand line rises to a height above the high tide line.

Illustration 12: Dune configuration

Illustration 13: Dune configuration. Note that wrack material forms the dune line.

The beach grass then begins to act as a baffle, trapping sand moved by the prevailing winds, and producing the vertical accumulation of sand called dunes.

On retreating shorelines, coastal dunes bordering the coastal beach move landward with the rest of the shoreline. This allows coastal dunes to maintain their form and volume. If the dune did not build landward, the dune would gradually be eroded away from the seaward side and the dune would become smaller and smaller, and therefore would be more likely to be completely washed away in a coastal storm. ■

BARRIER BEACHES
Section 29

The Regulations define Barrier Beaches as follows:

Section 29(2) "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.

Illustration 14: Aerial view of barrier beach at Nauset, Massachusetts

Identification Barrier beaches are found in many areas along the Massachusetts coastline. The following list includes many of the barrier beaches or barrier islands in the Commonwealth.

Town / Barrier Beach or Island

Barnstable
Mill Creek Spit
Hyannisport Spit
Squaw Island Beach — East and West Sides
Craigville - Long Beach
Dowses Beach
Dead Neck
Rushy Marsh Pond
Sandy Neck

Bourne
Sagamore Beach
Bassetts Island
Hog Island
Squeteague Harbor Beach
Scraggy Neck Beach

Brewster/Orleans
Namskaket Creek — East and West Spits

Chatham
Harding Beach
Forest Beach
Monomoy Island National Wildlife Refuge

Chilmark
Black Point Pond
Quanames Cove
Chilmark Pond
Stonewall Beach

Chilmark/Gay Head
Squibnocket Pond Beaches

Cohasset
Sandy Beach

Dartmouth
Sq. Barekheed Rocks Beach
Round Hill Reservation
Salters Pond Beach
Cow Yard Beaches
Georges Pond
Little Beach

Dennis
Chapin Beach
Sesuit Beach
Quivett Creek Beach — East and West Spits
Swan Pond River
Davis Beach

Duxbury
Duxbury Beach

Eastham
Rock Harbor Spit
Hatch Beach
Harmes Way (Sunken Meadow Beach)

Edgartown
Eel Pond, Little Beach
Chappaquiddick Beach
Cape Poge
Norton Point
Edgartown Great Pond Beach
Jobs Neck Pond Beach
Paqua Pond Beach
Oyster Pond

Eastham/Orleans/Chatham
Nauset Beach

Fairhaven
West Island Beach

Falmouth
Washburn Island Beach
Eel Pond Beach
Bourne Pond
Green Pond
Great Pond
Little Pond
Falmouth Inner Harbor
Falmouth Beach
Quissett Beach
Nobska Beach
Gunning Point
Sippewisset Beach
Lt. Sippewisset Marsh Creek Beach
Black Beach
Chappaquoit Beach
Herring Brook Spits
Wild Harbor Beach
Silver Beach

BARRIER BEACHES
Section 29

Gay Head
Lobsterville Beach (Menemsha Pond)

Gloucester
Coffins Beach
Wingaersheek Beach
Good Harbor Beach

Harwich
Red River Beach (town beach)
Saquatucket Harbor Beach
Wychmere Harbor Beach
Allen Harbor
Herring River

Hull
Nantasket Beach
Crescent Beach

Ipswich
Clark Pond
Castle Neck/Crane Beach

Manchester
Black Beach
White Beach

Marion
Planting Island

Marshfield
Sunrise Beach
Brant Rock

Mashpee
Popponesset Beach
Flat Pond Beach
South Cape Beach

Mattapoisett
Pine Island Beach (both sides)
Eel Pond Beach
Mattapoisett River Spit

Nantucket
West End Muskeget — Muskeget Island
North Pond (Tuckernuck)
East Pond (Tuckernuck)
Eel Point
Capaum Pond Beach
Reed Pond Beach
Coatue
Quaise Point
Folger's Marsh
Abram's Point
Pimneys Point
Great Point — Wauwinet
Sesachacha Pond
Tom Nevers Pond
Miacomet Pond
Cisco Beach
Long Pond

Newburyport/Newbury/Rowley/Ipswich
Plum Island

Oak Bluffs
Crystal Lake
Oak Bluffs Harbor
Farm Pond

Oak Bluffs/Edgartown
Sengekontaket

Orleans
Little Namskaket Creek — East and West Spits

Provincetown
Long Point — Wood End
Race Point
Hatches Harbor — South Spit
Head of the Meadow Beach

Plymouth
Saquish Neck
Long Beach
White Horse Beach
North Bayside Beach
Center Hill Pond
Ellisville Harbor — North and South Spits

Quincy
Quincy Memorial Beach

Revere
Revere Beach

Rockport
Pebbly Beach
Cape Hedge Beach
Long Beach

Salisbury
Salisbury

Sandwich
Town Beach
Spring Hill Beach — East Sandwich
Scorton Shores Beach

Scituate
Minot Beach
North Scituate Beach
Mann Hill Beach
First and Second Cliff Beaches
Peggotty Beach
North River — North Spit
Humarock Beach

Tisbury
Lake Tashmoo Spits
Mink Meadows

Tisbury/Oak Bluffs
Lagoon Bridge Beach

Truro
Pamet River — North and South Spits
Little Pamet River
Pilgrim Beach (Beach Point)

Wareham
Little Harbor
Long Beach Point

Wellfleet
The Gut — Jeremy Point

Wellfleet/Truro
North and South Bound Brook Island

Westport
East Horseneck
Horseneck
Cockeast Pond
Richmond Pond

West Tisbury
Lambert's Cove
Watcha Pond
Homer Pond
Long Cove Pond

West Tisbury/Chilmark
Tisbury Great Pond

Winthrop
Yirrell Beach

Yarmouth
Great Island Beach
Mill Creek
Parkers River
Sea Gull Beach
and East Spit

BARRIER BEACHES
Section 29

Since barrier beaches are complexes of coastal dunes, coastal beaches, and occasionally other coastal Resource Areas such as salt marshes, the boundaries of a barrier beach are the seaward edge of the outer coastal beach and the landward edge of the inner coastal dune or the inner coastal beach. On the oceanside, a barrier beach generally starts at the mean low water line, and includes, progressing landward, all areas defined as coastal beaches and coastal dunes and any fresh or salt marshes which may be present within the complex. Barrier beaches end on the landward side at the mean low water line if the embayment is tidally influenced, or, if not, at the landward edge of the coastal dune or coastal beach.

It is important to know whether a complex of Resource Areas is to be considered a barrier beach because the Regulations state that all coastal dunes located within a barrier beach, and not just those closest to the ocean, are presumed to be significant to storm damage prevention and flood control. ■

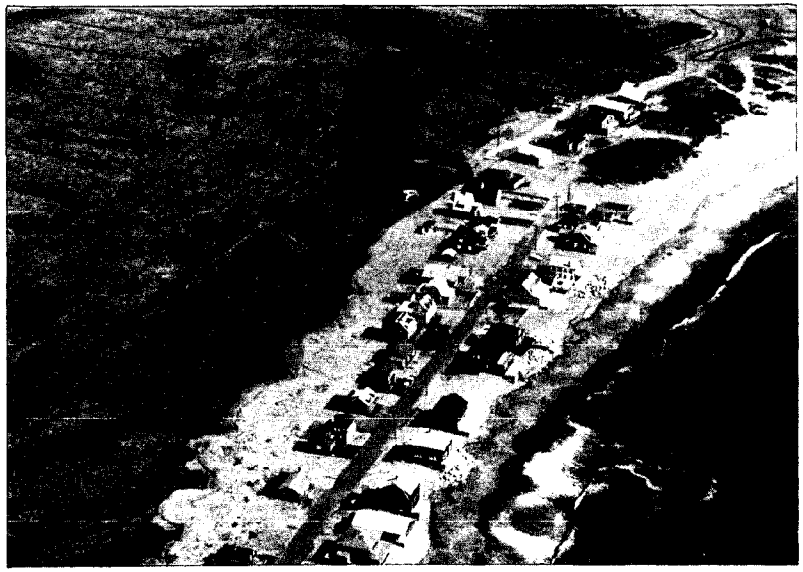


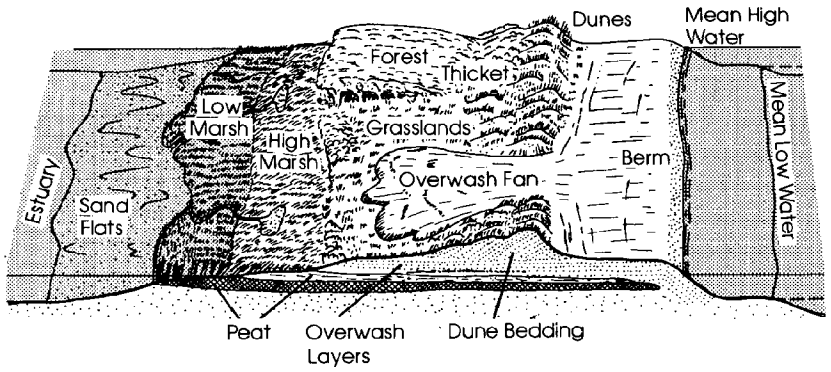
Illustration 15: Homes on barrier beach susceptible to storm damage

Resource Functions and Critical Characteristics

Physical Processes Barrier beaches play an important role in storm damage prevention and flood control. The characteristics of barrier beaches which are critical to these two interests are the volume and form of the coastal beaches and coastal dunes, and their ability to respond to wave action and storm wave overwash.

The concepts discussed in the sections on coastal beaches and coastal dunes apply to barrier beaches as well. In addition, barrier beaches move landward when sediment is carried across to the backside of barrier beaches by storm overwash surges This forms deposits known as "washover fans" which may develop into coastal dunes. Tidal inlets widen barrier beaches by means of the deposition of sand aprons or flood tidal deltas on the landward side of the barrier beach.

Biological Processes Barrier beaches also play an important role in the protection of marine fisheries. The characteristics of barrier beaches which make them critical to this interest are the same as those discussed in the tidal flats section. ■



Adapted from Oceanus, Vol. 19 No. 5, p. 29.

Illustration 16: Various elements of a typical barrier beach. Note that not all elements are necessarily present on any one barrier beach.

COASTAL BANKS
Section 30

The Regulations define Coastal Banks as follows:

Section 30(2) "Coastal Bank" means 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 those elevated land forms landward of coastal beaches, salt marshes, land under a salt pond, or rocky intertidal shores which are not coastal dunes. A coastal bank may also be behind a coastal dune, but usually the dune gradually becomes upland with no discernable bank.

Illustration 17 shows a classic coastal bank in North Truro, Massachusetts.

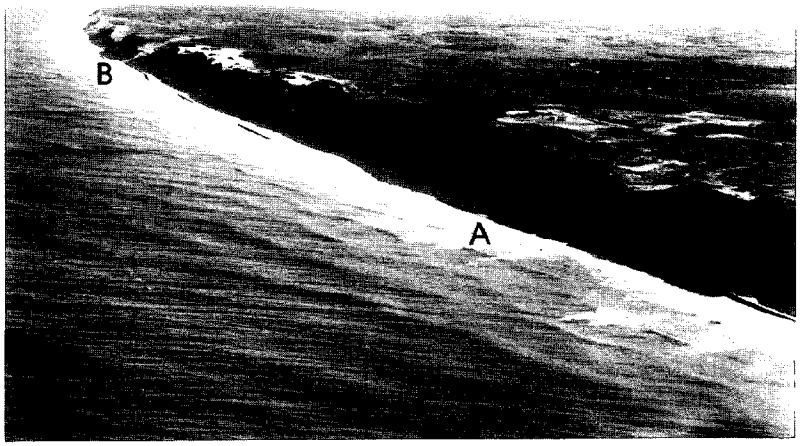


Illustration 17: Aerial view of coastal bank in North Truro

Identification Illustration 18 shows the relationship of coastal banks to other shoreline features.

If the landform behind a coastal beach, salt marsh, land under a salt pond or rocky intertidal shore, is elevated and does not fit the definition of a coastal dune, it is a coastal bank. It may be steep or gently sloping, it may be rock or fairly loose

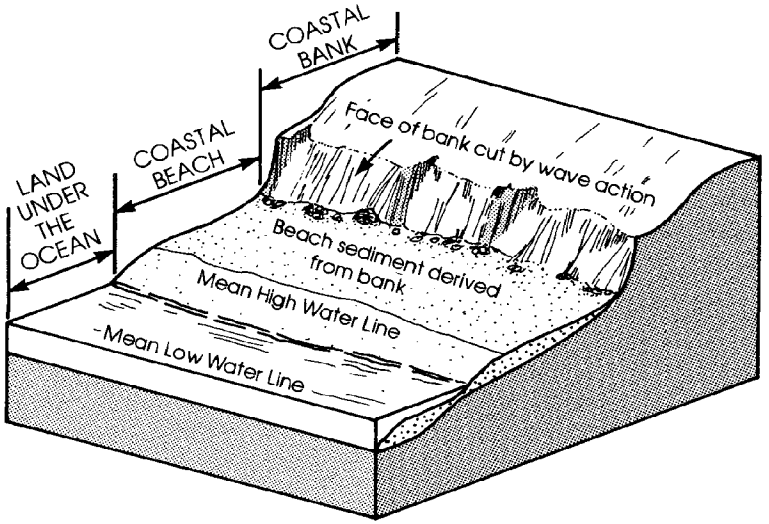


Illustration 18: Coastal bank cross section

sediment, but it is nevertheless a coastal bank. Note that sometimes a salt marsh is bounded by a freshwater marsh, so that there is no coastal bank or coastal dune behind it.

The coastal bank begins where the other coastal wetland ends, usually at the toe of the coastal bank slope.

The landward boundary is the top of, or the first major break in, the face of the coastal bank.

Both the seaward and landward boundary of coastal banks are readily identified by the use of topographic maps such as the U.S.G.S. topographic quadrangles. Illustration 19 is a section of the North Truro quadrangle showing the coastal bank pictured in the preceding photograph. The U.S.G.S. surficial geologic maps are very useful in distinguishing a coastal bank from a coastal dune landform. Most of the coastal banks in Massachusetts are glacial landforms such as glacial drumlins, ground moraines or deposits or glacial outwash. For those areas where these maps are available, they are the most useful information for determining the boundaries of a coastal bank. ■

COASTAL BANKS
Section 30

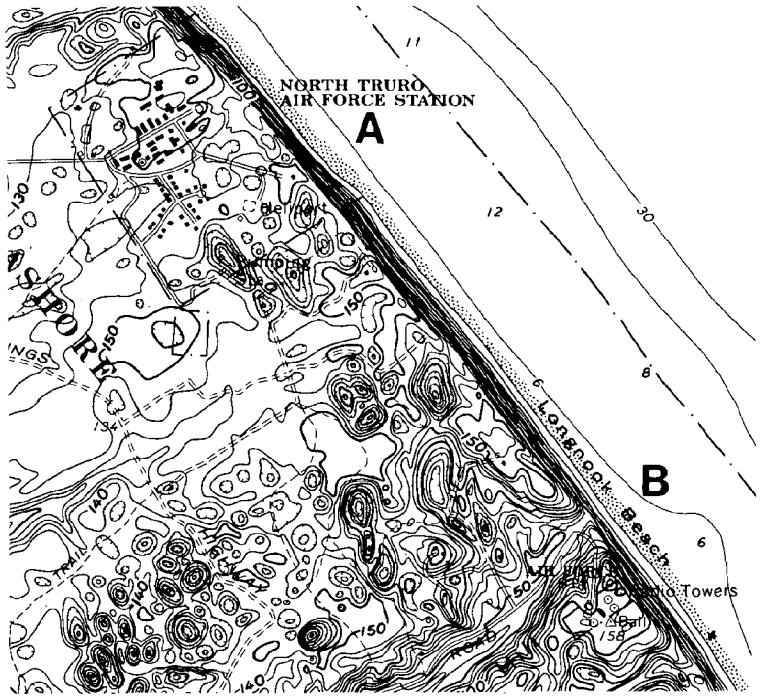


Illustration 19: Section of North Truro, Massachusetts topo sheet

Resource Functions and Critical Characteristics

Physical Processes – Coastal Banks — Coastal banks play an important role in storm damage prevention and flood control. The characteristics which make them important to these two interests are:

- An ability to erode in response to wave action, which allows coastal banks to supply sediment to coastal beaches, coastal dunes, barrier beaches and land under the ocean.
- A natural resistance to erosion caused by wind and rain runoff, which allows coastal banks to act as a vertical buffer to storm waters and waves.

Any particular coastal bank may serve either or both of these functions — they are not mutually exclusive. It is important to identify which functions a particular bank serves, since this identification will determine how it should be treated by the applicant and the conservation commission.

A coastal bank composed of consolidated material is not providing sediment to coastal beaches, coastal dunes or land under the ocean. But one consisting of unconsolidated sediment which is exposed to the open sea along a generally "straight" shoreline with adjacent coastal beaches is likely to be a significant sediment source because it erodes. Such coastal banks may be found along the shores of Massachusetts Bay, Cape Cod Bay, Nantucket Sound, Vineyard Sound and Buzzards Bay.

Coastal banks of unconsolidated sediment which are protected from vigorous wave action and which are not fronted by coastal beaches are not likely to be sources of sediment. Such coastal banks are commonly found along the margins of salt marshes, salt ponds or rocky intertidal shores. ■

Illustration 20: Close up photo of a coastal bank

COASTAL BANKS
Section 30

Bank erosion is an important source of beach sand where the coastal banks face the open sea, consist of unconsolidated sands or weakly cemented formations high in sand content, and are subject to erosion by vigorous wave action. Such cliffs often erode at rates of one or more feet per year. The cliffs of outer Cape Cod, for example, have been found to retreat at an average rate of 2.6 feet per year. The erosion of the sea cliffs provides a great deal of the sediment which makes up the coastal beaches, coastal dunes and barrier beaches of the east coast of Cape Cod. If the erosion of these cliffs was stopped, the beaches would eventually disappear. Other examples include the cliffs along the Cape Cod Bay shore of Eastham which have provided sediment to the Eastham beaches and barrier spits, and Sandy Neck in Barnstable which was formed by the deposition of material eroded by wave action from the exposed banks of local glacial deposits.

While erosion caused by wave action is an integral part of shoreline processes, the erosion by wind and rain runoff of the coastal bank, which plays a minor role in beach nourishment, should not be increased unnecessarily. Disturbances to coastal banks which undermine their natural resistance to wind and rain erosion increase the risk of their collapse and cause cuts in the banks. This increases the danger to structures at the top of the coastal bank and reducing the bank's ability to buffer upland areas from coastal storms. Vegetation tends to stabilize the bank and reduce the rate of erosion due to wind and rain runoff. ■

ROCKY INTERTIDAL SHORES
Section 31

The Regulations define Rocky Intertidal Shores as follows:

Section 31(2) "Rocky Intertidal Shores" means naturally occurring rocky areas, such as bedrock or boulder-strewn areas between the mean high water line and the mean low water line."

Illustration 21: Bedrock rocky intertidal shore

Identification Illustrations 22 and 23 show sections of the U.S.G.S. topographic maps illustrating the Survey's symbol for rocky shorelines. The star-like symbol illustrates rocky beaches composed of boulders, while the other symbol usually indicates more vertical exposures of bedrock that comprise rocky intertidal shores. U.S.G.S. surficial geologic maps, where they are available, are the best sources of information to aid in identifying a rocky intertidal shore.

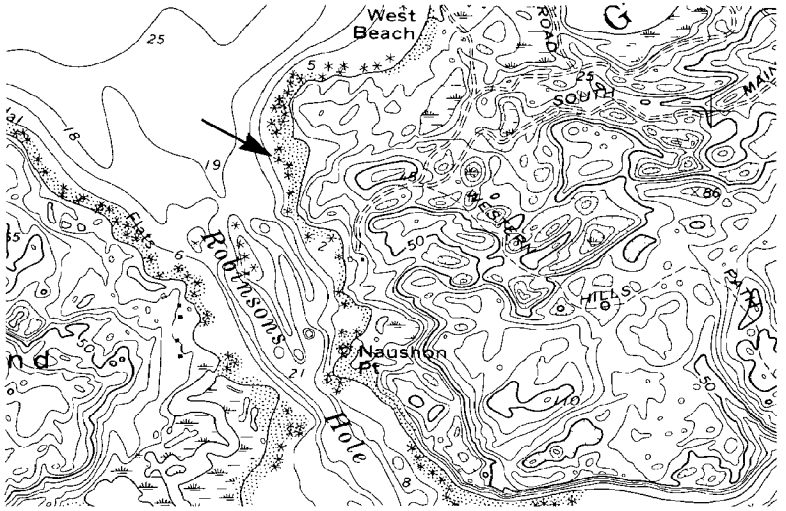


Illustration 22: Boulder beach symbol on topo sheet

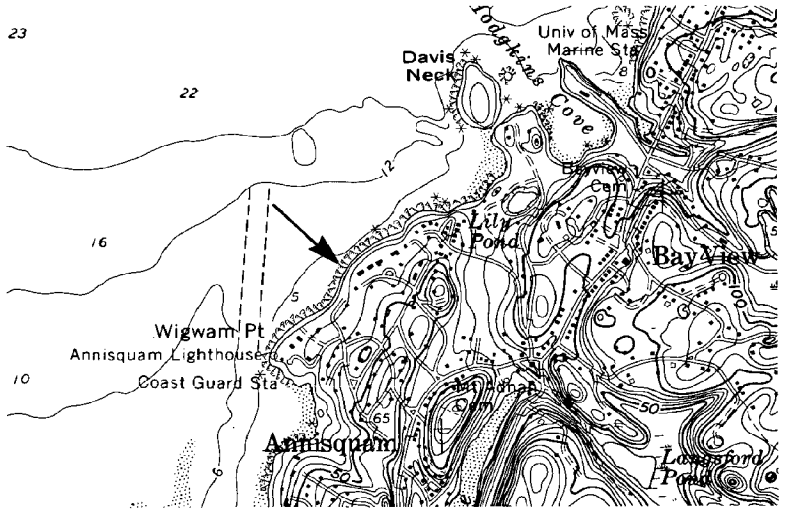


Illustration 23: Bedrock shore symbol on topo sheet

Because the seaward and landward boundaries of this Resource Area are defined by the mean low water and mean high water lines respectively, the exact locations can be identified only by determining the elevation of mean high and mean low water for the site on which the activity is proposed and then transferring these elevations to an accurate topographic map of the site. The nautical charts published by NOAA referred to in the section on "Land Under the Ocean," are one source of mean low and high water elevation.

When the applicant must supply topographic mapping for areas between the mean high and mean low water lines, it should be accurate to tenths of feet, especially where the rocky intertidal shore is of the more gently sloping type. ■

Resource Functions and Critical Characteristics

Physical Processes Rocky intertidal shores play an important role in storm damage prevention and flood control. In much the same manner as coastal beaches act, the sloping shore and/or the boulders dissipate wave energy and serve as natural buffers from the sea for the land behind the rocky intertidal shores.

Biological Processes Rocky intertidal shores also play an important role in the protection of marine fisheries and land containing shellfish. They are restricted environments to which a variety of plants and animals are specially adapted. Marine organisms are often found on exposed surfaces of the substrate, since burrowing, a common protection mechanism of sand dwellers, is not generally possible on the rocks. Exposure to air in this intertidal environment is therefore a more controlling factor in distribution and abundance of marine organisms than in other intertidal habitats.

The communities of the rocky intertidal shores are dominated by crustaceans (decapods and cirripedes), molluscs (bivalves and gastropods, such as snails and mussels), and macroscopic algae that may be used directly as a food. The algae mats of rocky shores produce detritus and nutrients which fertilize the coastal ecosystem.

The characteristics of rocky intertidal shores that are important to the protection of marine fisheries or land containing shellfish are water circulation and water quality.

The discussion of water circulation and water quality in the section on land under the ocean applies to rocky intertidal shores as well. ■

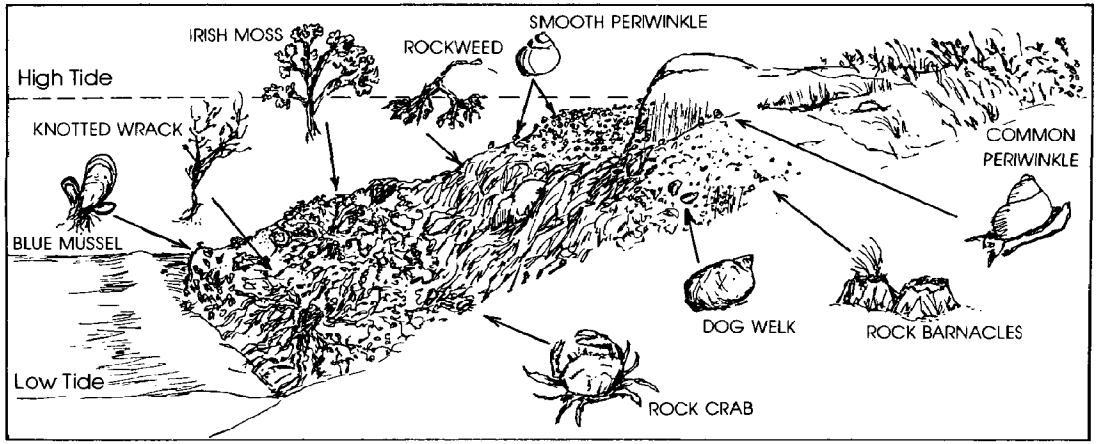


Illustration 24: A section of rocky intertidal shore

SALT MARSHES
Section 32

The Regulations define Salt Marsh as follows:

Section 32(2)(a) "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.

Section 32(2)(b) "Spring Tide" means the tide of the greatest amplitude during the approximately 14-day tidal cycle. It occurs at or near the time when the gravitational forces of the sun and the moon are in phase (new and full moons).

Illustration 25 is a typical salt marsh. *Spartina alterniflora* is shown adjacent to the tidal creeks. The *Spartina patens* is shown just landward of the *S. alterniflora*.

Illustration 25: Typical salt marsh

Identification Salt marshes are usually located adjacent to tidal waters. They may also be located, however, in areas where saline soil conditions are caused by storm overwash, as in the case of salt ponds or entrapped marshes within a barrier beach or barrier island.

Salt marshes are flat, open areas characterized by grasses that are bordered by upland vegetation. The vegetation of a salt marsh is noticeably different from the surrounding upland. In some cases, the transition from the salt marsh is gradual, particularly when the salt marsh grades into a freshwater marsh. The boundaries of salt marshes must be determined on the basis of vegetation. They do not always follow a contour line. The following plant list indicates which plants should and should not be used to identify salt marshes.

Common salt marsh plants that will be used as indicator species of a salt marsh:

Salt Marsh Cord Grass, *Spartina alterniflora*
Salt Meadow Grass, *Spartina patens*
Spikegrass, *Distichlis spicata*
Blackgrass, *Juncus gerardi*
Marsh elder, *Iva frutescens*
Glass worts, *Salicornia sp.*
Sea Lavender, *Limonium carolinanum*
Sea Blite, *Suaeda maritima*
Spearscale, *Atriplex sp.*
Salt Marsh Aster, *Aster maritima*
Little sea-pink, *Sabatia stellaris*

Plants that will *not* be used as salt marsh indicator species are:

Cattails, *Typha sp.*
Reedgrass, *Phragmites communis*
Prairie cordgrass, *Spartina pectinata*
Big cordgrass, *Spartina cynosuroides*
Softstem bulrush, *Scirpus validas*

Illustration 26 shows a cross section of a salt marsh.

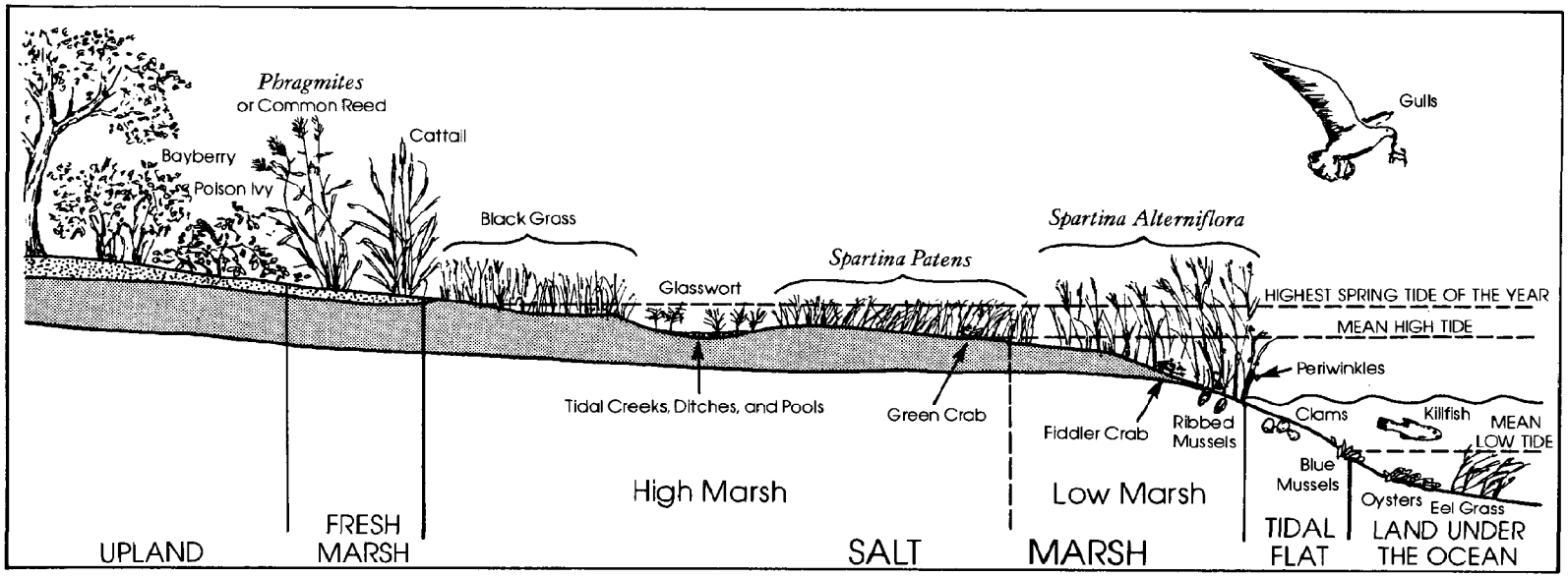


Illustration 26: Cross section of a salt marsh

If in doubt about where the landward boundary of the salt marsh lies, a good guide is to determine where a significant percentage of the plants are salt tolerant. "Significant percentage" means greater than fifty percent. If by actual count of plants or by percent of ground coverage of a 1 meter square plot, the number of plants or percent of ground coverage of species listed above is greater than fifty percent, the area is to be considered a salt marsh. Conversely, if the number is less than fifty percent, the area shall not be considered salt marsh, and the boundary can probably be located more seaward of the area where the count was made.

Drainage ditches and creeks are also likely to be found in salt marshes. Even though the ditches and creeks do not contain salt marsh vegetation, they are to be considered as part of the salt marsh by definition if: (1) they are substantially drained at mean low water level, and (2) they are within or substantially surrounded by salt marsh vegetation.

Larger streams and rivers that flow through areas of salt marsh vegetation are not part of the salt marsh if they contain water at mean low water.

One final note is that if isolated "salt pools" or "salt-pannes" (areas with little or no vegetation) are located within salt marshes, then these areas are to be considered salt marshes even if they do not contain typical salt marsh vegetation. ■

Resource Functions and Critical Characteristics

Physical Processes Salt marshes play an important role in storm damage prevention and groundwater supply. 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.

Biological Processes Salt marshes also play an important role in the protection of marine fisheries and land containing shellfish. 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. In the salt marsh system, inorganic chemicals and sunlight are converted into plant tissue by salt tolerant grasses and a variety of algaes. The materials produced by marsh photosynthesis may be used by consumers in the marsh or be flushed by tidal flow from the marsh as dissolved nutrients or detritus. 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 chemical characteristics of estuarine waters, particularly the levels of nutrients, dissolved oxygen and biological oxygen demand, are modified each time estuarine waters flush a salt marsh area. Salt marshes act to reduce pollution of the coastal zone by removing excess nutrients and heavy metals delivered by surface runoff from upland areas.

The characteristics of salt marshes which are critical to the protection of marine fisheries and prevention of pollution are: (a) the growth, composition and distribution of salt marsh vegetation, and (b) the flow and level of tidal and fresh water.

It is the growth, composition and distribution of the plants in a salt marsh which determine how well it performs the processes described above.

Either the destruction or the pollution of the salt marsh system will reduce or eliminate its productivity and subsequent contribution to the marine food chain. The productivity of salt marsh areas is extremely high. The total net production of salt marsh grasses may be as much as 3 times higher than the total net production of a Missouri tall grass prairie.

The viability of the salt marsh is dependent upon adequate tidal flow and drainage. The tides redistribute nutrients and sediments throughout the tidal marsh complex. Slight alterations in tidal flow and drainage can dramatically alter plant composition by altering the salinity and nutrient regimes necessary for healthy plant growth. The export of detritus from the marshes also depends, in large part, upon tidal activity. ■

AND UNDER SALT PONDS
Section 33

The Regulations define Salt Ponds as follows:

Section 33(2) "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."

Land under a salt pond is the surface of the earth beneath the waters of a salt pond.

Identification The Massachusetts Division of Marine Fisheries has identified many of the salt ponds within the coastal zone. These are listed below:

Town/ Salt Pond Name	Topographic Quadrangle
Chilmark	
Black Point Pond	Tisbury Great Pond
Chilmark Pond	Tisbury Great Pond
Stonewall Pond	Squibnocket
Chilmark/West Tisbury	
Tisbury Great Pond	Tisbury Great Pond
Dartmouth	
Allen's Pond	Westport, New Bedford South
Edgartown	
Edgartown Great Pond	Edgartown
Oyster Pond	Tisbury Great Pond
Pocha Pond	Edgartown
Falmouth	
Oyster Pond	Woods Hole
Salt Pond	Woods Hole
Little Pond	Falmouth
Gosnold	
Quicks Hold Pond	Cuttyhunk
Mattapoisett	
Eel Pond	Marion
Nantucket	
North Pond	Tuckernuck
East Pond	Tuckernuck
Sesachacha Pond	Siasconset
Cockata Pond	Great Point
Oak Bluffs	
Farm Pond	Edgartown
West Tisbury	
James Pond	Vineyard Haven

The boundary of a salt pond is the bank of the pond or the landward edge of any wetland adjacent to the water. ■

Resource Functions and Critical Characteristics

Biological Process Salt ponds play an important role in the protection of marine fisheries and land containing shellfish. 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, molluscs 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*. The unique 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.

The characteristics of land under a salt pond which are significant to the protection of marine fisheries are water quality, water circulation and freshwater inflow.

The discussion of water quality and water circulation contained in the section on land under the ocean applies to land under salt ponds as well.

SALT PONDS
Section 33

The inflow of freshwater into the salt pond is essential because it is a source of nutrients and it maintains the salinity regime of the salt pond environment. In salt ponds with ocean inlets, the freshwater inflow produces a mass, or head, of freshwater pushing seaward which helps keep the barrier inlet open. The dilution caused by freshwater inflow also creates a density difference within the water column of the salt pond. A two-layered system results in which the less dense freshwater flows seaward at the surface and denser salt water from offshore flows in along the bottom. The effect of this hydrological mechanism is to concentrate both nutrients and organisms within the salt ponds. ■

LAND CONTAINING SHELLFISH
Section 34

The Regulations define Land Containing Shellfish as follows:

Section 34(2)(a) "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.

Section 34(2)(b) "Shellfish" means the following species: Bay scallop (*Argopecten irradians*); Blue mussel (*Mytilus edulis*); Ocean quahaug *(Arctica islandica)*; Oyster *(Crassostrea virginica)*; Quahaug *(Mercenaria mercenaria)*; Razor clam *(Enis directus)*; Sea clam *(Spisula solidissima)*; Sea scallop *(Placopecten magellanicus)*; Soft shell clam *(Mya arenaria)*.

Land containing shellfish differs from the other Resource Areas in that it is both an interest to be protected by the Act and a Resource Area. Land containing shellfish should be treated as an "overlay Resource Area"— that is, wherever a "significant" shellfish area exists, as defined below, on land under the ocean, the tidal flats portion of coastal beaches, rocky intertidal shores, salt marshes or land under salt ponds, the performance standards contained in Sections 34(4), 34(5), 34(6), and 34(7) of the regulations shall be applied in addition to the performance standards established for the underlying Resource Area. If there is a conflict, the more restrictive performance standard shall apply.

Land containing shellfish, such as that shown in Illustration 27, is defined by Section 34(3) to be significant when it has been identified and mapped as follows:

Regulation 34(3)(a) "by the conservation commission or the Department in consultation with the Department of Marine Fisheries and based upon maps and designations of the Department of Marine Fisheries, or

Regulation 34(3)(b) "by the conservation commission or the Department, based upon maps and written documentation of the shellfish constable or the Department. In making such identification and maps, the following factors shall be taken into account and documented: the density of shellfish, the size of the area and the historical and current importance of the area to recreational or commercial shellfishing."

Illustration 27: Shellfish harvesting operation

Conservation commissions should encourage shellfish constables to prepare maps and documentation indicating the existence of non-DMF mapped shellfish areas, if any. These maps, together with any DMF maps, should then be made available to applicants who may be proposing work in or near them.

It should be noted however, that in order for the map to apply to the site of a particular project, it need not exist at the time a Notice of Intent is filed. A map accompanied by adequate documentation may be presented by the shellfish constable at the public hearing. The conservation commission can accept a map at the hearing because the Act states that the very purpose of the public hearing is to accept evidence concerning the significance of the site to the seven interests of the Act. However, it is advantageous for all concerned parties to have maps available before a project is proposed. If accepted by the conservation commission, or the Department on appeal, the map will be used to establish the existence of a significant shellfish area.

On appeal, the Department may submit its own shellfish map to establish significance, which may be different from the one submitted by the shellfish constable.

LAND CONTAINING SHELLFISH
Section 34

Identification The location of land containing shellfish within any of the applicable Resource Areas may be determined by consultation with the city or town's shellfish constable* or by consultation with the Commonwealth's Division of Marine Fisheries.

Both sources will usually have maps available showing the location of general shellfish areas or of specific, highly productive shellfish sites, known as "shellfish beds." Conservation commissions should keep copies of these maps, as well as a copy of the map prepared by the CZM Office showing the general locations of all Massachusetts shellfish beds. Whatever source is used, it must indicate the species of shellfish found within the area because only those shellfish species listed in the definition quoted above qualify an areas as land containing shellfish.

The Division of Marine Fisheries has available for inspection such maps at the following location:
Division of Marine Fisheries
100 Cambridge Street
Boston, Massachusetts 02202
(617) 727-3193

*Shellfish constable means the official in a city or town, whether designated a constable, warden, natural resources officer, or by some other name, in charge of enforcing the laws regulating the harvest of shellfish. (Regulation 34(2)(c)) ■

Resource Functions and Critical Characteristics

Biological Processes Land containing shellfish plays an important role in the protection of marine fisheries and shellfish areas. The characteristics of land containing shellfish which make it important to these interests of the Act are: (a) shellfish, (b) water quality, (c) water circulation and (d) the natural relief, elevation and distribution of sediment grain size of such land.

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

The ecological value of shellfish resources is less obvious, but no less significant. As consumers, shellfish are a link between the abundant phytoplankton and other resource important segments of the coastal ecosystem. As producers, shellfish may be viewed in two ways. First, adult shellfish represent a valuable resource to man and to the 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 the 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.

Water quality: 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.

The other aspects of water quality listed above have been discussed in the section on land under the ocean. The same general concepts apply to land containing shellfish as well.

LAND CONTAINING SHELLFISH
Section 34

Water circulation over land containing shellfish: water circulation patterns help maintain the temperature, dissolved oxygen, and salinity levels of waters over land containing shellfish, thereby helping to maintain conditions needed for productive shellfish beds. Water currents also supply nutrients and disperse pollutants.

The natural relief, elevation and distribution of sediment grain size of land containing shellfish: bivalves which burrow into the sediments have specific depth and grain size requirements.

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 in interstitial water affects the mortality rate of newly settled larvae. ■

FISH RUNS
Section 35

The Regulations define Fish Runs as follows:

Section 35(2)(a) "Anadromous Fish" means fish that enter fresh water from the ocean to spawn, such as alewives, shad and salmon.

Section 35(2)(b) "Catadromous Fish" means fish that enter salt water from fresh water to spawn, such as eels.

Section 35(2)(c) "Anadromous/Catadromous Fish Run" means that area within estuaries, ponds, streams, creeks, rivers, lakes or coastal waters, which is a spawning or feeding ground or passageway for anadromous or catadromous fish and which is identified by DMF or has been mapped on the Coastal Atlas of the Coastal Zone Management Program. Such fish runs shall include those areas which have historically served as fish runs and are either being restored or are planned to be restored at the time the Notice of Intent is filed. For the purposes of these regulations, such fish runs shall extend inland no further than the inland boundary of the coastal zone.

A fish run is an "overlay" Resource Area: that is, wherever a fish run exists in an estuary or other coastal waters, the performance standards contained in Sections *35(3) and 35(4) shall be applied in addition to the* performance standards established for the underlying Resource Area. If there is a conflict, the more restrictive performance standard shall apply.

Likewise, performance standards for fish runs in freshwater ponds, creeks, rivers or lakes are in addition to other project considerations relating to flood control, storm damage prevention, groundwater supply, prevention of pollution, or public or private water supply, as appropriate.

Fish runs include the spawning and nursery areas as well as the actual passageway in which the fish migrate.

"Planned to be restored" means that a public agency has a specific proposal to restore a fish run.

Note: Although Section 35 applies upstream only as far as the inland boundary of the coastal zone, it is Department policy that the remainder of the fish runs outside the coastal zone shall be given the same level of protection as those within the coastal zone.

Identification The Division of Marine Fisheries and the Division of Fisheries and Wildlife have identified the location of all presently known anadromous and catadromous fish runs within the Commonwealth's coastal zone. Fish runs include all the area within the natural banks of the particular watercourse. The seaward boundary of a fish run can usually be considered the mouth of the creek, river or stream. It does not include water bodies such as sounds, embayments or bays.

The following rivers and streams are listed in the order in which the Division of Marine Fisheries surveyed them between 1967 and 1970. The list begins at the Rhode Island-Massachusetts boundary on Narragansett Bay and follows the coastline to the New Hampshire border. Anadromous fish runs on Martha's Vineyard and Nantucket appear at the end of this list. Information is available for only certain anadromous species. However, in general streams or rivers that presently support an identified fish run will also support other, but not specifically identified anadromous/catadromous fish. Streams or rivers that do not support identified fish runs are most likely unsuitable for any anadromous/catadromous fish because of severe pollution and/or barriers to migration.

The code that identifies the various species of anadromous fish in this list is as follows:

A — alewife
B — blueblack herring
BT — brook trout
RS — rainbow smelt
S — shad
W — white perch

FISH RUNS
Section 35

Town / River	Species	Spawning Area if in Coastal Zone
Seekonk		
Runnins River	A,B,S	Old Grist Mill Pond
Rehoboth		
Palmer River	A, S, RS	Shad Factory Pond
Rocky Run	A, B, RS	Rocky Run
Swansea		
Kickamuit River	A	"Lower portion" of Kickamuit River
Coles River	A	Milford Pond
Berkley		
Dighton Somerset, Fall River, Freetown	A, S	Taunton River
Freetown	A, RS	Assonet River
Freetown		
Rattlesnake Brook	A, RS	Rattlesnake Brook
Dighton		
Segreganset River	A, RS	Immediately below first obstruction in Segreganset River
Three Mile River	A	Immediately below first obstruction in Three Mile River
Westport		
Richmond Pond	A	Richmond Pond
Cockeast Pond	A	Cockeast Pond
Westport River		
West branch	A	
East branch	A	East Branch
Angeline Brook	BT	
Dunham Brook	BT	
Dartmouth		
Slocums River	A, RS	Destruction Brook and the River Immediately below Russell's Mill Dam
New Bedford, Fairhaven		
Acushnet River	A	Acushnet Sawmill Pond
Mattapoisett		
Mattapoisett River	A	
Wareham, Marion		
Weweantic River	RS, A	Horseshore Pond and the river immediately below the pond
Wareham		
Sippican River	A	
Agawam River	A, RS	Smelt spawning area just below Mill Pond
Wankinco River	A	Parker Mills Pond
Red Brook	A, BT	White Island Pond
Gibbs Brook	A	Dicks Pond
Bourne		
Herring River	A	Little Herring Pond
Falmouth		
Wild Harbor River	A	Dam Pond
Herring Brook	A, BT	Wings Pond
Salt Pond	A	Salt Pond
Siders Pond	A	Shivericks Pond
Little Pond	A	Little Pond
Coonamesset River	A, BT	Coonamesset Pond
Mill Pond	A	Mill Pond
Childs River	A, BT	Impoundment at Old Mill Rd.
Quashnet River	A, BT	Quashnet River at base of first dam
Mashpee		
Mashpee River	A, BT	Mashpee Pond/Wakeby Pond
Santuit River	A, BT	Santuit Pond
Rushy Marsh Pond	A	Rushy Marsh Pond
Barnstable		
Marstons Mill River	A, BT	Middle Pond, Mystic Lake
Centerville River	A	Bearse Pond, Wequaquet Lake, Lake Elizabeth
Hall Creek	A	Simmons Pond
Yarmouth		
Mill Creek	A	Mill Pond, Little Sandy Pond
Parkers River	A	Long Pond

Town / River	Species	Spawning Area if in Coastal Zone
Yarmouth, Dennis		
Bass River	A	Mill Pond
Dennis		
Swan Pond River	A	Swan Pond
Harwich		
Herring River	A	Seymour Pond, Black Pond, Long Pond, Greenlough Pond
Harwich, Chatham		
Red River	A	Skinequit Pond
Chatham		
Frostfish Creek	A	Frostfish Creek impoundment
Stillwater Pond, Lovers Lake	A	Stillwater Pond, Lovers Lake
Harwich, Orleans		
Muddy Creek	A	Muddy Creek
Orleans		
Pilgrim Lake	A	Pilgrim Lake
Truro		
Pilgrim Lake	A	Pilgrim Lake
Pamet River	BT	
Wellfleet		
Herring River	A	Gull Pond
Eastham		
Herring Brook	A	Great Pond
Eastham, Orleans		
Rock Harbor Creek	A	Cedar Pond
Brewster		
Stony Brook	A	Lower Mill Pond, Upper Mill Pond, Walkers Pond
Brewster, Dennis		
Quivett Creek	A	Unnamed pond
Marshfield		
Little Creek	BT	
Sandwich		
Scorton Creek	BT, RT	
Coek Creek	BT, RT	
Barnstable		
Boat Cove Creek	A, BT, RT	Mill Pond
Sandwich		
Mill Creek	A, BT, RT	Lower Shawme Lake
Plymouth		
Little Herring Pond	A	Little Herring Pond
Beaverdam Brook	A, T	Bartlett Pond
Eel River	A, BT	Russell Mill Pond
Town Brook	A, RS	Billington Sea
Kingston		
Jones River	A, RS, S	Russell Pond — smelt spawn below the first dam
Smelt Brook	RS	Smelt Brook
Duxbury		
Island Creek	A, RS	Island Creek Pond
Marshfield		
South River	A, S, RS	South River
Littles Creek	BT	
Scituate		
North River		
First Herring Brook	A	Old Oaken Bucket Pond
Herring Brook	A	Oldham Pond, Furnace Pond
Indian Head River	A, S, RS	
Cohasset, Scituate		
Bound Brook	A	Lily Pond
Hingham		
Weir River	A	Triphammer Pond
Broad Cove	RS	Unnamed stream drains into cove
Hingham,Weymouth		
Back River	A, RS	Whitman Pond
Weymouth, Braintree, Quincy		
Weymouth Fore River	RS	Weymouth Fore River

Town/River	Species	Spawning Area if in Coastal Zone
Braintree		
Smelt Brook	RS	Smelt Brook
Quincy		
Town River	RS	Town River
Furnace Brook (Blacks Creek)	RS	Furnace Brook
Quincy, Boston		
Neponset River	RS	Base of first dam
Boston		
Charles River	A, RS, S	Charles River between Charles River dam and Watertown dam
Chelsea, Everett		
Mystic River	A	
Saugus, Lynn		
Saugus River	A	
Beverly, Manchester		
Chubb Creek	RS	Chubb Creek
Gloucester		
Little River	RS, A	Lily Pond; smelt spawn in the Little River near Route 133
Essex		
Essex River	RS, A	Chebacco Lake; smelt spawn in River near center of Essex
Ipswich		
Ipswich River	RS, A	Ipswich River
Rowley River	RS, A	Rowley River
Rowley, Newbury		
Mill River	RS	Smelt spawn in an area extending from dam downstream 2/3 of a mile
Newbury		
Parker River	RS, A, B, W	Blueback herring, smelt spawn in an area extending 200 yds. below the first dam
Newbury		
Little River	RS	Little River
Cart Creek	RS	Smelt spawn in an area several hundred yds. upstream of Orchard St. bridge in Div. of Fish & Wildlife Mgmt. area
Salisbury		
Merrimack River	A, RS, S, B	
Tisbury, Oak Bluffs		
Lagoon Pond	A	Headwater pond above Lagoon Pond
Oak Bluffs		
Farm Pond	A	Farm Pond
Edgartown		
Trapps Pond	A	Trapps Pond
Mattakessett	A	Edgartown Great Pond
Herring Brook		
Oyster Pond	A	Oyster Pond
Chilmark		
Black Point Pond	A	Black Point Pond
Chilmark Pond	A	Chilmark Pond
Chilmark, Gay Head		
Gay Head Herring Creek	A	Squibnocket Pond
West Tisbury		
James Pond	A	James Pond
Nantucket		
Hither Creek	A	Long Pond ■

Resource Functions and Critical Characteristics

Biological Processes Fish runs play an important role in the protection of marine fisheries. Anadromous fish are species of fish that grow to maturity in the ocean and migrate to freshwater to spawn. Catadromous fish spawn in the ocean but return to freshwater to grow to the adult stage. Anadromous fish that spawn in Massachusetts include the sea lamprey *(Petromyzon marinus)*, shortnose sturgeon *(Acipenser brevirostrum)*, Atlantic sturgeon *(Acipenser oxyrhynchus)*, alewife *(Alosa pseudoharengus)*, rainbow smelt *(Osmerus mordax)*, brook trout *(Salvelinus fontinalis)*, Atlantic salmon *(Salmo salar)*, and white perch *(Morone americana)*. The only catadromous fish found in Massachusetts is the American eel *(Anquilla rostrata)*.

Illustration 28: Anadromous fish run

The characteristics of fish runs which make them important to marine fisheries are the (a) fish, (b) accessibility of spawning areas and migratory routes, (c) the volume or rate of the flow of water within spawning areas and migratory routes, and (d) spawning and nursery areas.

Fish: In addition to their commercial and recreational importance, these fish are of ecological significance to the freshwater, estuarine and marine environments. During their early life stages, these fish eat plankton. As they grow, these same fish may be consumed by larger fish or directly by man. Their unique spawning migrations are of added significance because they permit the direct transfer of energy from the marine food web to estuarine, freshwater and terrestrial ecosystems.

Accessibility of spawning areas and migratory routes: Only those creeks, ponds, lakes, rivers and streams which have an unimpeded connection to the sea may serve as a spawning area for anadromous fish. These same water courses may provide a migration route for catadromous fish. Pollution or dams without fish ladders are barriers to spawning migrations and are the primary factors for the demise of many anadromous/catadromous fish runs.

The volume or rate of the water flow within spawning areas and migratory routes: The volume or rate of water flow within spawning areas is an important feature of these habitats. The water helps maintain the proper temperature, oxygen and nutrient balance, as well as prevent toxic accumulations of metabolic wastes. Adequate water depth and flow is also required as a behavioral stimulus for spawning. The migration routes of these fish are characterized by both the volume and chemical constituents of the stream discharge, which often serves as sensory cues for the migratory fish to find the spawning areas. Sufficient stream flow is also required to enable fish to overcome stream obstructions such as falls or log jams.

Spawning and nursery areas: In Massachusetts, spawning and nursery areas for anadromous fish include several diverse habitats such as stream riffles and shallow ponds or lakes. Each of these areas is characterized by certain physical, chemical, and biological factors. The volume and rate of flow of water is important as is the quality of the water. Fish in their early life stages are extremely vulnerable to fluctuations in their spawning or nursery environment. ■

CHAPTER 2
Regulated Coastal Activities

Regulated Coastal Activities
Introduction

The Wetlands Protection Act names four general activities — dredging, filling, removing and altering — which are regulated by the Act if proposed in or near a wetland. Part II of the Regulations sets forth performance standards for these activities in coastal wetlands (except for those few types of activities exempted by the Act). These performance standards do not provide a step by step description of how to do the activity, such as how to build a pier or dredge a channel. Rather, they state the level of protection which must be given to the Resource Area and what characteristics of the resource area must be protected when an activity is proposed.

The purpose of this chapter is to indicate what these performance standards mean in terms of the location, design and acceptability of specific types of activities which may be proposed along the coast.

Specifically, this chapter:

1. identifies and defines 15 common activities which are included in the general terms "dredging, filling, removal and altering," of the Act.

2. identifies the adverse impacts these 15 activities are likely to have on the interests of the Act.

3. indicates in which resource areas they are or are not likely to be acceptable, and if they are likely to be acceptable, how the activity can be designed and conditioned to meet the performance standards.

The performance standard for each resource area has two parts:

1. The level of protection required. The three levels used in the Regulations are:

a. "No adverse effect" — the project must be located and designed so that there is no adverse effect to the interests to which the Resource Area is significant.

b. Use of the "best available measures" so as to minimize adverse effects — the project must be located and designed using the best available measures to minimize the adverse effects to the interests to which the Resource Area is significant, and

c. Use of the "best practical measures" so as to minimize adverse effects — the project must be located and designed using the best practical measures to minimize the adverse effects to the interest to which the Resource Area is significant.

Note: See Sections 23(2) and 23(3) of Part II of the Regulations for the definitions of "adverse effect" and "minimize."

2. The specific characteristics of the Resource Area which must be protected in order to protect the interest(s) to which the Resource Area is significant.

For example, Section 28(3) for coastal dunes states that "any alteration ... on or within 100 feet of a coastal dune shall not have an adverse effect on the coastal dune by..." This is the first part of the performance standard — it sets the level of protection required — "no adverse effect."

Section 28(3) goes on to state the second part of the standard — it lists the characteristics of the dune which shall not be adversely affected.

The performance standards for the other resource areas follow the same format with only slight variations.

The activities or structures listed in Section A of this chapter are all related to the regulated activities listed in the Act. Most of them "alter" in one manner or another the critical characteristics of wetlands listed in each Resource Area section of the regulations. Only activities that are most likely to be proposed along the Massachusetts coastline have been included.

Many proposed projects will include two or more discrete types of activities. For example, roadways, boat launching ramps, marinas, or subdivisions involve several activities, such as dredging or removing, filling, grading, culverts, etc. These types of activities are called "complex activities" and are discussed further on in this chapter.

How To Use This Chapter

Once the applicant or the conservation commission has identified the resource areas and the activities involved in a proposed project, the tables and charts in this chapter can be used to determine how the activities should be designed and conditioned to meet the performance standards.

Step 1 — Determine Acceptability of Activity: The first step is to refer to the short table, titled "Activity Acceptability Table," which appears after the definition of each activity. This Table interprets the performance standards contained in Part II of the Regulations and indicates whether or not the particular activity is likely to be acceptable in each of the eleven Resource Areas.

The Tables show whether or not, given current state of the art designs and methods to minimize or prevent adverse impacts to wetland characteristics, a particular activity can be adequately designed so that it will meet the performance standards. The following notations are used:

1. A "likely to be conditioned" notation means that the activity may be permitted provided certain conditions are met.

2. A "may be conditioned in limited situations" notation means that, in general, the activity should not be proposed or permitted, but that there are certain limited circumstances in which the activity may be permitted.

3. A "not likely to be acceptable" means that, given the current state of the art with regard to the design of the specific activity, it is very unlikely that it can be designed to meet the performance standards.

4. An "unlikely to be proposed" notation means that the particular activity is not usually proposed to be located in the Resource Area. If it does happen to be proposed it must still meet the performance standards.

Step 2 — Identify Appropriate Measures for Acceptable Activities If an activity is "likely to be conditioned" or "may be conditioned in limited situations," the next step is to turn to the section dealing with the particular activity, e.g., dredging. Then, within that section, turn to the Resource Area in which the dredging is proposed, e.g., land under the ocean.

The charts are divided into four columns. The first column identifies one or more of the seven interests to which the Resource Area is presumed to be significant, as stated in the Preamble in the Regulations.

The second column very briefly identifies and summarizes how the activity may adversely affect the interest(s).

The third column lists the general types of conditions which should be considered by the applicant and conservation commission when designing or conditioning the activity. The level of protection required by the performance standard is incorporated into the suggested measures. The appropriate Regulation is cited at the top of the column.

The fourth column indicates the type of information that is required to put the general condition listed in column 3 into practice.

Important Notes:

1. Conservation commissions should not merely quote from column 3 or 4 when writing an Order of Conditions. These columns give the general idea only; the Order must be adapted to the specific circumstances of the specific project and location involved.

2. All Notices of Intent, without exception, should include complete descriptions of the project, the equipment involved, and the construction schedule. All Orders of Conditions should include this information by reference.

3. The notations on the acceptability tables are not regulations, but DEQE's interpretations of the regulations.

Complex Activities

Many proposed projects will include more than one of the fifteen activities described in detail in Chapter Two. These projects are termed "complex activities" in this Guide. The design and review of these activities may be more complicated. Not only will each activity have to be identified and evaluated, the cumulative adverse effects of all the activities together will have to be identified and analyzed. The measures to prevent or minimize these adverse effects will have to be coordinated and be able to function together. The applicant and the conservation commission should carefully review the proposed project from beginning to end — site preparation, construction, and ultimate use and maintenance.

A description of several complex activities and the most likely specific activities which will be involved, follows:

Marina A marina may include nearly all of the fifteen activities, depending upon how and where it is being proposed. A channel may have to be dredged and the dredged material disposed of; a seawall or jetty may be proposed to protect the channel and the channel bank; piles and piers will undoubtedly be needed for moorings; and there may be point sources of pollution.

The applicant should clearly specify what Resource Areas are involved at the site — probably land under the ocean, a coastal beach, and/or a coastal bank; and the type and location of the discrete activities needed to complete the proposed marina.

The marina should be designed and located so that the performance standards in each Resource Area can be met by each proposed discrete activity.

The conservation commission should closely examine the marina plans and be sure that all of the appropriate Resource Areas and activities are included.

Roads/Ramps Roadways will generally involve the following activities: fill, grading, seawalls if build near a coastal bank, and drains creating a point discharge not ordinarily covered under the NPDES program.

A launching ramp could include: dredging, dredged material disposal, fill, grading and removal.

It should also be noted that the effect of a launching ramp on a beach or dune can be similar to a groin because it acts as a barrier to sediment transport. Launching ramps may also prohibit the exchange of sediments between a coastal beach and a coastal dune.

Buildings Residential, commercial, and industrial buildings proposed in or adjacent to coastal wetlands may involve the following proposed activities: removal, fill, grading, seawall, revetment or bulkhead, boardwalks, stairs, or pathways (access), piers, piles, dolphins, septic system, point source pollution caused by drains not covered under the NPDES program; roadways (access, parking lots) and culverts.

They may also include one or more Resource Areas. The plans should identify which Resource Areas will be affected by these activities.

Point Source Discharges In addition to the actual liquid discharge, the installation of a proposed point source discharge may include the following activities: dredging, filling, grading, raking, piles or solid support system and a culvert.

It should be noted that the pipe which carries the discharge on a solid support system may have adverse effects similar to those of a groin on a beach or dune.

Large and Small Projects

The charts usually do not distinguish between large and small projects and whether they should be considered differently. There are several simple, common sense rules of thumb however, which should be followed by both applicants and conservation commissions:

HOW TO USE THIS CHAPTER

1. The amount of information required to describe a project, the site, and the adverse effects, will vary according to the size and complexity of the project and site. For example, a proposal for a 100 slip marina involving several Resource Areas will require considerably more information than a proposal to dredge a channel for one small family boat.

2. On the other hand, a small project in a very sensitive area (such as in a shellfish bed or *Area of Critical Environmental Concern)* will require more information than one in a less sensitive area.

3. The information requirements for any project must be reasonable and should include full disclosure of all information needed to review and evaluate the effect of the project on the seven interests. They should be tailored to the proposal so that the activities, Resource Areas, and adverse effects, are completely described.

DREDGING
Definition

Dredging is the mechanical process of removing, excavating, or mining of sands, silts, muds or other sediments from land under water. (Removal, as opposed to dredging, is generally used to describe removal of material from areas above mean high water, such as dunes).

Note that for land under the ocean, the Regulations make the distinction between "improvement" dredging and "maintenance" dredging.

Also note that dredging is subject to regulation by the Department of Environmental Quality Engineering (DEQE) through its Divisions of Waterways (Ch. 91, MGL) and Water Pollution Control (Ch. 21, MGL), the U.S. Army Corp of Engineers (Waltham) and the U.S. Environmental Protection Agency (Boston).

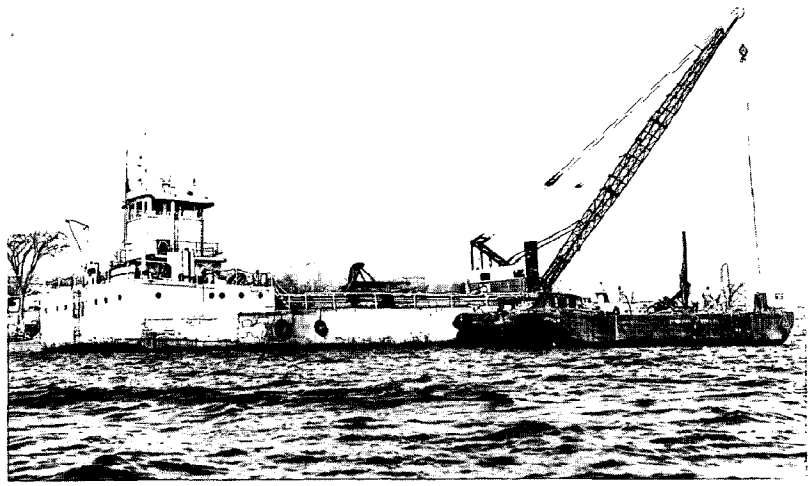


Illustration 30: Dredge and scow

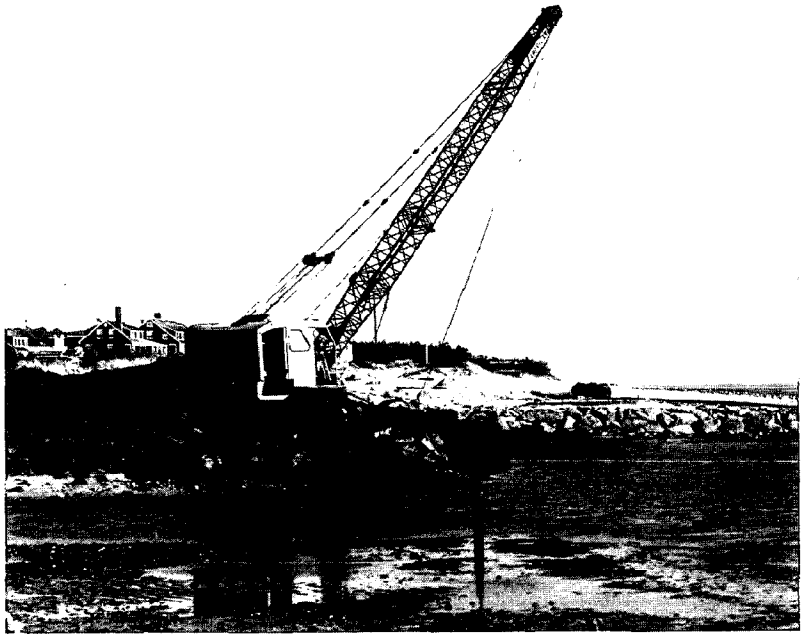


Illustration 29: Dredging operation

Activity Acceptability Table

This table indicates in which Resource Areas dredging is or is not likely to be able to be conditioned to meet the performance standards set forth in the Regulations.

Resource Area	Acceptability
Land Under the Ocean Section 25	likely to be conditioned.
Designated Port Areas Section 26	likely to be conditioned.
Coastal Beaches Section 27	may be conditioned in limited situations.
Coastal Dunes Section 28	unlikely to be proposed — see Removal.
Barrier Beaches Section 29	may be conditioned in limited situations.
Coastal Banks Section 30	unlikely to be proposed — see Removal.
Rocky Intertidal Shores Section 31	likely to be conditioned.
Salt Marshes Section 32	not likely to be acceptable: Sec. 32(3) states that no portion of a Salt Marsh may be destroyed.
Land Under Salt Ponds Section 33	not likely to be acceptable: any dredging in a salt pond will have an adverse impact on marine fisheries habitat. Note exception in Sec. 33(4).
Land Containing Shellfish Section 34	not likely to be acceptable in DMF mapped shellfish areas: dredging adversely effects such land and marine fisheries which is not permitted under 34(4). Note exception to this under 34(5). Likely to be conditioned in non-DMF mapped shellfish areas.
Fish Runs Section 35	likely to be conditioned.

DREDGING
Section 25 Land Under the Ocean
A. Improvement Dredging

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards.	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ The deepening of the near-shore bottom may result in an increase in the height of waves impacting the shore.	*1. Best available measures to meet Sec. 25(3)(a):* ■ Minimize depth of dredging — no more than necessary to accommodate the draft of the deepest draft vessel expected to use the harbor, at mean low water. ■ Minimize channel width — no more than necessary to accommodate the beam of the widest vessel to use the harbor. ■ Whenever possible, channel axis should not be parallel to the direction of major storm waves.	■ Deepest draft vessel expected ■ Mean low water elevation ■ Existing depth in proposed channel ■ Largest beam expected ■ Direction of major storm waves.
	■ A channel may interrupt the sediment transport process, thereby affecting the natural replenishment of beaches.	*2. Best available measures to meet Sec. 25(3)(b):* ■ Where the dredging is flanked by coastal beaches or barrier beach, a sand by-pass system must be developed so that the net littoral drift is not diminished to the downdrift beach. This may be done by periodic dredging of the channel and deposition of compatible dredged materials on the downdrift beaches or downdrift beach replenishment. If sediments in the channel become polluted or incompatible with the downdrift beach sediments, beach nourishment from the dredged area will not be allowed.	■ Description of the shoreline adjacent to and potentially impacted by the dredging — structures, bank or beach conditions, etc. ■ Calculation of existing wave energy impacting area described above. Calculation of energy impacts after the proposed dredging. ■ If energy impact is different, show engineering solutions to compensate. ■ Identification of legally responsible party for maintaining by-pass system or periodic beach nourishment. ■ A timetable for periodic beach nourishment or replenishment dredging. ■ Potential pollutants within dredged area.* ■ Description of grain size of dredged sediments and downdrift beach area. ■ A detailed plan indicating the exact area to be dredged, the amount of material to be dredged, and the proposed dredged material disposal site.

*See Division of Water Pollution Control Regulations

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of marine fisheries	■ Dredging may create an area of stagnation resulting in a deterioration of water quality.	*1. Best available measures to meet Sec. 25(3)(c):* ■ A condition which minimizes depth (as above) will also help meet this standard. ■ Dredge the channel so that all portions of it will be adequately flushed by the tides.	■ Bathymetry of proposed project
	■ Dredging may reduce marine productivity by destroying bottom habitat, by increasing turbidity, by stirring up pollutants, and by causing siltation which may bury bottom animals adjacent to the channel. These may, in turn, allow organisms to ingest and accumulate the stirred up pollutants and the siltation may destroy habitats or food source areas.	*2. Best available measures to meet Sec. 25(3)(d):* ■ Dredging should be done between October 1 and March 15. ■ Hydraulic dredging shall be employed where physically possible. ■ Where hydraulic dredging is not physically possible, the largest practical dredging bucket or clamshell shall be used. ■ Siltation curtains shall be used to completely enclose the dredged sediment plume, where conditions permit. ■ Dredging should avoid eel grass beds to the extent possible.	■ Size and location of plume based on type of equipment to be used, substrate conditions, and hydrographic conditions (depth and currents).

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of marine fisheries	■ Dredging may adversely affect water circulation by creating areas of stagnation. ■ Dredging may adversely affect water quality by changing dissolved oxygen, temperature, turbidity, or by stirring up pollutants in the bottom sediments.*	*1. Best available measures to meet Sec. 26(3):* ■ Dredge channel and port area so that all portions of them will be adequately flushed by the tides. ■ Complete the dredging operation as quickly as possible by using the most efficient and practical equipment. ■ Where possible, schedule dredging so as not to conflict with fisheries use.	■ Existing and proposed hydrography of designated port area. ■ Chemical, physical, and biological analysis of bottom sediments.** ■ Identify fisheries in the proposed dredged area, particularly anadromous/catadromous fish runs.
Storm damage prevention and flood control.	■ Extensive dredging of a port area may increase wave height, which may increase their potential destructive energy.	*1. Best practical measures to meet Sec. 26(4).* ■ Minimize the amount of dredging ■ Whenever possible, channel axis should not be parallel to direction of major storm waves.	■ A detailed plan indicating the exact area to be dredged, the amount of material to be dredged, and the proposed dredged material disposal site. ■ Scientific and/or engineering studies to show the storm surge before and after dredging. ■ Direction of major storm waves.

*A high concentration of certain pollutants in the bottom sediments, such as PCB's or heavy metals, may preclude the possibility of dredging under the regulations of the Division of Water Pollution Control (DWPC).

**Bottom sediment analysis and evaluation of dredging should be coordinated with the DWPC.

DREDGING
Section 27 Coastal Beaches and Section 29 Barrier Beaches

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Dredging a beach (or tidal flat) may increase the wave energy reaching the shore, thereby changing the volume and form of adjacent beaches and increasing the erosion potential.	*1. Measures to meet performance standards of "no adverse effect" — Sec. 27(3)* ■ On most beaches, there are no measures to reduce the adverse effects to the required level. Therefore, all beach dredging should be denied except in the following two circumstances: ■ 1. dredging through a shoal within existing jettied or natural tidal inlets. ■ 2. dredging in a tidal flat in a harbor provided that the applicant can demonstrate that there will be no increase in the erosion of adjacent coastal beaches, coastal dunes, or salt marshes.	■ Documentation of the existence of a tidal inlet prior to the filing of a Notice of Intent for the proposed dredging. ■ Description of current conditions, extent of proposed dredging, and location of dredge spoil disposal.
Protection of marine fisheries	■ Dredging as permitted under Sec. 27(3) — see above — may cause changes in water quality, particularly the level of turbidity. ■ As sediments settle out on adjacent tidal flats, the distribution of sediment grain size may change. ■ There may be pollutants in bottom sediments which will be disturbed and transported to adjacent areas.	*1. Best available measures to minimize adverse effects — Sec. 27(6).* ■ Dredging should be done between October 1 and March 15. ■ Hydraulic dredging shall be employed where physically possible. ■ Where hydraulic dredging is not physically possible, the largest practical dredging bucket or clamshell shall be used.	■ A detailed plan indicating the exact area to be dredged, the amount of material to be dredged, and the proposed dredged material disposal site.

Interest to be Protected	Adverse Impacts to Interest	Conditions Required to Minimize Adverse Impacts	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of land containing shellfish and marine fisheries	■ Dredging in any portion of any Resource Area which contains shellfish alters the relief and elevation of the area.	*1. Measures to meet performance standard of "no adverse effect" Sec. 34(4)* *A. In a DMF mapped shellfish bed* (34(3)(a)) there are no measures which will make dredging meet the "no adverse effect" standard, except dredging which will immediately and purposefully be filled such as for laying a pipe, which is permitted under Sec. 34(5). ■ In order for a project to be permitted under Sec. 34(5) in a DMF mapped area, the following conditions must be met: ■ shellfish in the area to be dredged must be relocated to a suitable location approved by DMF. ■ substrate identical in sediment composition, sediment grain size, and density to that removed must be used to fill the dredged area. ■ relief and elevation must be returned to pre-existing conditions. ■ siltation curtains designed and employed so as to preclude the transport of sediment from the dredging site onto other areas of the shellfish bed shall be employed where physical conditions permit. ■ if turbidity will impact other shellfish bed no dredging shall be allowed during the larval *setting stage.*	■ Existing substrate conditions in the area to be dredged, including sediment composition, sediment grain size, and sediment density. ■ Existing relief and elevation. ■ Proposed location of relocated shellfish and evidence of DMF and local shellfish constable approval.
		B. In a non-DMF mapped shellfish area (34(3)(b)), dredging may be permitted under the following conditions: ■ that the shellfish in the area to be dredged be relocated in a manner and to a location suitable and approved by DMF and the shellfish constable. ■ siltation curtains designed and employed so as to preclude the transport of sediment from the dredging site onto other areas of the shellfish bed shall be employed where physical conditions permit. ■ if turbidity will impact other shellfish beds, no dredging shall be allowed during the larval setting stage.	■ Existing substrate conditions in the area to be dredged, including sediment composition, sediment grain size, and sediment density. ■ Existing relief and elevation. ■ Proposed location of relocated shellfish and evidence of DMF and local shellfish constable approval. ■ A detailed plan indicating the exact area to be dredged, the amount of material to be dredged, and the proposed dredged material disposal site.

Interest to be Protected	Adverse Effects to Interest	Conditions to Minimize Adverse Effects	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Dredging rocky intertidal shores will reduce the volume and change the form of the shore. This may effect its ability to dissipate wave energy and to provide a buffer to inland areas.	*1. Best practical measures to minimize adverse effects — Sec. 31(3)* ■ The surface of the side slopes after dredging should have the same (or as close as possible) roughness and be of the same (or as close as possible) materials as the dredged area was prior to dredging.	■ Qualitative description of the roughness and materials in the area to be dredged before and after dredging. ■ A detailed plan indicating the exact area to be dredged, the amount of material to be dredged, and the proposed dredged material disposal site.
Protection of marine fisheries	■ Dredging of rocky intertidal shores is not likely to have an adverse effect on water circulation and water quality.	*1. Best available measures to meet Sec. 31(4)* ■ None required for dredging	

Interest to be Protected	Adverse Impacts to Interest	Conditions Required to Minimize the Adverse Impact	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of marine fisheries		*1. Measures to meet performance standard of "no adverse effect" — Sec. 35(3)*	
	■ Dredging in a fish run creates a turbidity plume which may impede the migration of fish.	■ No dredging shall be permitted during a fish migration.	■ Identification of anadromous or catadromous fish which use the fish run and their migration times.
	■ The sediment particles created by dredging may settle out on and cover spawning and nursery habitats.	■ Siltation curtains which completely enclose the turbidity plume shall be used when the sediment would otherwise settle out on spawning or nursery habitats, where physical conditions permit.	■ Scientific studies which clearly delineate spawning and nursery habitats.
	■ Dredging changes the cross-section of a channel, thereby altering the rate of water flow through the channel. ■ Dredging may destroy spawning and nursery habitats.	■ Dredging shall not change the rate of water flow so as to impede the migration of fish.	■ Rate of flow during migration season before and after proposed dredging. ■ A detailed plan indicating the exact amount of material to be dredged, and the proposed dredged material disposal site.

DREDGED MATERIAL DISPOSAL
Definition

Dredged Material Disposal is the process of discharging, depositing, dumping or utilizing the by-products of a dredging operation.

Dredged material disposal may occur on land, or if clean, in several of the coastal Resource Areas. Dredged material disposal commonly occurs at designated dump sites on land under the ocean, most of which are seaward of the municipal boundaries.

The volume, physical and chemical characteristics of the dredged materials (commonly called dredge "spoils"), the location of the dredging project, and federal and state requirements will dictate the methods of transport and ultimate location of the dredge material disposal site.

Common shore-based dredged material disposal sites and uses for clean material include, but are not limited to, dumping at an approved sanitary landfill, utilization as "fill" material for construction purposes, and deposition of clean dredged material onto coastal environments to replenish eroded sediments.

Off-shore dredged material disposal sites and uses include, but are not limited to, ocean dumping in approved areas, and deposition of dredged material in off-shore zones to replenish eroded or drifted materials.

If dredged materials are highly contaminated with toxic substances and would have little or no commercial value, then disposal in an approved dumping location may be the only alternative.

The ocean disposal of dredged materials must conform to the Waterways (MGL. Ch. 91) Regulations, the Massachusetts Ocean Sanctuaries Act and the Division of Water Pollution Control discharge permit criteria, as well as regulations promulgated by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency. The Divisions of Water Pollution Control and Waterways (DEQE), and the Army Corps should always be consulted in addition to the conservation commission, especially when toxic materials may be present in the dredged materials.

Illustration 31: Disposal of dredged material

Activity Acceptability Table

This table indicates in which Resource Area dredge material disposal is or is not likely to be able to be conditioned to meet the performance standards set forth in the Regulations.

Resource Area	Acceptability
Land Under the Ocean Section 25	likely to be conditioned*
Designated Port Areas Section 26	likely to be conditioned* — (clean dredged material only) see section on fill.
Coastal Beaches Section 27	likely to be conditioned* — (clean dredged material only) see section on fill.
Coastal Dunes Section 28	likely to be conditioned* — (clean dredged material only) see section on fill.
Barrier Beaches Section 29	likely to be conditioned* — (clean dredged material only) see section on fill.
Coastal Banks Section 30	likely to be conditioned* — (clean dredged material only) see section on fill.
Rocky Intertidal Shores Section 31	likely to be conditioned* — (clean dredged material only) see section on fill.
Salt Marshes Section 32	not likely to be acceptable — Sec. 32(3) states that no portion of a salt marsh may be destroyed.
Land Under Salt Ponds Section 33	not likely to be acceptable — disposal will have an adverse effect on marine fisheries habitat which is not permitted under Sec. 33(3).
Land Containing Shellfish Section 34	not likely to be acceptable in a DMF mapped shellfish area. Disposal will adversely affect shellfish productivity by altering elevation which is not permitted under Sec. 34(4)(b). Can be conditioned in non-DMF mapped shellfish areas — unless otherwise prohibited in the Resource Area containing shellfish. See section on fill for conditions.
Fish Runs Section 35	can be conditioned* — see section on fill.

***NOTE:** Only clean dredged materials may be disposed in any site other than a designated disposal site.

Interest to be Protected	Adverse Effects to Interests	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Disposal of dredged material may cause the shoaling of nearshore land under the ocean which will interrupt sediment transport processes, thereby affecting the volume and form of coastal beaches. ■ Disposal of clean dredged material on other than nearshore areas of land under the ocean is not likely to have an adverse effect on storm damage prevention or flood control.	*1. Measure to meet performance standard of "no adverse effects" Sec. 25(5)* ■ Wave height at any point along the shoreline shall not increase by more than 10% by disposal of dredged material on nearshore areas of land under the ocean.	■ Calculations showing existing and resulting wave heights.
Protection of marine fisheries	■ Disposal of clean dredged material may cause the shoaling of nearshore land under the ocean which can create areas of stagnation. ■ Disposal of clean dredged material can alter the distribution of sediment grain size. ■ Disposal of clean dredged material may bury eel grass beds.	*1. Measures to meet performance standard of "best available measures" Sec. 25(6)* ■ Disposal of spoil in discontinuous bands, interrupted at least every 250 ft. by 50 ft. breaks to provide for passage of water, nutrients and aquatic life. (These figures are guidelines only; the concept should be adjusted as necessary in the particular project). ■ Dredged material disposal on any portion of land under the ocean shall have a mean grain size distribution which does not differ from the existing land under the ocean sediment grain size by more than 50%. ■ Disposal of dredged material should avoid eel grass beds to the maximum extent possible.	■ Description of water currents in the vicinity of proposed project. ■ Existing substrate conditions in the area to be dredged, including sediment composition, sediment grain size, and sediment density. ■ Map of eel grass beds. ■ Alternative disposal locations to determine how to avoid eel grass beds to the maximum extent possible.

FILL
Definition

Filling is the process of depositing materials onto a coastal wetland, primarily for the purpose of raising the land surface or underwater bottom elevation permanently or temporarily.

Fill is usually related to another coastal activity such as backfill for bulkheads or seawalls, or fill for roadways or ramps. Beach or dune nourishment is also defined as fill.

Illustration 32: Coastal beach nourishment

Illustration 33: Filling a coastal wetland

Activity Acceptability Table

This table indicates in which Resource Areas fill is or is not likely to be able to be conditioned to meet the performance standards set forth in the Regulations.

Resource Area	Acceptability
Land Under the Ocean Section 25	not likely to be acceptable — fill requires a retaining structure such as a seawall, bulkhead or revetment, which is not permitted under Sec. 25(5) — see section on seawalls, bulkheads, and revetments. Therefore, fill is not acceptable, except as discussed in Dredged Material Disposal section.
Designated Port Areas Section 26	likely to be conditioned*
Coastal Beaches Section 27	likely to be conditioned*
Coastal Dunes Section 28	likely to be conditioned*
Barrier Beaches Section 29	likely to be conditioned*
Coastal Banks Section 30	likely to be conditioned*
Rocky Intertidal Shores Section 31	likely to be conditioned*
Salt Marshes Section 32	not likely to be acceptable — Sec. 32(3) states that no portion of a salt marsh may be destroyed
Land Under Salt Ponds Section 33	not likely to be acceptable — fill will have an adverse effect on marine fisheries habitat which is not permitted under Sec. 33(3).
Land Containing Shellfish Section 34	not likely to be acceptable in DMF mapped shellfish area. Fill will adversely affect shellfish productivity by altering elevation which is not permitted under Sec. 34(4)(b). Can be conditioned in non-DMF mapped shellfish areas unless such area is a salt marsh or land under a salt pond.
Fish Runs Section 35	likely to be conditioned*

***NOTE:** Whether or not fill can be placed on any of these Resource Areas depends upon the physical, chemical, and biological nature of the material.

FILL
Section 26 Designated Port Areas

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of marine fisheries	■ The process of placing fill behind or within seawalls or bulkheads may cause turbidity and sedimentation. ■ Pollutants which may be present in the fill may be leached out into or resuspended in the water column.	*1. Best available measures to meet Sec. 26(3)* ■ Fill must be contained within a seawall, bulkhead, or revetment permitted by the Regulations. ■ The area to be filled shall be dewatered prior to placement of the fill or a siltation curtain shall be placed immediately around the retaining structure to contain the material suspended in the water displaced as the area is filled, where conditions permit. ■ Only clean fill may be permitted (see description of clean fill in the waterways (Ch. 91) regulations.	■ Description of methods proposed to minimize turbidity and sedimentation. ■ Analysis showing that the proposed fill material is clean.

FILL
Section 27 Coastal Beaches and Section 29 Barrier Beaches

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Fill which is not compatible in terms of grain size may decrease the ability of a beach to respond to wave action, thereby altering the volume and form of an adjacent or downdrift coastal beach.	*1. Measures to meet performance standard of "no adverse impact" Sec. 27(3)* ■ Fill material on any portion of coastal beach (which includes tidal flats) shall be compatible with existing beach material. (Material which meets this condition will also comply with Sec. 27(5) which permits beach nourishment). ■ **NOTE:** structures to retain fill material on a beach such as bulkheads or seawalls are not permitted.	■ Sediment size characteristics of existing beach material and proposed fill material. ■ If proposed fill is silt or clay size sediment and is not from a naturally occurring, uncontaminated geologic deposit, analysis showing the level of pollutants, including heavy metals, hydrocarbons, pesticides, and other toxic materials. ■ Samples of existing beach material and proposed fill material may be substituted for test results for projects of less than 1000 cubic yards of fill.
Protection of marine fisheries	■ Pollutants which may be present in the proposed fill material would cause water pollution. This is usually not a problem with sand or gravel.	*1. Best available measures to meet Sec. 27(6)* ■ Only clean fill shall be permitted on tidal flats.	

FILL
Section 28 Coastal Dunes and Section 29 Barrier Beaches

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Fill which is not compatible in terms of grain size may decrease the ability of a dune to respond to wave action, modify the dune form, and interfere with a dune's landward or lateral movement.	*1. Measures to meet performance standard of "no adverse impact" Sec. 28(3)* ■ Fill material on any portion of coastal dune shall be compatible with existing dune material. ■ **NOTE:** structures to retain fill material on a dune such as bulkheads or seawalls are not permitted — groins may be permitted.	■ Sediment size characteristics of existing dune material and proposed fill material. ■ If material is not from a naturally occuring, uncontaminated geologic deposit, analysis showing the level of pollutants, including heavy metals, hydrocarbons, pesticides and other toxic materials. ■ Samples of existing dune material and proposed fill material may be substituted for test results for projects less than 1000 cubic yards of fill.
	■ Fill may disturb or bury vegetation.	■ Where dune grass (Ammophila brevilgulata) exists, the depth of the fill shall not be more than ½ of the average height of the dune grass and shall be placed in a manner that does not destroy the vegetation. ■ Fill shall be distributed so as to conform as closely as possible to existing topography.	■ Location and average height of dune grass.

FILL
Section 30 Coastal Banks

A. Coastal Banks which are significant because they supply sediment to coastal beaches, coastal dunes or barrier beaches.

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Fill which is not compatible in terms of grain size with the bank sediments may decrease the bank's ability to supply sediment to coastal beaches or land subject to tidal action.	*1. Measures to meet performance standard of "no adverse effect" Sec. 30(4)* ■ Fill material shall be compatible with existing bank material. ■ Only clean fill may be permitted.	■ Sediment size characteristics of existing bank material and proposed fill material. ■ If material is not from a naturally occurring, uncontaminated geological deposit, analysis showing the level of pollutants, including heavy metals, hydrocarbons, pesticides, and other toxic materials. ■ Samples of existing bank material and proposed fill material may be substituted for test results for projects less than 1000 cubic yards of fill.

B. Coastal Banks which are significant because they are a vertical buffer

Interest to be Protected	Adverse Effects to Interests	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Fill may bury and kill bank vegetation, thereby decreasing the bank's natural resistance to erosion caused by wind and/or rain runoff.	*1. Measures to meet performance standard of "no adverse effect" Sec. 30(6)* ■ Short term erosion control measures such as hay, mulch, or nets shall be used to prevent erosion immediately after placement of fill. ■ Replanting with suitable vegetation cover shall commence as soon as permitted by growing conditions.	■ Desciption of proposed erosion control techniques. ■ Description of vegetation to be replanted. ■ **NOTE:** information on replanting and other erosion control techniques may be obtained form the Soil Conservation Service.

Interests to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Detail to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Fill is not likely to have an adverse effect on storm damage prevention or flood control.	■ No conditions are necessary	
Protection of marine fisheries		*1. Best practical measures to meet Sec. 31(4)*	
	■ Fill which is not contained within a seawall, bulkhead, or revetment may be washed away and cause turbidity and smothering of marine fisheries habitats.	■ Fill which is not contained within a seawall, bulkhead, or revetment shall be compatible in terms of grain size to what exists on the rocky intertidal shore. (This means fill must be cobbles or larger.)	
	■ Pollutants which may be present in fill which is contained within a seawall, bulkhead, or revetment may be leached out by tidal action, causing water pollution.	■ Material which is contained within a seawall, bulkhead, or revetment shall be clean fill.	■ If material is from other than a naturally occurring, uncontaminated geologic deposit, analysis showing the levels of pollutants, including heavy metals, hydrocarbons, pesticides, and other toxic materials.

FILL

Section 34 Land Containing Shellfish – Non-DMF Mapped Only

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of land containing shellfish and marine fisheries	■ Change in relief and elevation of shellfish habitat, thereby altering existing habitats. ■ Smothering of shellfish ■ Pollutants which may be present in the fill may be leached out into or resuspended in the water column.	*1. Measures to meet the performance standard of "no adverse effect" Reg. 34(4) and 34(6)* ■ In addition to the conditions listed under Coastal Beaches (tidal flats), and Rocky Intertidal Shores, which relate to the protection of marine fisheries, the following conditions may be imposed on non-DMF mapped shellfish areas, if the issuing authority permits: ■ The shellfish shall be moved from the project site if DMF and the Shellfish Constable approve both the moving and the site to which the shellfish are being moved. ■ No filling shall begin until the moving and replanting have been completed. ■ Land containing shellfish adjacent to the project shall not be altered in relief or elevation.	■ Location of area to which shellfish will be relocated and evidence of approval by DMF and Shellfish Constable. ■ Map of any DMF or non-DMF mapped shellfish beds/areas in the vicinity of the proposal.

FILL
Section 35 Fish Runs

Interests to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of marine fisheries	■ Fill may act as a barrier which will impede or obstruct the migration of fish.	*1. Measures to meet performance standard of "no adverse impact" Sec. 35(3)*	■ Identification of anadromous/catadromous fish which use the fish run and their migration times.
		■ Fill which extends from one side of a channel to the other is a dam — see section on dams.	
	■ Fill may cause turbidity which may impede the migration of fish or suffocate fish eggs.	■ Fill may not be placed in any portion of a fish run between March 15 and May 31.	
		■ Fill which is permitted shall be permanently retained by a seawall, bulkhead, or revetment. (See section on seawalls, bulkheads and revetments.)	
	■ Fill may constrict the stream channel, thereby increasing the rate of flow, which may impede the migration of fish.	■ The rate of flow shall not be increased so as to impede fish migration.	■ Rate of stream flow during migration periods before and after proposed project.
	■ Fill may cover and eliminate nursery and spawning habitats.	■ No fill shall be allowed in a nursery or spawning area.	■ Scientific studies which clearly delineate spawning and nursery areas.
	■ Pollutants which may be present in fill may cause deterioration of water quality, thereby impairing the capacity of spawning or nursery habitats.	■ Only clean fill shall be permitted.	■ If material is not from a naturally occurring, uncontaminated geologic deposit, analysis showing the level of pollutants including heavy metals, hydrocarbons, pesticides, and other toxic materials.

GRADING AND RAKING
Definition

Grading is the redistribution of sediments within a coastal wetland. It may or may not involve the placement of fill or disposal of dredge material which is subsequently graded to a given level or slope.

Coastal beaches are graded as a regular maintenance practice in many areas of the Commonwealth. If not properly done however, this activity can destroy the natural sloped beach profile, and result in a loss of the coastal beach's storm damage prevention value.

Illustration 34: Grading of coastal beach

Activity Acceptability Table

This table indicates in which Resource Areas grading and raking is or is not likely to be able to be conditioned to meet the performance standards set forth in the Regulations.

Resource Area	Acceptability
Land Under the Ocean Section 25	unlikely to be proposed.
Designated Port Areas Section 26	unlikely to be proposed.
Coastal Beaches Section 27	likely to be conditioned.
Coastal Dunes Section 28	not likely to be acceptable, with exception. Grading increases the potential for storm and flood damage (Sec. 28(3)(3)) and on vegetated dunes it destabilizes the dune by disturbing vegetation (Sec. 38(3)(6)). **NOTE:** Sec. 28(4) is an exception to the above.
Barrier Beaches Section 29	likely to be conditioned.
Coastal Banks Section 30	likely to be conditioned.
Rocky Intertidal Shores Section 31	unlikely to be proposed.
Salt Marshes Section 32	unlikely to be proposed.
Land Under Salt Ponds Section 33	unlikely to be proposed.
Land Containing Shellfish Section 34	not likely to be acceptable, with exceptions. Grading alters relief and elevations which adversely effects shellfish productivity (Sec. 34(4)(6)), and grading machinery compacts sediments (Sec. 34(4)(c)).
Fish Runs Section 35	unlikely to be proposed.

GRADING AND RAKING
Section 27 Coastal Beaches

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Grading and raking may remove sediment from or change the form of coastal beaches, thereby decreasing their ability to dissipate wave energy. ■ Grading and raking may reduce the supply of sediment to other coastal Resource Areas, including coastal dunes, nearshore areas of land under the ocean, and other coastal beaches.	*1. Measures to meet performance standards of "no adverse effect" Sec. 27(3)* ■ Cleaning of coastal beaches must be accomplished using a rake in such a manner as to preserve the existing form, volume and grain size distribution of the beach. ■ Grading operations other than raking shall not be permitted on coastal beaches, except to move sediment deposited as the result of beach replenishment activities.	■ Existing beach sediment size characteristics. ■ Description of the rake. ■ **NOTE:** This information is required in order to insure that the rake teeth are sufficiently separated so that the beach sediment will not be removed and that the beach form will not be altered.
Protection of marine fisheries	■ Grading and raking of the tidal flat portion of a coastal beach may have an adverse effect on marine fisheries by altering the distribution of sediment grain size, and by altering water quality, particularly when a tidal flat composed of a high percentage of fine material or organic material is proposed to be graded.	*1. Best available measures to meet Sec. 27(6).* ■ On most tidal flat portions of coastal beaches there are no measures to reduce the adverse effects of grading and raking to the required level. Therefore all grading and raking of the tidal flat portion of coastal beaches should be denied. Grading or raking is permitted for strictly agricultural purposes, and when approved by DMF.	

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control.	■ Grading and raking are likely to destroy or impair dune vegetation and thereby destabilize the dune. ■ Grading and raking may modify the dune form, thereby increasing the potential for storm and flood damage.	*1. Measures required to meet performance standards stated in Sec. 28(4).* ■ Grading and raking of coastal dunes by mechanical means should be permitted only around existing structures. Dune sand removed as the result of these operations must be deposited on the beach or foredune, whichever will best serve the interests of storm damage prevention and flood control. The section covering "Fill" projects presents the conditions required for such deposition.	■ Location of proposed grading or raking by mechanical means. ■ Location of existing structures. ■ If sand is removed, location of the proposed site of deposition and all information required for "Fill" projects.
	■ Grading and raking may cause removal of sand from the dune, thereby increasing the potential for storm and flood damage.	*2. Measures required to meet performance standards stated in Sec. 28(3).* ■ Removal of debris from coastal dunes (except around existing structures) may be accomplished manually in such a manner as not to disturb dune volume, form or vegetative cover, or interfere with new dune formation.	

GRADING AND RAKING
Section 29 Barrier Beaches

Interest to be Protected	Adverse Effects to Interest.	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control.	*1. Sec. 29(3)* ■ Since barrier beaches are both significant to storm damage prevention and flood control, and this Resource Area is comprised of both coastal beaches and coastal dunes, see the sections on these Resource Areas for both the adverse effects and required conditions for grading and raking.	See charts for coastal beaches and coastal dunes	
Protection of marine fisheries	*1. Sec. 29(3)* ■ Since barrier beaches are significant to marine fisheries, and this Resource Area is comprised of both coastal beaches and coastal dunes, see the sections on these Resource Areas for both the adverse effects, and required conditions for grading and raking.		

GRADING AND RAKING
Section 30 Coastal Banks

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Grading and raking may disturb the stability of coastal banks by removing material from them, thereby reducing their functions as a vertical buffer to storm waters. ■ Grading and raking may disturb the stability of coastal banks by destroying the existing vegetation.	*1. Measures to meet performance standards stated in Sec. 30(6)* ■ Grading and raking of coastal banks may not result in a decrease in the total volume of the bank. Material may be moved in such a manner as to increase the stability of the bank, as for example, by terracing the bank face. ■ Following the grading or raking project, the bank must be replanted with suitable vegetation in order to decrease erosion caused by wind and rain runoff.	■ Description of project including the proposed movement of bank material. ■ Description of existing vegetation on the coastal bank. ■ Description of proposed replanting.

GRADING AND RAKING
Section 34 Land Containing Shellfish

Interest to be Protected	Adverse Impacts to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of land containing shellfish and marine fisheries	■ Grading or raking of any Resource Area which contains shellfish has an adverse effect on the productivity of such land by altering relief and elevation, and by altering the distribution of sediment grain size. Grading and raking may also adversely change water quality by increasing turbidity levels.	*1. Measures to meet performance standard of "no adverse effect" Sec. 34(4)* ■ In a DMF mapped shellfish bed (Reg. 34(3)(a)) there are no measures which will make grading or raking meet the "no adverse effect" standard. Therefore these activities are unacceptable and are to be denied when proposed in DMF mapped shellfish beds. Grading or raking is permitted, however, for strictly agricultural purposes, and when approved by DMF.	■ A detailed plan of the Resource Areas containing shellfish, showing where grading or raking is proposed.
		■ In a non-DMF mapped shellfish area (Sec. 34(3)(b)) grading or raking may be permitted under the following condition: ■ that the shellfish in the area to be graded or raked be relocated in a manner and to a location suitable and approved by DMF.	■ Proposed location of the shellfish relocation, and evidence of DMF and shellfish constable approval.

REMOVAL
Definition/Acceptability

Removal is defined as taking away any portion of a coastal wetland. Removal generally refers to wetlands or portions of wetlands located above the mean high water mark. Removal of wetlands located below mean high water (subaqueous) is generally referred to as dredging.

Illustration 35: Coastal wetland removal operation

Activity Acceptability Table

This table indicates in which Resource Areas removal is or is not likely to be able to be conditioned to meet the performance standards set forth in the Regulations.

Resource Area	Acceptability
Land Under the Ocean Section 25	unlikely to be proposed — (see dredging).
Designated Port Areas Section 26	unlikely to be proposed — (see dredging).
Coastal Beaches Section 27	may be conditioned in limited situations. Removal changes the volume and form of a beach which is not permitted under Sec. 27(3).
Coastal Dunes Section 28	may be conditioned in limited situations. Removal changes the ability of waves to remove sand, disturbs dune vegetation, modifies dune form, and removes sand from the dune artificially, which are not permitted under Sec. 28(3). Note the exception under Sec. 28(4).
Barrier Beaches Section 29	may be conditioned in limited situations.
Coastal Banks Section 30	not likely to be acceptable: removal of a portion of bank decreases sediment supply and decreases the stability of adjacent banks which are not permitted under Sec. 30(4) and 30(6).
Rocky Intertidal Shores Section 31	not likely to be proposed.
Salt Marshes Section 32	not likely to be acceptable — Sec. 32(3) states that no portion of a salt marsh can be destroyed.
Land Under Salt Ponds Section 33	unlikely to be proposed — (see dredging).
Land Containing Shellfish Section 34	unlikely to be proposed — (see dredging).
Fish Runs Section 35	unlikely to be proposed — (see dredging).

REMOVAL

Section 27 Coastal Beaches

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Removal of sediment from a coastal beach reduces the volume and changes the form of the landform so that its ability to dissipate wave energy and supply sediment to other coastal Resource Areas (coastal dunes, nearshore land under the ocean, and other coastal beaches) is reduced.	*1. Measures to meet performance standard of "no adverse effect" Sec. 27(3).* ■ There are no conditions that could be applied to prevent the adverse effect, therefore removal may not be permitted from coastal beaches, with the following exceptions: ■ 1. Removal of sediments from a coastal beach that is allowed in the dredging section. ■ 2. Removal of sediments from a coastal beach for sand bypassing across a jettied inlet (transfer of sediment from the updrift to downdrift side of the inlet) and sand bypassing from behind a breakwater to the downdrift coastal beach (see jetties or breakwaters section).	■ See section on dredging of coastal beaches. ■ See section on jetties on coastal beaches. ■ See section on breakwaters on land under the ocean.

Section 28 Coastal Dunes

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
	1. Sec. 28(3)	*1. Measures to meet performance standard of "no adverse effect" Sec. 28(3).*	
Storm damage prevention and flood control	■ Removal of sediment from a coastal dune reduces potential supply of sediment to coastal beaches and reduces its function as a barrier to storm wave overwash. ■ Removal of sediment would also destroy the vegetative cover which contributes to the growth and stability of coastal dunes by providing conditions favorable for sand deposition.	■ There are no conditions that could be applied to prevent adverse effect, therefore removal may not be permitted from coastal dunes, with the following exception: ■ As permitted and defined in the grading section on coastal dunes.	

SEAWALLS, BULKHEADS AND REVETMENTS
Definition/Acceptability

Seawalls, Bulkheads, and Revetments are structures placed parallel to the shoreline, separating a land area from a water area.

Bulkheads are vertical walls generally used to contain fill. They may be constructed of steel, timber, or concrete.

Seawalls are basically massive bulkheads designed to withstand the direct onslaught of ocean waves. Seawalls may be built with vertical, curved or stepped faces. The design has a bearing on how wave energy is reflected back to the ocean.

Revetments are composed of one or more layers of stone to armor a sloping shoreline face. Occasionally, concrete construction is used. The sloping face of revetments causes less wave energy refraction, and depending on design, a greater amount of energy dissipation, both of which may result in less damaging effects to fronting beaches or flats than vertical sea walls.

The most likely locations for bulkheads, seawalls, and revetments are on coastal banks. These sloping areas are usually proposed to be reveted with stone or masonry.

The base of a bulkhead or seawall may be on a coastal beach. If the structure is proposed for a coastal bank so that the base or toe of the structure is located below mean low water, land under the ocean will be affected. This situation is most commonly found where land under the ocean is found within designated port areas.

Illustration 36: Revetment

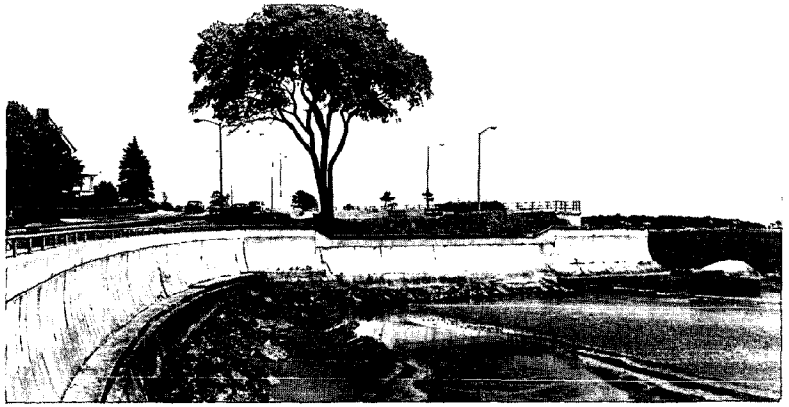


Illustration 37: Seawall

Activity Acceptability Table

This table indicates in which Resource Areas seawalls, bulkheads, and revetments are or are not likely to be able to be conditioned to meet the performance standards set forth in the Regulations.

SEAWALLS, BULKHEADS AND REVETMENTS
Acceptability

Resource Area	Acceptability
Land Under the Ocean Section 25	may be conditioned in limited situations.
Designated Port Areas Section 26	likely to be conditioned.
Coastal Beaches Section 27	may be conditioned in limited situations — Sec. 27(3) states that no project can have an adverse effect on coastal beaches by increasing erosion, decreasing the volume or changing the form of a coastal beach. Seawalls, revetments and bulkheads cannot be designed to prevent these adverse effects. Note exception in Sec. 27(3) with respect to revetments, bulkheads, and seawalls on Coastal Banks which overlap onto Coastal Beaches. See conditions under coastal banks.
Coastal Dunes Section 28	not likely to be acceptable — Sec. 28(3) states that no project can adversely affect a dune by affecting the ability of waves to remove sand from the dune. Seawalls, revetments, and bulkheads cannot be designed to prevent this adverse effect.
Barrier Beaches Section 29	not likely to be acceptable — see coastal beach and coastal dunes
Coastal Banks Section 30	likely to be conditioned, but only for the protection of structures existing prior to August 10, 1978, or where the coastal bank comes under Sec. 30(7)
Rocky Intertidal Shores Section 31	likely to be conditioned
Salt Marshes Section 32	not likely to be acceptable — Sec. 32(3) states that no portion of a salt marsh may be destroyed
Land Under Salt Ponds Section 33	not likely to be acceptable — seawalls, bulkheads, and revetments change the relief and elevation of bottom topography, and thereby adversely affect marine fisheries habitat which is not permitted under Sec. 33(3).
Land Containing Shellfish Section 34	not likely to be acceptable in DMF mapped shellfish areas — seawalls, bulkheads, and revetments will have an adverse affect on such land and on marine fisheries which is not permitted under Sec. 34(4). Can be conditioned in non-DMF mapped areas if otherwise allowed in a particular Resource Area.
Fish Runs Section 35	likely to be conditioned.

SEAWALLS, BULKHEADS AND REVETMENTS
Section 25 Land Under the Ocean

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Seawalls, bulkheads, and revetments may cause a reflection of wave energy or interfere with the movement of sediments, such that adjacent areas of land under the ocean are scoured and depleted of sediment. This change in bottom topography may increase the potential for erosion of coastal beaches, coastal banks, coastal dunes, or salt marshes.	*1. Measures to meet performance standard of "no adverse effect" Sec. 25(5)* ■ There are no conditions to prevent this adverse effect, therefore seawalls, revetments, and bulkheads may not be permitted on land under the ocean, with the following exceptions: ■ when a seawall, bulkhead, or revetment is permitted on a coastal bank or rocky intertidal shore, and its base must be on land under the ocean, it may be permitted. See conditions for building seawalls, bulkheads, and revetments on coastal banks and rocky intertidal shores and conditions to protect marine fisheries below. ■ the base of the seawall, bulkhead, or revetment must be located as close as possible to the coastal bank.	■ Note: bulkheading on land under the ocean implies that fill will be placed behind it. See fill section.
Protection of marine fisheries	■ The process of construction of seawalls, bulkheads, and revetments may adversely effect marine fisheries and shellfish by increasing turbidity levels and when the sediment settles out, by altering the distribution of sediment grain size in nearby areas of land under the ocean. ■ If present in the disturbed sediments, pollutants will be released and distributed. ■ Eel grass beds may be destroyed	*1. Best available measures to meet Sec. 25(6)* ■ When a seawall, bulkhead, or revetment is permitted on a coastal bank or rocky intertidal shore, and if its base must be on land under the ocean, it may be permitted subject to the following additional conditions: ■ siltation curtains should be used to completely contain the turbidity plume caused by construction, where conditions permit. ■ whenever an eel grass bed is destroyed by construction, a new eel grass bed of comparable size shall be planted in a suitable environment as close as possible to the site.	■ The size and location of the expected turbidity plume. ■ Map of existing eel grass beds at the site.

SEAWALLS, BULKHEADS AND REVETMENTS
Section 26 Designated Port Areas

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of marine fisheries	■ Construction of seawalls, bulkheads and revetments are likely to adversely affect water quality by generating turbidity in the area.	*1. Best practical measures to meet Sec. 26(3)* ■ The construction should be accomplished as quickly as possible using the most efficient and practicable equipment.	■ Identification of measures being taken to reduce turbidity.
Storm damage prevention and flood control	■ The placement of seawalls, bulkheads and revetments within designated port areas is not likely to have an adverse effect to storm damage prevention and flood control.	*1. Best practical measures to meet Sec. 26(4)* ■ No conditions are necessary.	

SEAWALLS, BULKHEADS AND REVETMENTS
SECTION 27 COASTAL BEACHES and
SECTION 29 BARRIER BEACHES

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Seawalls, revetments or bulkheads on coastal beaches reflect wave energy and thereby increase erosion and change the volume and form of adjacent or downdrift coastal beaches.	*1. Measures to meet performance standards of "no adverse effect" Sec. 27(3)* ■ There are no conditions to prevent this adverse effect, therefore, seawalls, revetments, and bulkheads should not be permitted on coastal beaches, with the following exceptions: ■ when a seawall, revetment, or bulkhead is permitted on a coastal bank and its base must be on a coastal beach, it may be permitted — see conditions for building seawalls, revetments, and bulkheads on coastal banks and conditions to protect marine fisheries below. ■ the base of the seawall, bulkhead, or revetment must be located as close as possible to the coastal bank.	
Protection of marine fisheries	(Tidal flats) ■ The process of construction of seawalls, bulkheads, and revetments may adversely effect marine fisheries and shellfish by increasing turbidity levels and, when the sediment settles out, by altering the distributions of sediment grain size in nearby tidal flats	*1. Best available measures to meet Sec. 27(6)* ■ When a seawall, revetment or bulkhead is permitted on a coastal bank and its base must be on a tidal flat, it may be permitted subject to the following additional conditions: ■ siltation curtains should be used to completely contain the sediment to turbidity plume caused by construction where conditions permit. ■ the base of the seawall, bulkhead or revetment must be located as close as possible to the coastal bank.	

SEAWALLS, BULKHEADS AND REVETMENTS

SECTION 30 COASTAL BANKS

A. Coastal banks which supply sediment to coastal beaches, coastal dunes, or barrier beaches

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	*1. Sec. 30(3)* ■ Bulkheads, seawalls and revetments prevent the removal of sediments from the bank to supply the coastal dune or barrier beach. These activities also alter wave action which may adversely alter the volume and form of adjacent and downdrift beaches. ■ Stabilizing vegetation may be damaged or destroyed during construction.	*1. Best available measures to meet Sec. 30(3)* ■ No bulkhead revetment or seawall can be designed to prevent this adverse effect. Therefore, no seawall, revetment or bulkhead may be permitted on a coastal bank which supplies sediment to coastal beaches, coastal dunes or barrier beaches, with the following exceptions: ■ when a bulkhead, revetment or seawall is needed to prevent storm damage to a building constructed or for which a Notice of Intent was filed prior to August 10, 1978, it may be constructed under the following conditions: ■ The slope of a protective seawall, bulkhead or revetment should be less steep than a 3:1 slope. A steeper slope will require that sediment be added on a periodic basis to insure that the form and volume of the fronting coastal beach are not changed. ■ The face of the structure should be rough, as opposed to smooth to minimize reflected wave energy. ■ The structure shall overlap onto the fronting coastal beach, or land under the ocean, only to the extent necessary to achieve structural stability and desired slope. ■ No more than the minimum amount of fill to achieve stability of the structure shall be permitted. ■ Destroyed or damaged vegetation shall be replaced after completion of the structure. ■ Hay bales, mulch, or nets shall be used during construction and up till the time new vegetation takes hold to minimize erosion.	■ Documentation of the storm damage threat to a structure. This should include historic measurement of bank retreat and an estimate of the time to structural collapse. ■ Detailed plans and construction specifications. ■ Documentation as to when the building was constructed or when Notice of Intent was filed. ■ NOTE: Buildings which were constructed prior to August 10, 1978 or for which a Notice of Intent was filed prior to that date, and have been reconstructed but not enlarged by more than 50% of the original floor area, are included in this exception. ■ Where beach nourishment is required, evidence of a legal committment to provide for periodic replenishment. ■ Documentation showing the minimum amount of backfilling required to provide structural stability of the bank and the proposed structure. ■ A justification by the applicant that there is no way other than the proposed structure to protect the building. Among alternatives which should be considered are moving the structure, terracing and protective plantings.

SEAWALLS, BULKHEADS AND REVETMENTS
Section 30 Coastal Banks

B. Coastal Banks which are a vertical buffer to storm damage or flooding and do not provide sediment to coastal beaches, coastal dunes, or barrier beaches.

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Bulkheads, seawalls, and revetments may transfer runoff to adjacent, unprotected coastal banks, thereby causing erosion and destabilizing them.	*1. Measures to meet performance standard of "no adverse effects" Sec. 30(6)*	
		■ Depending upon the site, the following may be appropriate: ■ Vegetation to diffuse runoff and stabilize bank. ■ Spillways to accommodate the runoff.	■ Calculations showing the amount and directions of runoff, and a detailed plan showing how the increased runoff will be accommodated.
	■ Bulkheads, seawalls, and revetments may prevent groundwater seepage from the bank face. This groundwater backup could result in the collapse and slumping of the bank. Clay seams in glacial till, if present, may exacerbate the problem by increasing a perched water table behind the structure.	■ Berms or other techniques to divert surface water landward from the top of the bank may be employed.	■ Calculations showing the amount and direction of runoff, and a detailed plan showing how the runoff will be accommodated.
	■ Stabilizing vegetation may be damaged or destroyed during construction.	■ The revetment, bulkhead, or seawall should contain sufficient weep-holes toward the base of the structure to allow groundwater to drain.	■ Calculations showing the amount of groundwater backup expected and a plan showing the location and size of the weep-holes.
		■ Where clay seams are present, more extensive dewatering is likely to be required. If sufficient dewatering techniques, or berms to direct runoff, are not feasible to prevent a decrease in bank stability, the proposed structure should be denied.	■ Geologic information indicating whether or not clay seams are present; calculations, showing the amount of groundwater backup expected and how this will be removed from the bank.

Interest to be Protected	Adverse Impacts to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Seawalls, revetments, and bulkheads on rocky intertidal shores may reflect wave energy such that erosion may increase on adjacent beaches (if any) and adjacent land under the ocean. Adjacent structures may also be subject to increased wave attack caused by the reflected wave energy.	*1. Best practical measures to meet Sec. 31(3)* ■ The structure shall be designed, where possible, to not reflect wave energy toward adjacent beaches or structures.	■ Location of adjacent beaches or structures. ■ Calculations of existing and proposed amount and direction of wave energy reflected toward adjacent beaches or structures.
Protection of marine fisheries	■ Seawalls, revetments, and bulkheads are not likely to adversely effect marine fisheries by changing water circulation and water quality.	*1. Best available measures to meet Sec. 31(4)* ■ No conditions are required with respect to the protection of marine fisheries.	

SEAWALLS, BULKHEADS AND REVETMENTS
Section 34 Land Containing Shellfish – Non-DMF Mapped Area Only

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of land containing shellfish and marine fisheries	■ Destruction of shellfish	*1. Measures to meet performance standard of "no adverse effect" Sec. 34(4) and 34(6)* ■ In addition to the conditions listed under land under the ocean, tidal flats, and rocky intertidal shores, which relate to the protection of marine fisheries, the following conditions may be imposed in non-DMF mapped shellfish areas, if the issuing authority permits: ■ the shellfish shall be moved from the project site if DMF and the local shellfish constable approve both the moving and the site to which the shellfish are being moved. ■ No construction shall begin until the moving and replanting have commenced. ■ Shellfish shall be removed only from the area directly impacted by the project. ■ Land containing shellfish adjacent to the project shall not be compacted, and shall not be altered in relief or elevation.	

SEAWALLS, BULKHEADS AND REVETMENTS

Section 35 Fish Runs*

Interest to be Protected	Adverse Effects to Interests	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of marine fisheries	■ Seawalls, bulkheads, or revetments built on the banks of or on land under ponds, streams, rivers, lakes, or creeks which are associated with anadromous/catadromous fish runs may:	*1. Measures to meet performance standard of "no adverse effect" Sec. 35(3)*	■ Identification of anadromous/catadromous fish which use the fish run and when they migrate
	■ impede the migration of fish by reducing the width and depth of the stream, river or creek. It shall be presumed that any bulkhead or revetment will impede migration, so that DMF review is required.	■ Require that DMF review the reduction of stream width and depth. If DMF approval is not obtained by applicant, project may not be constructed.	
	■ change the rate of flow of water in the fish run by changing the cross section of the stream, river, or creek.	■ The rate of flow may not be changed so as to impede migration.	■ Rate of flow during migration season before and after proposed project.
	■ Impair the capacity of spawning or nursery habitats by displacing them and by altering current patterns or creating turbidity.	■ No spawning or nursery habitat shall be destroyed.	■ Studies which clearly delineate spawning and nursery areas.
		■ Siltation curtains shall be used to completely contain sediments which may be stirred up as a result of construction, if conditions permit.	■ Plan, location, and specifications for siltation curtains.
		■ No construction shall be done between March 15 and June 15.	

*When a coastal bank or land under the ocean is associated with an anadromous/catadromous fish run, see the conditions for seawalls, bulkheads and revetments under those sections.

BREAKWATERS
Definition/Acceptability

A Breakwater is a structure used to protect a coastal area from the effects of waves and wave energy. Commonly, breakwaters are used in conjunction with navigational improvements in the protection of harbors or anchorages.

Breakwaters are classified as either "offshore" or "shore-connected." Offshore breakwaters have no physical connection with the shoreline. Shore connected breakwaters have one arm that extends to shore and acts more or less like a jetty, in providing a total barrier to the movement of littoral drift.

Breakwaters may be rubble mound, composite, concrete-caisson, sheet-piling cell, crib or mobile. Most breakwaters in Massachusetts are of the rubble-mound type as illustrated in the accompanying photo.

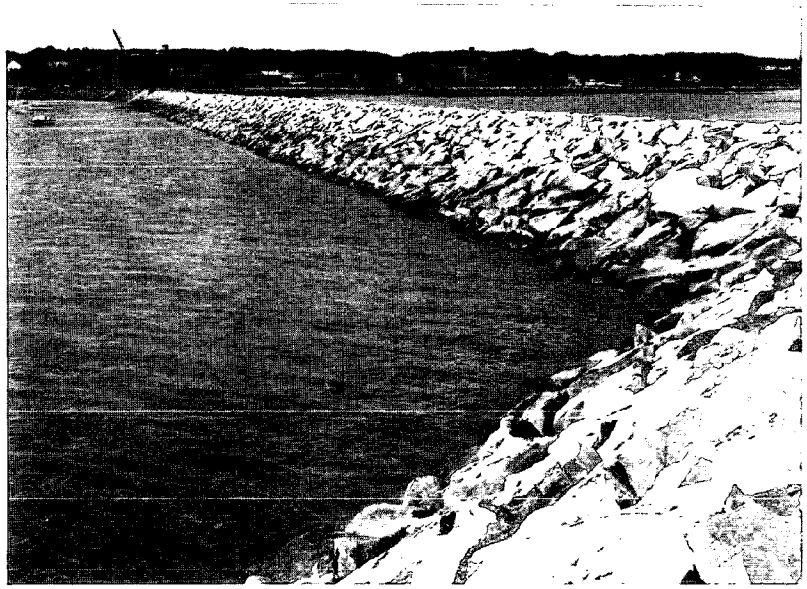


Illustration 38: Shore-connected rubble mound breakwater

Activity Acceptability Table

This table indicates in which Resource Area non-floating breakwaters are or are not likely to be able to be conditioned to meet the performance standards set forth in the Regulations.

Resource Area	Acceptability
Land Under the Ocean Section 25	may be conditioned in limited situations.
Designated Port Areas Section 26	unlikely to be proposed.
Coastal Beaches Section 27	unlikely to be proposed.
Coastal Dunes Section 28	unlikely to be proposed.
Barrier Beaches Section 29	unlikely to be proposed.
Coastal Banks Section 30	unlikely to be proposed.
Rocky Intertidal Shores Section 31	unlikely to be proposed.
Salt Marshes Section 32	unlikely to be proposed.
Land Under Salt Ponds Section 33	unlikely to be proposed.
Land Containing Shellfish Section 34	not likely to be acceptable in DMF mapped shellfish areas. Non-floating breakwaters will adversely affect productivity of such areas which is not allowed under Sec. 34(4). Likely to be conditioned in non-DMF mapped shellfish areas.
Fish Runs Section 35	unlikely to be proposed.

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards.	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Both offshore and shore-connected breakwaters interrupt longshore sediment transport processes by reducing or absorbing wave energy that would otherwise serve as the necessary driving force for longshore sediment movement.	*1. Measures to meet performance standards of "no adverse effect" Sec. 25(5).* ■ There are no measures to reduce the adverse effects to the required level of "no adverse effect." Therefore, breakwaters should be denied except in the following circumstances: ■ Breakwaters proposed fronting an area having no net littoral drift (equal drift in each direction) are acceptable provided a sand bypass system is designed to transfer sediment in both directions.	■ Coastal engineering, physical oceanographic, and/or coastal geologic information showing the impact of the proposed structure on on-shore flood and storm damage conditions. ■ Detailed plans and specifications for the breakwater and sand bypass system. Information indicating the gross and net volume and rate of littoral drifting in the area before the breakwater is built and estimates of the rate and volume expected after it is built. ■ A schedule for periodic sediment nourishment, if necessary.
Protection of marine fisheries	■ Breakwaters that are allowed on land under the ocean are not likely to have an adverse effect on marine fisheries.	*1. Best available measures to meet Sec. 25(b)* ■ None required for breakwaters.	

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of land containing shellfish and marine fisheries	■ Breakwaters, in any portion of any Resource Area which contains shellfish, may alter the productivity of such land by altering water circulation, relief or elevation of the existing Resource Area containing shellfish, or water quality. The construction process of installing breakwaters may also adversely affect water quality by increasing turbidity levels in the area.	*1. Measures to meet performance standard of "no adverse effect" Sec. 34(4).* ■ In a DMF mapped shellfish bed (34(3)(a)), there are no measures which will make breakwaters meet the "no adverse effect" standard. ■ In a non-DMF mapped shellfish area (34(3)(b)) breakwaters may be permitted under the following conditions: ■ that the shellfish in the area in which the breakwater is proposed are relocated in a manner and to a suitable location and approved by DMF and the shellfish constable. ■ siltation curtains designed and employed so as to preclude the transport of sediment from the construction site onto other areas of the shellfish bed shall be employed, where physical conditions permit.	■ Map of DMF shellfish beds in the vicinity of the proposal. ■ Proposed location of relocated shellfish and evidence of DMF and shellfish constable approval of such area. ■ Plan and specifications for siltation curtains.

GROINS
Definition

A Groin is a structure built of rock, steel, timber or concrete that is used to modify longshore sediment transport. It is generally built perpendicular to the shoreline. Groins are narrow structures but their length can vary depending upon the configuration of the coast where it is built.

Groins are classed as permeable or impermeable, high or low, long or short, fixed or adjustable, and permanent or temporary.

Groins are used to build a protective beach by trapping sediment along a portion of shoreline where little beach exists. They are also used to retard erosion of existing or restored beaches.

Historically groins have been considered necessary when certain updrift conditions have cut off the natural supply of sand feeding downdrift areas. For example, when natural erosion of bluffs or cliffs is halted, sediment starvation occurs in downdrift areas. Downdrift beaches start to disappear because their source of sediment is curtailed. Groins have traditionally been built in such cases to trap what little moving sediment remained.

The usual result has been that while sediment was trapped immediately updrift of the groin, almost none was left to replenish downdrift areas. This resulted in the creation of "groin fields," where each property owner installed separate groins in an attempt to catch whatever sand was available.

Since groins do not address the initial cause of the decrease in littoral drift, i.e., a blockage of sediment transport form the source, groins have often produced unsatisfactory results.

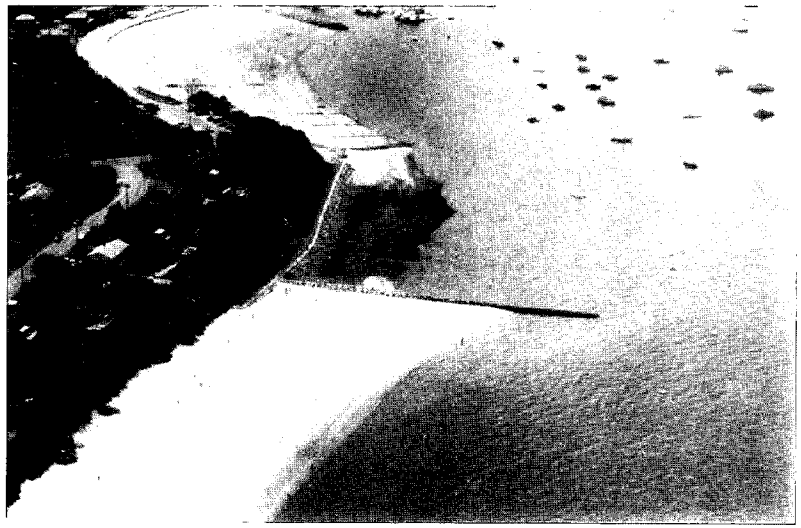


Illustration 39: Groin

Illustration 40: Groin field

Activity Acceptability Table

This table indicates in which Resource Area groins are or are not likely to be able to be conditioned to meet the performance standards set forth in the Regulations.

Resource Area	Acceptability
Land Under the Ocean Section 25	may be conditioned in limited situations.
Designated Port Areas Section 26	unlikely to be proposed.
Coastal Beaches Section 27	may be conditioned in limited situations.
Coastal Dunes Section 28	unlikely to be proposed.
Barrier Beaches Section 29	may be conditioned in limited situations.
Coastal Banks Section 30	unlikely to be proposed.
Rocky Intertidal Shores Section 31	likely to be conditioned.
Salt Marshes Section 32	unlikely to be proposed.
Land Under Salt Ponds Section 33	unlikely to be proposed.
Land Containing Shellfish Section 34	unlikely to be acceptable in DMF mapped shellfish areas: groins adversely affect such land and marine fisheries which is not permitted under Sec. 34(4). Likely to be conditioned in non-DMF mapped shellfish areas.
Fish Runs Section 35	unlikely to be proposed.

Interest to be Protected	Adverse Impacts to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Groins interrupt longshore sediment movement so as to decrease the volume of downdrift coastal beaches and deepen nearshore land under the ocean. Longshore movement is terminated because groins are both a barrier to the movement and they interfere with waves which are the necessary driving force for longshore sediment movement.	*1. Measures to meet performance standard of "no adverse effect" Sec. 25(5)* ■ There are no measures to reduce the adverse effects to the required level in most cases. Therefore, groins shall be denied except in the following circumstances: ■ beach construction or nourishment projects where there are no downdrift beaches to be starved of sediment movement along the shore. Under this exception, the following conditions must be met: ■ groins must be filled to entrapment capacity with sediment compatible with beach sediment at the site.	■ Demonstration that there are no downdrift beaches within the littoral system of the proposed project.
Protection of marine fisheries	■ Groins that are allowed above are not likely to have an adverse effect on marine fisheries.	*1. Best available measures to meet Sec. 25(6)* ■ None required for groins	

Interest to be Protected	Adverse Impacts to Interest	Conditions Required to Minimize Adverse Impacts	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Groins adversely effect the volume and form of downdrift coastal beaches, by creating a barrier to longshore sediment movement, and by interfering with waves which are the driving force necessary for longshore sediment movement.	*1. Measures to meet performance standard of "no adverse effect" Sec. 27(3)* ■ There are no measures to reduce the adverse effects to the required level. Therefore, groins shall be denied, except in the following circumstances: ■ 1. Beach construction or nourishment projects where there are no downdrift beaches to be starved of sediment movement along the shore. Under this exception, the following conditions must be met: ■ Groins must be filled to entrapment capacity with sediment compatible with the beach sediment upon adjacent areas. ■ 2. When the coastal beach form has already been altered by an offshore breakwater located parallel to the shoreline, the breakwater tends to cause buildup of sediment behind the structure (see breakwater). To lessen the volume of sediment buildup behind the breakwater, a groin or groins could be placed updrift of the breakwater shadow.	■ A demonstration that there are no downdrift beaches within the littoral system of the proposed project. ■ A demonstration that the sediment proposed for nourishment is compatible with the existing beach sediment.
Protection of marine fisheries	■ Groins adversely affect the marine fisheries value of the tidal flat portion of coastal beaches and barrier beaches by altering the water circulation.	*1. Best available measures to meet Sec. 27(6)* ■ Where groins are allowed under exception #2 above, the length of the groin shall be such that no stagnation in the area behind the breakwater is created.	■ Studies of existing and proposed water circulation in the area potentially affected by placement of the groin.

GROINS
Section 31 Rocky Intertidal Shores

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Groins placed on rocky intertidal shores are likely to have an adverse effect on the form and volume of exposed intertidal bedrock and boulders, generally causing a diminishment in the rocky shores' ability to diffuse and absorb wave energy. This causes focusing or reflecting wave energy to other areas.	*1. Best practical measures to minimize adverse effects (Sec. 31(3)* ■ Groins shall be located so as not to focus reflected wave energy to nearby existing structures.	■ Construction plans and specifications. ■ Direction of storm wave approach.
Protection of marine fisheries	■ Rubble mound groins placed on rocky intertidal shores are not likely to have an adverse effect on water circulation and water quality.	*1. Best available measure to meet Sec. 31(4)* ■ None required for rubble mound groins.	

Section 34 Land Containing Shellfish

Interest to be Protected	Adverse Impacts to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of land containing shellfish and marine fisheries	■ Groins in any portion of any Resource Area which contains shellfish may alter the productivity of such land by altering water circulation, relief and elevation or water quality. Construction of groins, particularly, may adversely effect water quality by increasing turbidity levels in the area.	*1. Measures to meet performance standard of "no adverse effect" Sec. 34(4)* ■ In a DMF mapped shellfish bed (34(3)(a)) there are no measures which will make groins meet the "no adverse effect" standard.	■ Map of DMF shellfish beds in the vicinity of the proposal.
		■ In a non-DMF mapped shellfish area (34(3)(b)), groins may be permitted under the following conditions: ■ that the shellfish in the area in which the groin is proposed be relocated in a manner and to a location suitable and approved by DMF and the shellfish constable.	■ Proposed location of the relocated shellfish and evidence of DMF and shellfish constable approval.
		■ siltation curtains designed and employed so as to preclude the transport of sediment from the construction site onto other areas of the shellfish bed shall be employed, where physical conditions permit.	■ Plan and specification for siltation curtain.

JETTIES
Definition/Acceptability

The purpose of a jetty is to prevent shoaling which occurs when longshore sediment transport encounters an inlet. On the flood-tide materials are brought into the inlet. At ebb-tide, an outer bar is formed. Neither occurence is desirable when navigation is the primary need in the area. Thus, a jetty is constructed on the updrift side of the inlet to completely trap the sand before it reaches the inlet. To be successful, the jetty must be of sufficient height to trap all of the sand movement and long enough to extend from the upper reaches of waves on a beach seaward to the terminus of the zone in which movement of littoral drift takes place.

Because of this impoundment of the sand at the updrift jetty, the sand supply to downdrift areas is terminated, resulting in erosion of the downdrift beach.

Illustration 41: Jetty

Activity Acceptability Table

This table indicates in which Resource Area jetties are or are not likely to be able to be conditioned to meet the performance standards set forth in the Regulations.

Resource Area	Acceptability
Land Under the Ocean Section 25	may be conditioned in limited situations.
Designated Port Areas Section 26	unlikely to be proposed.
Coastal Beaches Section 27	may be conditioned in limited situations.
Coastal Dunes Section 28	unlikely to be proposed.
Barrier Beaches Section 29	may be conditioned in limited situations.
Coastal Banks Section 30	unlikely to be proposed.
Rocky Intertidal Shores Section 31	likely to be conditioned.
Salt Marshes Section 32	unlikely to be proposed.
Land Under Salt Ponds Section 33	unlikely to be proposed.
Land Containing Shellfish Section 34	not likely to be acceptable in DMF mapped shellfish areas; jetties adversely affect such land and marine fisheries which is not permitted under Sec. 34(4). Likely to be conditioned in non-DMF mapped shellfish areas.
Fish Runs Section 35	unlikely to be proposed.

terest to be Protected	**Adverse Effects to Interest**	**Conditions Required to Meet Performance Standards**	**Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions**
Storm damage prevention and flood control	■ Jetties interrupt longshore sediment movement so as to decrease the volume of downdrift coastal beaches and deepen nearshore land under the ocean. ■ Longshore movement is terminated because jetties are both a barrier to the movement of littoral drift and because they interfere with waves which are the driving force for longshore sediment movement.	*1. Measures to meet performance standards of "no adverse effect" Sec. 25(5)* ■ Jetties may be placed within land under the ocean to prevent shoaling of the inlet provided that:	■ Demonstration that the natural inlet is used for navigational purposes, or if an artificial inlet, that it was legally dredged prior to August 10, 1978.
		■ A sand by-pass system shall be designed to accompany the proposal for construction of a jetty. The system shall be capable of transferring trapped littoral drift to downdrift areas of land under the ocean.	■ Detailed plans and construction specifications for the jetty and sand by-pass system.
		■ If the length and height of the jetty necessary to prevent inlet shoaling also change the wave energy delivered to coastal beaches and thereby reduces the net amount of littoral drift in the area, artificial nourishment shall also be required, in addition to sand by-passing, to return the net amount of littoral drift available to downdrift areas of land under the ocean and coastal beaches to that experienced prior to emplacement of the jetty system.	■ Calculations showing littoral movement past the area in which the jetty is proposed. Calculations of resultant change in littoral movement. Evidence of legal responsibility to provide both for operation of sand by-pass system and for periodic nourishment.
		■ The jetty shall be the minimum length necessary to help reduce the inlet from shoaling.	
Protection of marine fisheries	■ Jetties that are allowed under the above conditions on land under the ocean are not likely to have an adverse effect on marine fisheries.	*1. Best available measures to meet 25(6)* ■ None required for jetties	

JETTIES
Section 27 Coastal Beaches and Section 29 Barrier Beaches

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Jetties adversely affect the volume and form of downdrift coastal beaches and barrier beaches by creating a barrier to longshore sediment movement, and by interfering with waves which are the driving force for longshore sediment movement.	*1. Measures to meet performance standard of "no adverse effects" Sec. 27(3)* ■ Jetties may be constructed on the coastal beach or barrier beach portion of land contiguous to the inlet channel provided that the same conditions listed under land under the ocean, above, are complied with.	
Protection of marine fisheries	■ Jetties that are allowed above on coastal beaches or barrier beaches, are not likely to have an adverse effect on marine fisheries.	*1. Best available measures to meet Sec. 27(6)* ■ None required for jetties.	

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ The section of a jetty that is placed upon a rocky intertidal shore usually causes a reflection and focusing of wave energy to other areas.	*1. Best practical measures to minimize adverse effects — Sec. 31(3)* ■ Jetties shall be located so as not to focus reflected wave energy to nearby existing structures.	■ Direction of storm wave approach
Protection of marine fisheries	■ The placement of a rubble mound section of jetty on a rocky intertidal shore is not likely to have an adverse effect on water circulation and water quality.	*1. Best available measures to meet Sec. 31(4)* ■ None required for jetties.	

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of land containing shellfish and marine fisheries	■ Jetties in any portion of any Resource Area which contains shellfish may alter the productivity of such land by altering water circulation, relief or elevation of the existing Resource Area containing shellfish, or water quality. The construction process of installing jetties may also adversely affect water quality by increasing turbidity levels.	*1. Measures to meet performance standard of "no adverse effect" Sec. 34(4)* ■ In a DMF mapped shellfish bed (34(3)(a)), there are no measures which will make jetties meet the "no adverse effect" standard. ■ In a non-DMF mapped shellfish area (34(3)(b), jetties may be permitted under the following conditions: ■ that the shellfish in the area in which the jetty is proposed be relocated in a manner and to a location suitable and approved by DMF and the shellfish constable.	■ Map of DMF shellfish beds in the vicinity of the proposal. ■ Proposed location of the relocated shellfish, and evidence of DMF and shellfish constable approval.

BOARDWALKS, STAIRWAYS, PATHWAYS and FOUR-WHEEL DRIVE TRAILS

Definition/Acceptability

Boardwalks, Stairs, Pathways and Four-Wheel Drive (4WD) vehicle trails are commonly proposed activities on coastal wetlands and need no formal definition.

Examples of each of these activities are given in Illustrations 42 and 43.

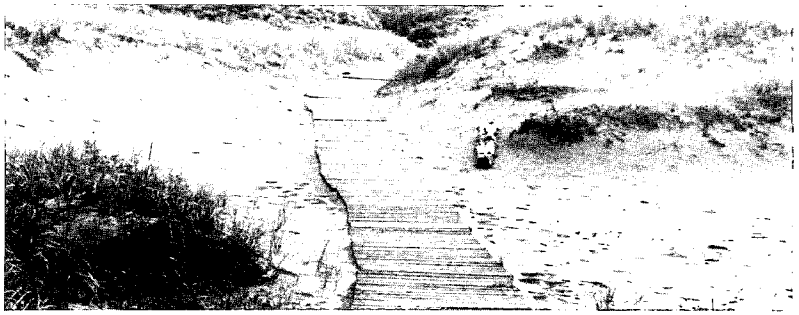


Illustration 42: Boardwalk

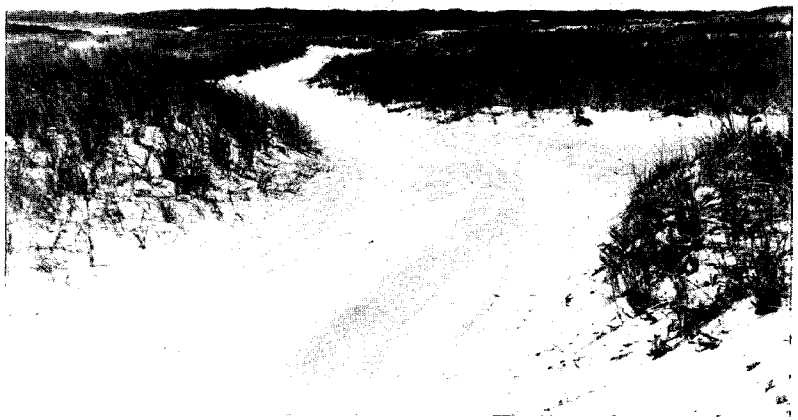


Illustration 43: Four-wheel drive vehicle trail

Activity Acceptability Table

This table indicates in which Resource Area boardwalks, stairs, pathways, and four-wheel drive trails are or are not likely to be able to be conditioned to meet the performance standards set forth in the Regulations.

Resource Area	Acceptability
Land Under the Ocean Section 25	unlikely to be proposed.
Designated Port Areas Section 26	unlikely to be proposed.
Coastal Beaches Section 27	likely to be conditioned.
Coastal Dunes Section 28	likely to be conditioned.
Barrier Beaches Section 29	likely to be conditioned.
Coastal Banks Section 30	likely to be conditioned.
Rocky Intertidal Shores Section 31	likely to be conditioned.
Salt Marshes Section 32	likely to be conditioned.
Land Under Salt Ponds Section 33	unlikely to be proposed.
Land Containing Shellfish Section 34	may be conditioned in limited situations.
Fish Runs Section 35	unlikely to be proposed.

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Pathways constructed of fill, or of fill and bituminous material, on coastal beaches do not allow the beach to respond to wave action, resulting in a change in the form of the coastal beach on which the pathway is located. Downdrift beaches may also be adversely affected if the structure prohibits the transfer of sediments to downdrift areas.	*1. Measures to meet performance standards of "no adverse effect" Sec. 27(3)* ■ All pathways on coastal beaches shall be considered temporary in nature. No fill, bitumen or concrete shall be allowed in the construction of a pathway.	■ Construction plans and specifications
	■ Stairs built of stone or concrete on coastal beaches (usually on beach berms) have the same adverse effect as described above.	■ Only stairs of light wood construction should be allowed on coastal beaches. The stairs should be supported on wooden piles.	
	■ In the same manner, overly large boardwalks securely anchored to the coastal beach may modify the beach form and response to wave action, thereby adversely affecting its statutory value.	■ The use of boardwalks should be limited to the backshore of the coastal beach, landward of the mean high water mark except where the coastal beach is a tidal flat located in a low energy environment such as within an estuary. The boardwalks must be of wooden construction and supported on wooden piers. The boardwalk should be designed to be temporary in nature, such that it can be moved in response to beach changes. The required temporary nature will also insure that in the event of removal or damage by storm wave action, the structure does not remain an obstacle to beach processes.	

(Continued)

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of marine fisheries	■ Pathways and boardwalks constructed on the tidal flat portion of a coastal beach may create areas of stagnation if pathways are built using fill construction, or if boardwalks are supported on piers or pilings dense enough to alter circulation of water over the surface of the tidal flat.	*1. Best available measures to minimize adverse effects — Sec. 27(6)* ■ No pathway shall be constructed on fill; all pathways shall be constructed as boardwalks of light wooden construction supported on wooden pilings spaced no closer than twenty (20) times the diamter of the pilings. The superstructure of the boardwalk must be elevated so as to be no closer than one (1) foot above the highest spring tide expected.	■ Plans and specifications for the boardwalk.
	■ The construction process used to install boardwalks on the tidal flat portion of a coastal beach may adversely affect marine fisheries by changing water quality, particularly turbidity.	*2. Best available measure to minimize adverse effects — Sec. 27(6)(c)* ■ The construction of boardwalks allowed on the tidal flat portion of coastal beaches shall not disturb any portion of the flat except for the immediate area of the boardwalk. Construction of a boardwalk out onto a tidal flat shall be accomplished by working out from and upon completed sections of the boardwalk. No construction equipment shall be allowed to traverse the tidal flat directly, or upon emplaced fill for the purpose of constructing the boardwalk.	

BOARDWALKS, STAIRWAYS, PATHWAYS AND FOUR-WHEEL DRIVE TRAILS
Section 28 Coastal Dunes

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control.	■ Construction of excessively wide pathways on coastal dunes causes stabilizing dune grass to be removed, increasing the potential of destabilizing the coastal dune, or creating a "blow-out." ■ Boardwalks or stairways of substantial nature may interfere with the landward or lateral movement of a coastal dune. They may also interfere with the ability of waves to remove sand from the dune.	*1. Measures to meet performance standard of "no adverse effect" Sec. 28(3)* ■ Pathways on a coastal dune shall generally be no wider than four (4) feet. The coastal dune shall not be stabilized under the proposed pathway. ■ Boardwalks or stairways may be permitted provided that: ■ The stairway is no wider than four (4) feet and of wooden construction.	■ Construction plans and specifications, showing proposed location of the structure relative to the coastal dunes, coastal beaches, and land under the ocean, in the area.

Section 29 Barrier Beaches – See Coastal Beaches and Coastal Dunes

BOARDWALKS, STAIRWAYS, PATHWAYS AND FOUR-WHEEL DRIVE TRAILS

Section 30 Coastal Banks

A. Coastal Banks that supply sediment to coastal beaches, coastal dunes, or barrier beaches

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control.	■ Boardwalks and stairways constructed on eroding coastal banks may interfere with the supply of sediment to coastal beaches.	*1. Measures to meet performance standard of "no adverse effect" Sec. 30(4)* ■ The construction of any pathway, boardwalk or stairway on an eroding coastal bank shall be considered temporary in nature.	■ Detailed plans and specifications.

B. Coastal Banks that act as a vertical buffer to storm waters

Storm damage prevention and flood control	■ The use of four-wheel drive (4wd) vehicles and "dune buggies" on stable coastal banks that act as buffers to storm waters may disturb the vegetation or otherwise destabilize the coastal bank.	*1. Measures to meet performance standard of "no adverse effect" Sec. 30(6)* ■ Trails for 4WD vehicles or "dune buggies" upon coastal banks shall be designed and constructed so as to prevent erosion of any material from the coastal banks.	■ A detailed plan and construction specifications of the proposed coastal banks crossing area, showing, in particular, steps to be taken to insure against bank erosion or destabilization.

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Stairways, pathways or boardwalks on rocky intertidal shores are unlikely to have an adverse effect on the values of storm damage prevention and flood control.	*1. Best practical measures to minimize adverse effects — Sec. 31(3)* ■ None required for stairways, pathways or boardwalks.	
Protection of marine fisheries	■ Stairways, pathways or boardwalks on rocky intertidal shores are unlikely to have an adverse effect on marine fisheries by adversely affecting water circulation or water quality.	*1. Best available measures to meet Sec. 31(4)* ■ None required for stairways, pathways or boardwalks.	

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of marine fisheries	■ Pathways through salt marshes constructed on fill will destroy a portion of the marsh underlying the fill. Likewise, pathways at grade will result in loss of salt marsh vegetation by trampling. ■ Wide, low boardwalks constructed in salt marshes do not allow sunlight to reach the marsh plants, resulting in a loss of productivity of the salt marsh below the boardwalk. ■ Use of four wheel drive vehicles or "dune buggies" on salt marshes adversely affects marsh productivity by destroying vegetation, compacting the soil, and creating ruts which subsequently fill with water and do not allow for proper growth of salt marsh cordgrass. ■ The construction process used to install boardwalks on salt marshes may adversely affect the productivity of a salt marsh by compaction, or through changes in water quality, particularly turbidity, generated by the construction process.	*1. Measures to meet performance standard of "no adverse effects" Sec. 32(3)* ■ There are no measures which will make construction of pathways on fill or at-grade meet the performance standard of "no adverse effect." Therefore construction of pathways using fill, or at-grade, in salt marshes is not permitted. All pathways shall therefore be constructed as boardwalks. ■ Boardwalks within salt marshes shall be of wooden construction, supported on wooden pilings, spaced no closer than twenty (20) times the diameter of the piling. The superstructure of the boardwalk must be elevated so as to be no closer than one (1) foot above the highest spring tide expected. Boardwalks should be more than four (4) feet wide. ■ No vehicles should be permitted on the marsh except on pads or swamp mats. ■ Construction should be performed during the non-growing season of the marsh grasses. ■ There are no measures which will make use of 4WD or other vehicles in salt marshes meet the performance standard of "no adverse effect." Therefore, this activity or use is not permitted, and, if proposed, is to be denied. ■ The construction of boardwalks allowed within salt marshes shall not disturb any portion except for the immediate area of the boardwalk. Construction of a boardwalk out onto a salt marsh shall be accomplished by working out from and upon completed sections of the boardwalk. No vehicles should be permitted on the marsh except on pads or swamp mats. ■ Construction should be performed during the non-growing season of the marsh grasses.	■ Construction specifications.

(Continued)

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Pathways, boardwalks and four-wheel drive (4WD) vehicle trails destroy portions of the salt marsh, altering its resistance to erosion and ability to dissipate wave energy.	*1. Measures to meet performance standard of "no adverse effect" Sec. 32(3)* ■ Compliance with the conditions required for protection of marine fisheries, above, will insure protection of the storm damage prevention and flood control values of salt marshes.	
Prevention of pollution	■ Pathways, boardwalks, and four-wheel drive (4WD) vehicle trails destroy portions of the salt marsh, altering the ability of salt marsh plants and substrate to remove pollutants from surrounding waters.	*1. Measures to meet performance standard of "no adverse effect" Sec. 32(3)* ■ Compliance with the conditions required for protection of marine fisheries, above, will insure protection of the prevention of pollution value of salt marshes.	
Groundwater supply	■ Pathways, boardwalks and four-wheel drive (4WD) vehicle trails destroy portions of the salt marsh and underlying peat which serves as a barrier between fresh groundwater landward of the salt marsh and the ocean.	*1. Measures to meet performance standard of "no adverse effect" Sec. 32(3)* ■ Compliance with the conditions required for protection of marine fisheries, above, will insure protection of the fresh groundwater supply value of salt marshes.	

BOARDWALKS, STAIRWAYS, PATHWAYS AND FOUR-WHEEL DRIVE TRAILS
Section 34 Land Containing Shellfish

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of land containing shellfish and marine fisheries	■ Trails for four-wheel drive vehicles (4WD) or "dune buggies" on any Resource Area also classified as land containing shellfish may adversely affect such land or marine fisheries by a change in productivity caused by compaction of sediments.	*1. Measures to meet performance standard of "no adverse effect" Sec. 34(4)(c)* ■ In a DMF mapped shellfish bed, there are no measures which will make 4WD trails meet the "no adverse effect" standard; therefore, pathways are not permissable. ■ In a non-DMF mapped shellfish bed, such pathways may be permitted under the following conditions: ■ that the shellfish in the area in which use of these vehicles is desired be relocated in a manner and to a location suitable and approved by DMF and the shellfish constable.	■ A plan of the proposed area in which use of 4WD vehicles or "dune buggies" is proposed. ■ Proposed location of relocated shellfish and evidence of DMF and shellfish constable approval.
	■ Pathways constructed on fill on any Resource Area also classified as land containing shellfish adversely affect the productivity of such areas by altering water circulation, causing stagnation. Fill also alters the relief and elevation of a shellfish bed. Boardwalks supported by use of numerous piers or pilings may alter circulation of water over the surface of land containing shellfish.	*2. Measures to meet performance standard of "no adverse effect" Sec. 34(4)(a)(b)* ■ In either a DMF or non-DMF mapped shellfish bed, there are no measures which will make the use of fill to construct pathways meet the "no adverse effect" standard. All pathways through mapped shellfish beds shall be of boardwalk type construction provided that: ■ the boardwalk is of wooden construction, supported on wooden piles and no wider than four (4) feet. ■ the spacing of the support piles shall be no closer than twenty (20) times the diameter of the piling. ■ the superstructure of the boardwalk must be elevated so as to be no closer than one (1) foot above the highest spring tide expected.	■ Plans and specifications for the proposed boardwalk

(Continued)

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
	■ The construction process used to install boardwalks in Resource Areas also classified as land containing shellfish may adversely affect the productivity of such areas by changing water quality, particularly turbidity.	*3. Measures to meet performance standard of "no adverse effect" Sec. 34(4)(f)* ■ The construction of boardwalks allowed upon Resource Areas classified as land containing shellfish shall not disturb any portion of such land except for the immediate area of the boardwalk. Construction of a boardwalk out onto or over land containing shellfish shall be accomplished by working out from and upon completed sections of the boardwalks. No construction equipment is allowed to traverse land containing shellfish directly or upon emplaced fill, for the purpose of constructing the boardwalk.	■ An outline of detailed construction procedures proposed to be used for the installation of the boardwalk.

PIERS, DOCKS, WHARVES, FLOATS, PILES and DOLPHINS

Definition

Piers are structures extending out from shore to the water to serve as a landing place or as a recreational facility in itself.

Floats are buoyant structures, anchored or free floating, that serve as a place where vessels may discharge or receive passengers.

Wharves are like piers, but usually connote a structure of substantial size, and are generally fixed in that they do not rise and fall with the tide.

Piles are long heavy timbers or sections of concrete or metal driven or jetted into the earth to serve as a support for a coastal facility such as a pier or wharf, or for support of roadways or pipelines crossing coastal wetlands.

Sheet Piles are pilings having a generally flat cross-section, which when interlocked with each other, form a continuous wall or support that are used for a variety of coastal structures.

A dolphin is a cluster of piles, generally of timber or concrete lashed or otherwise bonded together, which serve as protection to shoreline features from the effects of ice or from errant water vessels. Dolphins are also used to secure vessels as an anchorage.

Illustration 45: Commercial activity atop wharf built on piers

Illustration 44: Pier on piles with adjacent floating pier

Activity Acceptability Table

This table indicates in which Resource Areas piers, docks, wharves, floats, piles, and dolphins are or are not likely to be able to be conditioned to meet the performance standards set forth in the Regulations.

Resource Area	Acceptability
Land Under the Ocean Section 25	likely to be conditioned.
Designated Port Areas Section 26	likely to be conditioned.
Coastal Beaches Section 27	likely to be conditioned.
Coastal Dunes Section 28	unlikely to be proposed.
Barrier Beaches Section 29	likely to be conditioned.
Coastal Banks Section 30	likely to be conditioned.
Rocky Intertidal Shores Section 31	likely to be conditioned.
Salt Marshes Section 32	likely to be conditioned.
Land Under Salt Ponds Section 33	likely to be conditioned.
Land Containing Shellfish Section 34	likely to be conditioned.
Fish Runs Section 35	likely to be conditioned.

PIERS, DOCKS, WHARVES, FLOATS, PILES AND DOLPHINS
Section 25 Land Under the Ocean

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Piers, docks, wharves, floats, piles, and dolphins may interrupt sediment movement by acting as a barrier to the sediment movement or by interfering with waves which are the driving force for sediment movement. The effect may be to deepen the nearshore land under the ocean which may increase the height of waves impacting the shore and/or interrupt the natural sediment replenishment of coastal beaches.	*1. Measures to meet performance standard of "no adverse effect" Sec. 25(5)* ■ Piers, etc. should be designed with piles adequately spaced and sized so as to allow most wave energy to pass through them.	■ Calculations of existing wave energy and the wave energy that will be expected through the project area should be required for projects where the volume of all pilings below mean high water added together is greater than 5% of the total water volume beneath the pier during mean high water.
Protection of marine fisheries		*1. Best available measures to meet performance of Sec. 25(6)*	
	■ Piers, etc. eliminate a corresponding area of substrate as habitat for benthic organisms.	■ Pier construction should avoid eel grass beds.	■ Mapping of eel grass beds.
	■ Short term negative impacts produced by the construction of piers, etc. result in turbidity and siltation.	■ When turbidity from construction is anticipated to be a problem (e.g., working on fine grain bottoms), construction techniques which produce the least turbidity, or use of siltation curtains or both must be employed.	■ Sediment grain size analysis for "large" projects.
	■ Wood preservative treatments may leach into the surrounding water, resulting in a degradation of water quality.	■ Non-leaching wood preservatives must be used for any wooden portion of the structure below mean high water.	■ Identification of wood preservatives used in construction materials, if any.
	■ Piers, etc. may create areas of stagnation by interfering with the circulation of tidal waters.	■ Piers, etc. should be designed with piles adequately spaced and sized so as to allow water to pass relatively unimpeded through them.	■ Description of water currents in the vicinity of the proposed project.

PIERS, DOCKS, WHARVES, FLOATS, PILES AND DOLPHINS
Section 26 Designated Port Areas

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control.	■ Piers, piles, etc., are unlikely to have an adverse effect on storm damage prevention in designated port areas.	■ No conditions are necessary.	
Protection of marine fisheries		*1. Best practical measures to meet Section 26(3)*	
	■ Piers, piles, etc., which are too close together may alter water circulation and cause areas of stagnation, thereby adversely affecting water quality.	■ Space piles as far apart as practical for the structure being built, in no case less than 10 feet apart.	■ Description of pile installation procedures.
	■ Installation of piles, piers, etc., may cause turbidity and sedimentation during the construction process.	■ Construction shall be completed as quickly as possible to minimize the amount of turbidity and sedimentation.	

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Minimize the Adverse Impacts	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control		*1. Measures to meet performance standards of "no adverse effect" Sec. 27(3)*	
	■ Piers, etc. may adversely affect the volume and form of downdrift coastal beaches by creating a barrier to longshore sediment movement, and by interfering with waves which are the driving force for longshore sediment movement.	■ Piers, etc. should be designed with piles adequately spaced and sized so as to allow longshore littoral drift to continue.	■ Calculations of existing wave energy and the wave energy that will be expected through the project area should be required for projects where the volume of all pilings below mean high water added together is greater than 5% of the total water volume beneath the pier during mean high water. ■ Map of eel grass beds.
Protection of marine fisheries		*1. Measures to meet performance standards of "best available effect" Sec. 27(6)*	
	■ Piers, etc. may create areas of stagnation by interfering with the circulation of tidal waters.	■ Piers, etc. should be designed with piles adequately spaced and sized so as to allow water to pass relatively unimpeded through them.	■ Description of water currents in the vicinity of the proposed project.
	■ Piers, etc. eliminate a corresponding area of substrate as habitat for benthic organisms.	■ Pier construction should avoid eel grass beds.	■ Map of eel grass beds.
	■ Short term negative impacts produced by the construction of piers, etc. result in turbidity and siltation.	■ When turbidity from construction is anticipated to be a problem (e.g., working on fine grain bottoms), construction techniques which produce the least turbidity, or use of siltation curtains or both must be employed.	
	■ Wood preservative treatments may leach into the surrounding water resulting in a degradation of water quality.	■ Non-leaching wood preservatives must be used for wood construction materials.	■ Identification of wood preservatives used in construction materials, if any.

PIERS, DOCKS, WHARVES, FLOATS, PILES AND DOLPHINS
Section 30 Coastal Banks
A. Coastal Banks that supply sediment to coastal beaches, coastal dunes, or barrier beaches.

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
		1. Measures to meet performance standard of "no adverse effect" Sec. 30(3)	
Storm damage prevention and flood control.	■ Piers, piles, etc., with bank stabilization structures as part of the design to prevent them from being undermined interfere with sediment supply to coastal beaches.	■ The construction of any pier, pile, etc., on an eroding coastal bank shall be considered temporary in nature. No bank stabilization structure shall be allowed — See Sec. 30(5).	■ Detailed plans and construction specifications

B. Coastal Banks that act as a vertical buffer to storm waters

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ The construction process may disturb vegetative cover or otherwise destabilize the bank.	*1. Measures to meet performance standard of "no adverse effect" Sec. 30(6)*	
		■ Use erosion control measures such as vegetation so that no erosion occurs.	■ Detailed erosion control plans.

PIERS, DOCKS, WHARVES, FLOATS, PILES AND DOLPHINS
Section 31 Rocky Intertidal Shores

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Minimize the Adverse Impacts	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of marine fisheries		*1. Measures to meet performance standards of "best available measures" Sec. 31(4)*	
	■ Piers, etc., may create areas of stagnation by interfering with the circulation of tidal waters.	■ Piers, etc., should be designed with piles adequately spaced and sized so as to allow water to pass relatively unimpeded through them.	■ Description of water currents in the vicinity of the proposed project.
	■ Piers, etc., eliminate a corresponding area of substrate as habitat for benthic organisms.	■ Pier construction should avoid eel grass beds.	■ Map of eel grass beds.
	■ Short term negative impacts produced by the construction of piers, etc., result in turbidity and siltation.	■ When turbidity from construction is anticipated (e.g., working on fine grain bottoms), construction techniques which produce the least turbidity, or use of siltation curtains or both must be employed.	
	■ Wood preservative treatments may leach into the surrounding water, resulting in a degradation of water quality.	■ Non-leaching wood preservatives must be used for wood construction materials.	■ Identification of wood preservatives used in construction materials if any.
Storm damage prevention and flood control.		*1. Best practical measures to meet Sec. 31(3)*	
	■ Piers and pilings are unlikely to have an adverse effect on the form and volume of exposed intertidal bedrock and boulders.	■ No conditions are necessary.	

PIERS, DOCKS, WHARVES, FLOATS, PILES AND DOLPHINS
Section 32 Salt Marshes
Section 33 Land Under Salt Ponds*

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of land containing shellfish and marine fisheries		*1. Best practical measures to meet Sec. 32(3)*	
	■ Piers, etc. in salt marshes do not allow sunlight to reach the marsh plants, resulting in a loss of productivity of the salt marsh below the structure.	■ Piers, etc. within salt marshes shall be of wooden construction, supported on wooden pilings, spaced no closer than twenty (20) times the diamter of the piling. The superstructure of the pier or wharf must be elevated so as to be no closer than one (1) foot above the highest spring tide expected. The superstructure must be designed so that no area beneath it is completely shielded from direct sunlight.	
	■ The construction process used to install the proposed facility on salt marshes may adversely affect the productivity of a salt marsh by compaction.	■ The construction of pilings allowed within salt marshes shall not disturb any portion except for the immediate area of the piling. Construction of a pier, etc., in a salt marsh shall be accomplished by working out from and upon completed sections. No construction equipment shall be allowed to traverse the salt marsh directly or upon emplaced fill for the purpose of constructing the facility.	■ An outline of detailed construction procedures proposed to be used for installation of the superstructure upon the pilings.
Storm damage prevention and flood control	■ Installation of pilings in a salt marsh may disturb the peat layers, making the marsh edges more vulnerable to wave attack.	*1. Measures to meet performance standard of "no adverse effect" Sec. 32(3)* ■ Compliance with the conditions required for protection of marine fisheries, above, will insure protection of the storm damage prevention and flood control values of salt marshes.	
Groundwater supply	■ The installation of piers, etc., may destroy portions of the salt marsh and underlying peat which serves as a barrier between fresh groundwater landward of the salt marsh, and the ocean.	*1. Measures to meet performance standard of "no adverse effect" Sec. 32(3)* ■ Compliance with the conditions required for proetction of marine fisheries, above, will insure protection of the groundwater supply value of salt marshes.	
Prevention of pollution	■ Installation of piers, etc., may destroy portions of the salt marsh, altering the ability of salt marsh plants and substrate to remove pollutants from surrounding waters.	*1. Measures to meet performance standard of "no adverse effect" Sec. 32(3)* ■ Compliance with the conditions required for protection of marine fisheries, avove, will insure protection of the prevention of pollution value of salt marshes.	

*Same as protection of marine fisheries chart on page 121.

PIERS, DOCKS, WHARVES, FLOATS, PILES AND DOLPHINS
Section 34 Land Containing Shellfish

Interests to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of marine fisheries		*1. Measures to meet performance standards of "no adverse effect" Sec. 34(4)*	
	■ Piers, etc., may create areas of stagnation by interfering with the water circulation	■ Piers, etc., should be designed with piles adequately spaced and sized so as to allow water to pass relatively unimpeded through them.	■ Description of water currents in the vicinity of the proposed project.
	■ Piers, etc. eliminate a corresponding area of substrate as habitat for benthic organisms.		
	■ Short term negative impacts produced by the construction of piers, etc., result in turbidity and siltation.	■ When turbidity from construction is anticipated (e.g., working on fine grain bottoms), construction techniques which produce the least turbidity, or use of siltation curtains or both must be employed.	
	■ Wood preservative treatments may leach into the surrounding water resulting in a degradation of water quality.	■ Non-leaching wood preservatives must be used for wood construction materials.	■ Identification of wood preservatives used in construction materials, if any.
	■ Sediments may be compacted and relief, elevation or grain size distribution altered during construction.	■ Mechanical pile driving should be required; construction machinery should not be permitted on land containing shellfish; construction to be done from floating barges.	

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of marine fisheries	■ Piers, etc., may impede or obstruct migration. ■ Piers, etc., may change rate of flow. ■ Wood preservatives on piles may leach into the surrounding water, thereby impairing spawning or nursery habitats. ■ The construction may cause short-term turbidity and siltation problems, thereby impairing spawning or nursery habitats or impeding migration.	*1. Measures to meet performance standard of "no adverse effect" Sec. 35(3)* ■ Piers, piles, etc., shall be designed so that there is no change in the rate of flow within the run. ■ Non-leaching preservatives shall be used on any wooden portion of the structure below mean high water. ■ When turbidity is anticipated to be a problem (e.g., when working on a fine grain or organic bottom), construction techniques which produce the least turbidity, use of siltation curtains, or both must be employed. ■ No construction shall be allowed between March 15 and June 15.	■ Rate of flow during migration season before and after project.

DAMS AND TIDAL GATES

Definition/Acceptability

Dams and Tidal Gates by definition are intended to obstruct the natural flow of water.

Dams are used to regulate the height or elevation of water in a creek, river, or stream. Impoundments may be created by the use of dams, such as on Cape Cod where streams are dammed to create impoundments for use in irrigating cranberry bogs.

Tidal Gates are devices used to protect upstream areas from high tidal levels caused by storm surges.

Activity Acceptability Table

This table indicates in which Resource Areas dams and tidal gates are or are not likely to be able to be conditioned to meet the performance standards set forth in the Regulations.

Resource Area	Acceptability
Land Under the Ocean Section 25	not likely to be acceptable — Sec. 24(2) requires that a project proposed in one Resource Area which will adversely effect another Resource Area must comply with the performance standard for each Resource Area. This means that the more restrictive performance standard shall apply. Therefore, although a dam or tidal gate is usually built on and may otherwise be permitted on land under the ocean, if the dam or tidal gate will adversely effect a coastal beach, a barrier beach, a salt marsh, land under a salt pond or land containing shellfish, it is not acceptable.
Designated Port Areas Section 26	unlikely to be proposed.
Coastal Beaches Section 27	not likely to be acceptable — a dam or tidal gate will interfere with sediment transport, thereby increasing erosion, decreasing the volume and changing the form of a coastal beach which is not permitted under Sec. 27(3).
Coastal Dunes Section 28	unlikely to be proposed.
Barrier Beaches Section 29	not likely to be acceptable — (see coastal beaches above)
Coastal Banks Section 30	unlikely to be proposed.
Rocky Intertidal Shores Section 31	unlikely to be proposed.

DAMS AND TIDAL GATES
Acceptability (Continued)

Resource Area	Acceptability
Salt Marshes Section 32	not likely to be acceptable — a dam or tidal gate will restrict flow and level of tidal waters and thereby, adversely affect the productivity of salt marshes which is not permitted under Sec. 32(3).
Land Under Salt Ponds Section 33	not likely to be acceptable — a dam or tidal gate will modify the flow of fresh and/or salt water and thereby may adversely affect the marine fisheries habitat of a salt pond which is not permitted under Sec. 33(3).
Land Containing Shellfish Section 34	not likely to be acceptable — a dam or tidal gate adversely effects the productivity of such land which is not permitted under Sec. 34(4).
Fish Runs Section 35	can be conditioned.

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of marine fisheries	■ These structures act as barriers to upstream migration of spawning adults. ■ These structures may be barriers to juvenile migration. ■ These structures can destroy spawning and nursery habitat. ■ Increase or decrease water volume and velocity in fish run and/or nursery and spawning area, thereby impeding spawning.	*1. Measures to meet performance standards of "no adverse effect" Sec. 35(3).* ■ Provide adequate passage facilities around or over dams or tidal gates. The applicant must obtain approval of DMF. ■ Adequate volume and rate of flow shall be maintained over or through the dam or tidal gates during the Spring to attract migrating fish into the fish runs. ■ Sufficient water over or through the dam or tidal gate shall be provided during the time of year the young fish migrate. ■ No nursery or spawning area shall be destroyed. ■ An adequate rate of water flow through nursery or spawning areas shall be maintained during the season when these areas are utilized by the fish.	■ Identification of the type of anadromous/catadromous fish involved and the time of year the adults and young migrate. ■ Calculate stream flow for the time of year the adults migrate. ■ Calculate the amount and rate of flow necessary to allow adult and young fish to go over or through the dam or tidal gate, and calculations and design showing how the required flows will be maintained. ■ Studies which clearly delineate nursery or spawning areas. ■ Calculations showing the rate of flow and/or the volume of water in nursery and spawning areas during the time of year these areas are utilized.

CULVERTS
Definition/Acceptability

A Culvert is a man-made structure to transmit or carry water. It may be closed (as under a road or bridge) or open (as a drainage ditch). This section is concerned only with closed culverts. Open culverts would involve dredging or removal, and are included in the sections dealing with those activities.

Activity Acceptability Table

This table indicates in which Resource Areas culverts are or are not likely to be able to be conditioned to meet the performance standards set forth in the Regulations.

Resource Area	Acceptability
Land Under the Ocean Section 25	culverts are included under point source discharges.
Designated Port Areas Section 26	
Coastal Beaches Section 27	
Coastal Dunes Section 28	
Barrier Beaches Section 29	
Coastal Banks Section 30	
Rocky Intertidal Shores Section 31	
Salt Marshes Section 32	
Land Under Salt Ponds Section 33	
Land Containing Shellfish Section 34	
Fish Runs Section 35	likely to be conditioned.

Interest to be Protected	Adverse Impacts to Interest	Conditions Required to Minimize the Adverse Impact	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of marine fisheries	■ Culverts can be barriers to the upstream migration of spawning adults because of the high rate of flow caused by these structures or because of elevated outlets.	*1. Measures to meet performance standard of "no adverse effect" Sec. 35(3)* ■ Culverts must be designed so that outlets are not elevated above the minimum stream flow that occurs between March 15 and May 31.	■ Identification of anadromous/catadromous fish which use the fish run and when they migrate.
		■ Culverts must be designed so that any scour inducing outflow velocities are eliminated.	■ Rate of stream flow before and after proposed project.
	■ Culverts can be barriers to the downstream emigration of adults or juveniles because of elevated inlets and/or low stream flow.	■ Offset or spoiler baffles must be considered, primarily in modifying existing culvert installations which block fish migration due to high velocities. A minimum baffle height of 0.30 meters or one (1) foot is recommended.	■ Scientific studies which clearly delineate spawning and nursery areas.
		■ The adequacy of baffles should be judged by checking: (1) jet veolcities and jet distances; (2) swimming capabilities of the fish species involved and (3) the effects of hydraulic efficiency reduction and headwater increase.	■ For modifying existing culverts, engineering plans must include consideration for spoiler or offset baffles.
		■ Culverts must be designed so that inlets are not elevated above the minimum stream flow that occurs between July 1 and October 1.	

SEPTIC SYSTEMS
Definition/Acceptability

Septic Systems include underground systems for the disposal of sanitary waste as defined in Title 5 of the State Environmental Code. The building of a septic system in or within 100 feet of any Resource Area comes under the jurisdiction of the Act.

Activity Acceptability Table

This table indicates in which Resource Areas septic systems are or are not likely to be able to be conditioned to meet the performance standards set forth in the Regulations.

Resource Area	Acceptability
Land Under the Ocean Section 25	unlikely to be proposed.
Designated Port Areas Section 26	unlikely to be proposed.
Coastal Beaches Section 27	not likely to be acceptable — the placement of a septic system requires that the contours of the site be stabilized. This would prevent the changes in beach form which occur on a seasonal basis in response to wave action, thereby altering the form and volume of a coastal beach which is not permitted under Sec. 27(3).
Coastal Dunes Section 28	not likely to be acceptable — the placement of a septic system requires the site to be stabilized. This would interfere with the landward or lateral movement of the dune, which is not permitted under Sec. 28(3).
Barrier Beaches Section 29	not likely to be acceptable — see coastal beaches and coastal dunes.
Coastal Banks Section 30	likely to be conditioned — subject to the provisions of Sec. 30(5) and of Title 5.
Rocky Intertidal Shores Section 31	unlikely to be proposed.
Salt Marshes Section 32	not likely to be acceptable — Sec. 32(3) states that no portion of a salt marsh can be destroyed.
Land Under Salt Ponds Section 33	not likely to be acceptable — Sec. 33(3) prohibits fill in land under salt ponds, therefore no septic systems.
Land Containing Shellfish Section 34	unlikely to be proposed.
Fish Runs Section 35	unlikely to be proposed.

POINT DISCHARGES
Definition/Acceptability

Point Sources of Discharge are defined as any discernible, confined and discrete conveyance including, but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation or vessel or other floating craft from which pollutants are or may be discharged.

Point discharges are used for the elimination of wastes and other pollutants originating from various types of land uses. Most point discharges to surface waters are covered by an NPDES (National Pollutant Discharge Elimination System) Permit. In cases of new NPDES Permits the conservation commission shall incorporate the effluent limitations of the NPDES permit within the Order of Conditions (See Section 24(c).)

Concentrated storm water discharge, such as runoff from a large parking lot discharging to a surface water through a culvert system, is not covered by the NPDES permit. This type of discharge is defined as a point discharge. In this case, the issuing authority shall impose such additional conditions as required to protect the statutory values of Resource Areas to which stormwater discharge is directed.

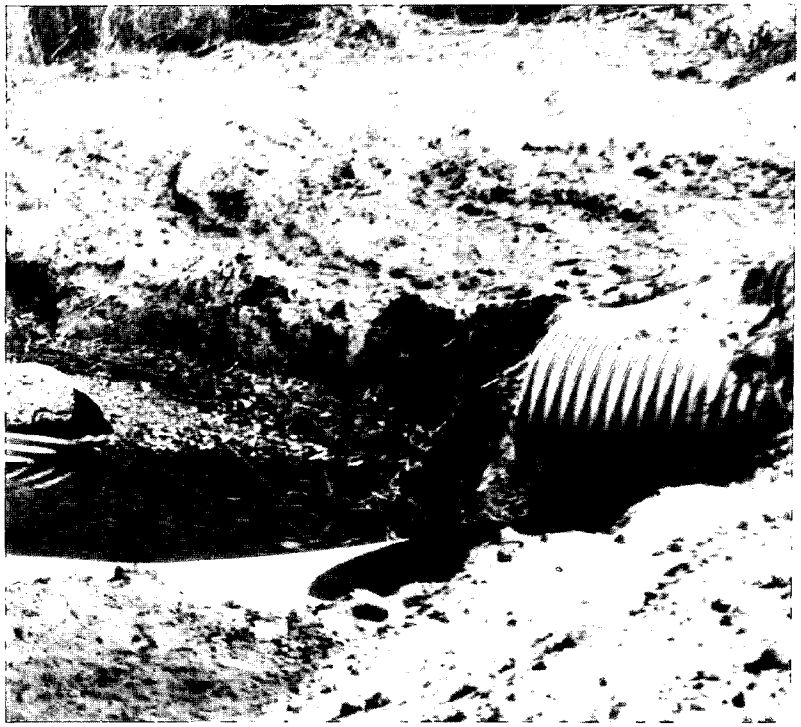


Illustration 46: Point source of discharge

Activity Acceptability Table

This table indicates in which Resource Areas point discharges are or are not likely to be able to be conditioned to meet the performance standards set forth in the Regulations.

Resource Area	Acceptability
Land Under the Ocean Section 25	likely to be conditioned.
Designated Port Areas Section 26	likely to be conditioned.
Coastal Beaches Section 27	likely to be conditioned.
Coastal Dunes Section 28	likely to be conditioned.
Barrier Beaches Section 29	likely to be conditioned.
Coastal Banks Section 30	likely to be conditioned.
Rocky Intertidal Shores Section 31	likely to be conditioned.
Salt Marshes Section 32	likely to be conditioned.
Land Under Salt Ponds Section 33	likely to be conditioned.
Land Containing Shellfish Section 34	not likely to be acceptable — point source discharges from roads or parking lots contain pollutants which will adversely affect water quality, which is not permitted under Sec. 34(4).
Fish Runs Section 35	likely to be conditioned.

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of marine fisheries	*1. Sec. 25(6)* ■ Runoff from roads and parking lots or other paved surfaces contains pollutants such as oil, grease, heavy metals and particulate matter, thereby adversely affecting water quality.	*1. Best available measures to meet Sec. 25(6).* ■ Sedimentation or catch basins as appropriate to the amount of runoff. ■ Gas traps. ■ Periodic maintenance and cleaning of the basins and traps. ■ Periodic cleaning of debris from paved surfaces. ■	■ Maximum rate of runoff. ■ Detailed plans showing size and location of sedimentation or catch basins and gas traps. ■ Schedule for maintenance and cleaning.
Storm damage prevention and flood control	■ Headwall and support may interrupt sediment transport.	■ Headwall and supports must be spaced so that sediment transport is not interrupted.	

POINT DISCHARGES
Section 27 Coastal Beaches and Section 29 Barrier Beaches

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	*1. Sec. 27(3)* ■ Outflow can cause erosion and change the form and volume of a beach. ■ Headwall and support may interrupt sediment transport.	*1. Measures to meet performance standard of "no adverse effect" Sec. 27(3)* ■ The velocity of the outflow shall not cause scouring of the beach. ■ Headwall and supports must be spaced so that sediment transport is not interrupted.	■ Amount of runoff. ■ Angle of outfall pipe in relation to beach and calculation to determine design discharge velocity. ■ Design of energy diffusion techniques.
Protection of marine fisheries	■ Runoff from roads and parking lots or other paved surfaces contains pollutants such as oil, grease, heavy metals and particulate matter, thereby adversely affecting water quality.	*1. Best available measures to meet Sec. 27(6)* ■ Catch basins. ■ Gas traps. ■ Periodic maintenance and cleaning of the basins and traps. ■ Periodic cleaning of debris from paved surfaces.	■ Detailed plans showing size and location of catch basins and gas traps. ■ Schedule for maintenance and cleaning.

POINT DISCHARGES
Section 28 Coastal Dunes and Section 29 Barrier Beaches

Interest to be Protected	Adverse Effects to Interest	Conditions Imposed to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ Discharges may disturb vegetative cover. ■ Point discharges may cause erosion and thereby modify dune form by causing removal of sand from the dune artifically.	*1. Measures to meet performance standard of "no adverse effect" Sec. 28(3)* ■ The velocity of the outflow shall not cause scouring or disturb vegetation.	■ Maximum rate of runoff. ■ Calculations to determine design discharge rate. ■ Design of energy diffuser.

Section 30 Coastal Bank

Interest to be Protected	Adverse Effects to Interest	Conditions Imposed to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Storm damage prevention and flood control	■ The outflow may cause erosion and disturb vegetation, thereby destabilizing the bank and increasing its erosion rate artificially and the potential for bank collapse.	*1. Measures to meet performance standard of "no adverse effect" Sec. 28(3)* ■ The velocity of the outflow shall not cause scouring or disturb vegetation.	■ Maximum rate of runoff. ■ Calculations to determine design discharge rate. ■ Design of energy diffuser.

Interest to be Protected	Adverse Effects to Interest	Conditions Required to Meet Performance Standards	Information Required to Develop the Actual Details to be Incorporated into an Order of Conditions
Protection of marine fisheries	■ Runoff from roads and parking lots or other paved surfaces contains pollutants such as oil, grease, heavy metals and particulate matter, thereby adversely affecting water quality. ■ The outflow may remove vegetation by scouring the upper layers of the substrate.	*1. Measures to meet performance standard of "no adverse effect" Sec. 32(3).* ■ Catch basins. ■ Gas traps. ■ Periodic maintenance and cleaning of the basins and traps. ■ Periodic cleaning of debris from paved surfaces. ■ The velocity of the outflow shall not cause scouring of the substrate.	■ Maximum rate of outflow from the pipe. ■ Detailed plans showing size and location of catch basins and gas traps. ■ Maintenance and cleaning schedules. ■ Angle of outfall pipe in relation to salt marsh and calculations to determine design discharge velocity. ■ Design of energy diffusion technique.

CHAPTER 3

Discussion of Regulation Section 24

DISCUSSION OF REGULATION SECTION 24

General Provisions for Part II

The purpose of this chapter is to elaborate on several of the provisions in Section 24.

Section 24(1) states: *If the issuing authority determines that a resource area is significant to an interest of the Act for which no presumption is stated in the Preamble to the applicable section, the issuing authority shall impose such conditions as are necessary to contribute to the protection of such interest.*

In most cases, a Resource area will be significant only to those interests specified in the Preamble. However, there may be instances when a Resource Area is significant to an interest not specified. In such cases, the applicant must locate and design the proposed project to protect the interest, and the conservation commission must impose conditions it feels are necessary to protect the interest.

For example, although a coastal dune is likely to be significant to storm damage prevention and flood control, there may be instances where a coastal dune is significant to groundwater supply. The groundwater supply must be protected by both the applicant and the conservation commission.

Section 24(2) states: *When the issuing authority determines that a project in one resource area would adversely affect another resource area, the issuing authority shall impose such conditions as will protect the interests to which each resource area is significant to the same degree as required in the regulations concerning each resource area.*

This provision is best illustrated by an example: Fill may be allowed on coastal banks under certain conditions. When the coastal bank is one which supplies sediment to an adjacent coastal beach, it is likely that the fill dumped on the coastal bank will eventually end up on the coastal beach. The issuing authority may reasonably determine that if the fill is not of a grain size and distribution compatible with the coastal beach, it would adversely affect the coastal beach and not meet the performance standards set forth for the coastal beach.

Therefore, the work involving the fill must meet the performance standards for both the coastal bank and the coastal beach. It should be noted that the issuing authority should not utilize this provision on the basis of mere speculation of adverse effects to the other Resource Areas (in the example, the coastal beach), but only when it is clear that an adverse effect will occur.

Section 24(3) states: *A determination which finds that a resource area is not significant to an interest to which it is presumed in these regulations to be significant, or is significant to an interest to which it is presumed to be not significant, shall be made on Form 7. No such determination shall be effective unless a copy of this form and the accompanying written explanation for the determination required by these regulations is sent on the day of issuance to the appropriate regional office of the Department.*

The presumptions of significance or non-significance which are contained in each Preamble state to which of the seven interests protected by the Act the particular Resource Area is likely to be significant or not significant, nearly all of the time. This means that the conservation commission should expect to make a finding that, if a particular site is, in fact, in one of the eleven Resource Areas, it is in an area which is significant or not significant, in accordance with the presumptions.

The purpose of Section 24(3) is to insure that these presumptions of significance are not overcome by the conservation commission without serious consideration and documentation and only after the public hearing. (Form 7 can be filled out only after the public hearing has been held.)

The Department will closely examine each case in which a presumption of significance is overcome. The conservation commission has the burden of proof if it makes a finding that contradicts a presumption of significance or non-significance.

Section 24(4) (a) — *no comment necessary.*

Section 24(4) (b) states: *When the site of a proposed project is subject to a Restriction Order which has been duly recorded under the provisions of G.L.C. 130, s. 105, such a project shall conform to these regulations.*

The owner of the property will, in most cases, know whether or not the proposed site is subject to a Restriction Order recorded under G.L. Chapter 30, section 105, the Coastal Wetlands Restrictions Act. If the owner does not know, the conservation commission may know or the information can be obtained from:
Director, Wetlands Restriction Program
Department of Environmental Management
100 Cambridge Street
Boston, Massachusetts 02202
(617) 727-8893

Even if a proposed project is allowed under the Restriction Order, it must still conform to the performance standards of these Regulations and must follow all the regular filing procedures.

Section 24(4) (c) states: *If an NPDES permit for any new point-source discharge has or will be obtained prior to the commencement of the discharge, the effluent limitations established in such permit shall be deemed to satisfy the water quality standards established in any section of these regulations relative to the effects of the new point-source discharge on water quality. Such effluent limitations shall be incorporated or shall be deemed to be incorporated into the Order of Conditions.*

The federal Clean Water Act established a program known as the National Pollutant Discharge Elimination System (NPDES) under which point source discharges (i.e., anything which comes out of the end of a channel or pipe) are regulated through the granting of permits. In Massachusetts, the NPDES permit system is administered jointly by the Massachusetts Division of Water Pollution Control and the U.S. Environmental Protection Agency.

The intent of Section 24(4)(c) is to eliminate duplicate reviews, and the pontential for contradictory or inconsistent requirements being placed on an applicant and to simplify for conservation commissions what is often a difficult and complex technical matter. Therefore, according to Section 24(4)(c), when a proposed project requires an NPDES permit, the terms of the permit are deemed to be a part of the Order of Conditions. For the sake of clarity, the terms should be spelled out in the Order or the Order should state that when an NPDES permit is granted, it will become a part of the Order. Neither the conservation commission or the Department may impose either a more stringent or a less stringent condition with respect to water quality on the point source discharge.

Further information on the NPDES permit system may be obtained from the Massachusetts Division of Water Pollution Control or the U.S. Environmental Protection Agency.

Section 24(5) (a) states: *When any area subject to these regulations has been designated an Area of Critical Environmental Concern by the Secretary of Environmental Affairs pursuant to G.L. c.21A and CZM Regulations, and when the Secretary has made a finding of the significance of the area to one or more interests of the Act, the issuing authority shall presume that such area is significant to those interests.*

Section 25(5) (b) states: *When any portion of a designated Area of Critical Environmental Concern is determined by the issuing authority to be significant to any of the interests of the Act, any proposed project in or impacting that portion of the Area of Critical Environmental Concern shall have no adverse effect upon those interests, except as provided under Regulation 25(4) for maintenance dredging.*

DISCUSSION OF REGULATION SECTION 24

Information concerning the location of Coastal Areas of Critical Environmental Concern may be obtained from:

Director, Coastal Zone Management Program
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, Massachusetts 02202
(617) 727-9530

When a proposed project is in or near an Area of Critical Environmental Concern which is also significant to the interests of the Wetlands Protection Act, the project shall have "no adverse impact" on the interests in that area. In several Resource Areas, the performance standard is already "no adverse effect," so this provision requires no additional conditions. When the performance standard is less than "no adverse effect," (i.e., "best available measures" or "best practical measures" are required), the applicant should design and the conservation commission should condition the project so that it has "no adverse effect" to the interests in the Area of Critical Environmental Concern. Assistance may be obtained from the appropriate DEQE regional office.

Section 24(6) — *No comment necessary.*

Section 24(7)(a) — This provision applies only to the construction, reconstruction, operation, and maintenance of structures associated with electric generating facilities. Since there are likely to be relatively few projects which come under this provision, no detailed discussion is provided in this Guide.

The conservation commission should work closely with the applicant and other reviewing government agencies to insure the specific requirements of this provision are met.

Section 24(7)(b) — This provision applies only to the construction, reconstruction, operation and maintenance of underground and overhead electrical distribution or transmission lines, and communication, sewer or natural gas lines.

Since there are likely to be relatively few projects which come under this provision, no detailed discussion is provided in this Guide. The conservation commission should work closely with the applicant and other reviewing government agencies to insure the specific requirements of this provision are met.

APPENDICES AND GLOSSARY

APPENDIX A
General Overviews of Physical and Biological Processes in Coastal Wetlands

A broad view of the Massachusetts coast reveals a zone which consists of a variety of interrelated and interdependent coastal wetland features. These features, and the coastal physical and biological processes which created and maintain them are valuable for flood control, storm damage prevention, protection of marine fisheries, protection of land containing shellfish, prevention of pollution and groundwater supply. The purpose of this section is to generally describe the dynamic forces which shape coastal wetlands and land forms and allow them to provide the public benefits noted above.

Overview - Physical Coastal Processes

The Wetlands Protection Act (the Act) protects certain coastal landforms (Land Under the Ocean, Coastal Beaches, Coastal Dunes, Barrier Beaches, Rocky Intertidal Shores, and Coastal Banks) because they play a role in storm damage prevention and flood control. The Act and the Regulations seek to protect these landforms from adverse effects which may be caused directly by filling, dredging or removal, or indirectly by altering the processes which create and maintain them (i.e., the coastal interaction of sediments with wind, waves, and water currents, and a rising sea level).

The location of the shoreline varies with "relative" sea level — that is, the mean level of the sea with respect to the level of land. For the past thousands of years, relative sea level has been rising in Massachusetts, and it is still rising at a rate of about one foot per century. As sea level rises, the shoreline moves landward, or retreats, and along with it the entire complex of coastal wetland features gradually moves landward. As a result the beaches, banks, dunes and barrier beaches are generally retreating, some at an average rate of several feet or more per year.

In addition, coastal wetlands are continually changing their form in response to the forces exerted on them by waves, currents and wind. These changes in form always result in a closer balance between the coastal features and the forces which control them. The waves, currents and winds vary widely with both the regular fluctuations caused by seasonal and astronomical patterns and with such irregular changes as violent storms.

The relentless rise of sea level and the consequent landward movement of coastal features, and the constant interaction between the land and the sea means that coastal features are in constant movement. It is the process of formation and reformation of coastal features which protects the land from the forces of the sea.

The coast's first line of defense against wave energy is the shoaling nearshore bottom of land under the ocean. Waves are altered in form and direction as they travel shoreward, and the larger waves are forced to break offshore, diminishing their stored energy. Thus, during storms, the bottom topography reduces the size and energy of waves which might otherwise damage shoreline property and structures such as piers, wharves and houses.

The coast's second major line of defense against wave produced storm damage is provided by coastal beaches. Beaches are deposits of sediment built by wave action into a form which, under ordinary conditions, dissipates all of the incoming wave energy. Waves lose energy by breaking on the steep beach "foreshore" and by percolating down into the loose beach sediment. Sediment is moved both on and offshore and alongshore by wave action; it is thereby supplied to other coastal landforms — such as coastal dunes, land under the ocean, and other coastal beaches. Even during those rare instances (usually occuring at high tide during storms with onshore winds) when waves cross the beach, flood low inland areas, and cut into banks and dunes, most of the wave energy is dissipated by the beach before the waves reach inland features.

Most of the sediment which makes up the coastal beaches (as well as coastal dunes and barrier beaches) of Massachusetts

is supplied by the erosion of unconsolidated coastal banks. These banks, consisting mostly of loose sediment, are found on the landward side of some coastal beaches. When storm waves cross the coastal beach they are able to cut into the banks, causing the banks to erode. Sediment eroded from the banks or cliffs is transferred to the adjacent beaches. Banks are cut back by wave action until a beach is wide enough to prevent waves from reaching the bank, thus protecting the banks from further erosion. Cape Cod provides an example of the importance of coastal banks to coastal beaches: If coastal banks on the east coast of Cape Cod were eliminated as a source of sediment, beaches could disappear completely in less than 100 years.

The erosion of coastal banks by wave action is extremely important to the preservation of coastal landforms since coastal banks are the primary source of sediment required to replenish that removed by natural coastal processes. However, coastal banks which rise above storm wave and coastal flood levels are also significant to storm damage prevention and flood control because they are a barrier to storm waves and floods. Therefore, bank erosion caused by wind and rain runoff which causes banks to collapse must be minimized in order to protect upland areas. This is a second type of coastal bank and it plays only a minor role in beach nourishment. Bank vegetation tends to stabilize the bank face and reduce this type of erosion.

The sediment supplied by bank erosion is moved along the shore by wave action. This movement is called littoral drift. In turn, coastal dunes are built and maintained by onshore winds and occasional stormwave "overwash" which carry sand from the coastal beaches landward and deposit it in those areas sufficiently removed from wave action that coastal vegetation is able to survive and trap the wind transported sand.

On those occasions when sea and beach conditions permit waves to cross the coastal beach, the coastal dunes, because of their elevation and form, act as a barrier which protects inland coastal features and man-made structures behind them from wave action and flooding. At times, storm waves cut the face of coastal dunes and add this sediment to the volume of the coastal beach, thereby furthering the dissipation of wave energy. Coastal dunes are vital to storm damage prevention and flood control because they both protect inland coastal features and add sediment to coastal beach volume.

At numerous locations along the Massachusetts coast, coastal beaches and coastal dunes together form long narrow coastal features known as barrier beaches, which lie between the open sea and such wetlands as estuaries, salt marshes and salt ponds. Barrier beaches protect the inner wetlands from vigorous wave action, and thereby provide both safe harbors for boats and productive habitats for marine plants and animals. The coastal beaches and coastal dunes of barrier beaches consist of sediment transported to them by wave and wind action and supplied by coastal bank erosion. Barrier beaches build along their inner landward edges by the landward movement of coastal dunes, by sand carried across their width by storm overwash and by the deposits formed by tidal inlets. It is because of these processes that barrier beaches tend to migrate landward — that is, to maintain their general form despite a retreating outer shoreline.

As the seaward portion of a barrier beach erodes, the landward portion builds, so that the form and volume of the barrier beach are maintained. If the building processes on the landward side are interrupted while the erosion of the seaward portion continues, the barrier beach will gradually (or sometimes during only one violent storm) lose the typical shape, form and volume which protects inland areas from flooding and storm damage.

Overview - Biological Coastal Processes

The Wetlands Protection Act protects certain coastal areas (Land Under the Ocean, Coastal Beaches including Tidal Flats,

APPENDIX A
General Overviews of Physical and Biological Processes in Coastal Wetlands

Salt Marshes, Rocky Intertidal Shores, Land Under Salt Ponds and Anadromous/Catadromous Fish Runs) because they play a role in the protection of marine fisheries and land containing shellfish and the prevention of pollution. The Act and the Regulations seek to protect these biologically productive areas from adverse effects which may be caused directly by filling, dredging, or removal, or indirectly by alterations in water quality, the food chain and habitat.

The productive ecosystems in the coastal zone of Massachusetts support extensive populations of finfish and shellfish. The fundamental characteristics of coastal ecosystems — biological communities and coastal habitats — must therefore be maintained to protect the future productivity of these valuable finfish and shellfish resources.

"Community" refers to all the organisms found within a particular habitat, and includes all finfish and shellfish, as well as the organisms which make up the coastal food web.

The interaction of the marine community and marine habitats gives rise to the amount (weight) of fish and shellfish which are available. This interaction includes the following factors:

1. Import from outside the area being considered: migration of new fish stocks into the area.
2. Reproduction: the addition of new individuals to the community.
3. Growth: the increase in weight of the available fishery due to growth of existing animals.
4. Export to other areas: migration of fish away from an area.
5. Predation: the eating of fish by organisms other than man.
6. Fishing: the capture and removal of fish by man.
7. Mortality: death due to causes other than predation or fishing.

Export and import over the long term are probably not important factors if the environment remains the same, while growth and mortality may have significant effects on the number and weight of marine animals available to the fishery.

Of all the factors above, reproduction and the success of the young stages of organisms are perhaps the most vulnerable and therefore the most critical in assuring the future of coastal fisheries. The fisheries abundance depends initially on the successful development of the delicate early growth stages of marine animals and plants (much of which takes place in the plankton community). For this reason, maintaining the productivity of coastal food webs, as well as habitat characteristics such as water quality and sediment characteristics are essential to the continued productivity of the fisheries.

"Habitat" refers to the places, or physical settings, in which plants and animals live in all stages of their life. Because the amount and variety of marine life in a community depend upon the nature of the habitat, the physical and biological characteristics of the habitat must be maintained and protected. Fundamental habitat characteristics include sediment grain size, relief and elevation of the substrate, water circulation and water quality, each of which is discussed below:

1. Sediment characteristics, including grain size and sediment compaction are physical features of a habitat which influence the productivity of marine communities. Larval stages of many bottom dwelling marine animals, particularly invertebrates such as worms and clams, require specific grain sizes to permit successful "settlement," or sinking from the drifting stage, to establish themselves on or in the bottom sediments. The size of the sand grains control the ability of the sensitive young larva to dig into the protective bottom, and thereby controls the abundance of bottom dwelling marine animals. Grain size also influences the rate of exchange of interstitial water (water between the sediment grains) by restricting or permitting water flow. The quality of interstitial water, particularly such characteristics as dissolved chemical and gas concentrations, is directly affected by water exchange. The quality of the water trapped between sand grains controls the success of burrowing or surface-living invertebrates and thus affects the productivity

of habitats composed of unconsolidated sediments.

Compaction of sediments influences many of the same characteristics of marine habitats which are influenced by grain size. The greater the compaction, the more restricted the flow of water between sand grains and the greater the variation in water quality. Compaction affects the ability of larvae and adults to burrow into the sediment.

2. Elevation of the bottom affects the productivity in intertidal habitats where even minor variations in relief result in different periods of exposure to air by surface dwelling and burrowing marine animals. Since many marine organisms can tolerate only certain limits of exposure, this can control the distribution and abundance of adults and young stages of animals and plants, which cannot survive when their limits are exceeded.

3. Water circulation is essential to the continued productivity of the various habitats and communities which make up the biologically productive coastal wetlands. It transports nutrients from their source (such as salt marshes) to the habitats where finfish and shellfish breed and live. It moves shellfish from spawning to nursery areas. By continually mixing waters and preventing areas of stagnation, it reduces extremes of turbidity, pollutants and salinity.

4. The quality of waters which flow over or through marine habitats controls the communities which live in them by affecting fundamental life processes. Water quality is defined by such factors as the amount of dissolved oxygen, pollutants, turbidity, temperature, salinity and nutrients.

a. Oxygen concentration in water is a function of (1) exchange of oxygen from the atmosphere, (2) the production of oxygen by plants, and (3) the consumption of oxygen by plants and animals. Oxygen is required by all higher forms of life including marine vertebrates and invertebrates. The concentration of oxygen required to support life varies, depending upon the kind of organism, its activity and the temperature of the environment. Generally, stagnant (non-circulating) conditions result in great fluctuations in oxygen concentration and stress on marine animal communities. This results in reduced productivity of marine resources.

b. Pollutants may be lethal or sublethal. They may cause direct mortality or result in subtle changes either in the species composition of communities or reproduction and behavior of species. Some nutrients or metals may be beneficial at certain concentrations and may be classified as pollutants when concentrations reach relatively high levels. Other pollutants, such as synthetic chemicals, can be extremely toxic even in very low concentrations. The circulation of marine waters flushes pollutants away from the source, limiting the concentration and reducing detrimental effects on the resources.

c. Turbidity influences marine habitats in two ways. First, it causes the elimination or reduction of light penetration. Since photosynthesis requires sunlight, a reduction of sunlight reduces the rate of this basic process on which the food web of the marine environment depends. Second, the solids suspended in water which cause turbidity have two effects generally classed as "siltation effects": (1) the settling out and smothering of bottom plants and animals resulting in a drastic change in the habitat and (2) the plugging or abrasion of respiratory and feeding mechanisms leading to changes in the numbers and kinds of organisms comprising the community. While the elimination of light penetration may be sublethal, siltation effects are often fatal to marine organisms and usually drastically change the productivity of marine resources.

d. Organisms respond to changes in temperature or their surroundings in various ways. Since most marine organisms cannot regulate their own temperature, the metabolism and growth of organisms are modified according to the surrounding temperature. Each type of marine animal or plant has its own upper and lower limits beyond which a temperature change will have detrimental effects. Some of these effects will be lethal, others sublethal, but nevertheless, abnormal. Direct mortality has obvious effects on coastal resources and on the communities on which such resources depend, while the more

subtle sublethal effects such as altered behavior, reproduction or physiology may also profoundly affect marine communities and the productivity of associated fisheries.

e. Marine organisms also have specified tolerance limits to salinity variation. The composition of the community and its living resources, and thus its productivity is controlled by the level of and changes in salinity of the waters flowing over the habitat.

f. Nutrients, which fertilize the plants of the coastal waters and start the cycles of energy flow through food webs, may, in unusually high concentrations, act to upset the natural balances on which marine communities and coastal resources depend. Marine plants have specific nutrient requirements and changes in the concentration of these nutrients will alter the composition and density of plant communities, thereby altering the rate of production of plant materials on which the fisheries ultimately depend.

APPENDIX B
Approximate Spawning Times for Anadromous/Catadromous Fish

Species and Time Period

Alewife, March-May
American eel , Autumn
American shad, May-June
Atlantic salmon, Spring and/or fall, depending upon the specific river
Atlantic sturgeon, May-June
Blueback herring, April-June
Brook trout, May-June (spawning occurs in the fall)
Rainbow smelt, February-April
Sea lamprey, April-June
Shortnose sturgeon, April-June
White perch, March-April

APPENDIX C
Sources of Maps and Aerial Photographs

Barnstable: Barnstable Marine Service, Inc., Barnstable Harbor Millway Marine, Inc., Barnstable Harbor

Beverly: Comdel, Inc., Beverly Airport

Boston: Berry Hardware Co., 395 Neponset Avenue, James Bliss Co., Inc., 82 Summer Street; Boxwell Marine Corporation, 68 Long Wharf; Broad Marine Supply Co., 102 Broad Street; Hub Nautical Supply Co., Inc., 127 Broad Street; Klausen-Gestby Company, 214 Northern Avenue; Marine Hardware & Supply Co., 390 Atlantic Avenue; Boston Harbor Sailing Club, Inc., East India Row; J. L. Hammett Company, 48 Canal Street

Braintree: Bra-Wey Sport Shop, Inc., 178 Quincy Ave., Rt. 53

Brant Rock: Bud's Inc. of Marshfield, Mass., 21 Dyke Road

Buzzards Bay: Bosnengo Hardware, Inc., 45-47 Main Street

Cambridge: Cambridge Camera & Marine, 37 Brattle Street

Canton: James Bliss & Co., Inc., Shawmut Road

Cataumet: Kingman Marine, Shipyard Lane

Chatham: Mayflower Shop, 475 Main Street; Old Harbor Marine Service, Inc., Crowell Road, R.R. 1 Stage Harbor Marine, Bridge Street

Chathamport: Ryders Cove Marine, Rt. 28, on Ryders Cove

Cohasset: Fieldbrook Boat Sales, Inc., 40 Border Street

Cotuit: Pecks' Boats, Falmouth Road

Dedham: James Bliss & Co., Inc., 100 Rt. 128 (Exit 61)

Dorchester: Norwood Marine, Inc., r 24 Ericsson St.; Freeport Engine Co., d/b/a The Dinghy Shop, 272 Adams St.

Dracut: Roussel Marine, Inc., 1543 Bridge St., Rt. 38

Duxbury: Duxbury Marina Corp., 31 Mattakeesett Ct.

East Dennis: Sesuit Marine Service, Inc., Sesuit Harbor

Edgartown: Robin Hood's Barn, Inc., Main Street, Edgartown Marine, Inc., Morse Street

Fall River: Capt. Joseph J. O'Connell Co., Inc., 180 River St.

Falmouth: Falmouth Marine Railways, Inc.; Falmouth Harbor Yacht Sales, Inc., 53 Falmouth Heights Rd.

Gloucester: Building Center Stores, 1 Harbor Loop; Brown's Yacht Yard, Inc., R 139, E. Main St.; Cape Ann Marina Corp., 75 Essex Avenue; Enos Marine Inc., 75 Essex Ave.; Parisi Plastic Fishing Gear, Inc., 27 Commercial St.; Gloucester Museum, Inc., 180-181 Main St.; Three Lanterns, 108 East Main St.

Green Harbor: Green Harbor Marina, Rt. 139

Hamilton: The Map Grotto, 31 Homestead Circle

Harwichport: Allen Harbor Marine Service, Inc., 335 Lower County Rd.; Portside Marine Inc., Rt. 28, Saquatucket Harbor

Hanover: Marine Stores, Inc., 1775 Washington Street

Hingham: Latady Instruments, Inc., 220 Prospect Street; Kehoe's Ship's Chandlery, 3 Otis Street

Hingham Harbor: Steve Mehl's Boat House, Route 3-A Rotary

Hyannis: Bradbury Marine, Inc., 157 Pleasant Street; Anchor Outboard Co., Inc., 135 South Street; Hyannis Marina, Inc., Arlington St.

Lawrence: Marine Publications, 130 Shepard St.

Lynn: Lynn Hardware Co., Inc., 34-38 Munroe St.

Manchester: Manchester Marine Corp., Ashland Avenue; Cartographics Corp., 50 Forest St., PO Box 88

Marblehead: Fred L. Woods, 76 Washington St.; Marblehead Transportation Company, Ferry Lane; Port of Call, Inc., 26 Atlantic Avenue

Marion: Barden's Boat Yard, Inc., 2 Island Wharf Road; Burr Bros. Boats, Inc., 309 Front Street

Nantucket: Hardy's Inc., 5 South Water Street; Nantucket Ship Chandlery Corp., Old SouthWharf

Natick: Natick Marine, Inc., 158E. Central St., Rt. 135

New Bedford: C. E. Beckman Co., 11-35 Commercial St.

Newbury: Parker River Marine, Inc., Rt. 1A at Parker River

Newburyport: Jack Hart's Marine Supply, Tournament Wharf; Hudson's Outboard, Inc., 38 Merrimac Street

North Quincy: Boston Harbor Marina, Inc., 542 E. Squantum Street

N. Weymouth: The New Tern Harbour Marina, Inc., 275 River St.; Bridge Marine Supply, 230 Bridge St.; Snug Harbor Marine Supply Co., Inc., 121 Bridge St.

APPENDIX C
Sources of Maps and Aerial Photographs

Oak Bluffs: Blue Anchor Marine, Harbor Bulkhead

Orleans: Goose Hummock Shop, Inc., Route 6A; Compass Rose Book Shop, Main Street.

Osterville: Crosby Yacht Yard, Inc., 72 Crosby Circle

Plymouth: Plymouth Marine Railways, Inc., 14 Union St.

Provincetown: Lands End Marine Supply Co., Inc., 337 Commercial St.; Marine Specialties, Inc., 235 Commercial St.

Revere: The Chart Locker, 555 North Shore Road

Rockport: Building Center, Inc., 18 Railroad Ave

Salem: Jaynes Marine Supplies, Inc., 77 Bridge St.

Sandwich: E. T. Moffitt Corp., Sandwich Cape Cod Canal; Marina, East Boat Basin

Scituate: Scituate Marine, 207 Front Street

South Dartmouth: The Packet, Inc., 250 Elm St.

Sudbury: Havencraft of New England, Inc., 83 Boston Post Rd.

Vineyard Haven: Martha's Vineyard Shipyard, Inc., Beach Rd.

Wareham: Warr's Marine, Inc., Lower Main St.

Wellfleet: Bay Sails Marine, Inc., Rt. 6

West Bridgewater: Tight Lines, Inc., 220 South Main St.

West Dennis: Bass River Marina, Inc., 140 Main St.

Westwood: Better Boating Association, 17 Country Lane

Weymouth: Monahan's Marine, 396 Washington St.

Winchester: Card Marine, Inc., 632 Main St.

Woburn: James Bliss and Co., Inc., 406 Washington St.

Woods Hole: Woods Hole Marine Railway & Supply Co., Inc., 89 Water St.

APPENDIX D
Selected References Annotated

American Society of Civil Engineers, *Proceedings of the Fifteenth Coastal Engineering Conference.* Vol. 1, 1976, pp. 1-1092. Volume 1, the first of four, contains numerous professional papers on the mechanics of waves and currents. Of particular interest are articles on wave set-up and run-up, wave behavior in the coastal zone and wind induced drift currents in the intertidal zone.

American Society of Civil Engineers, *Proceedings of the Fifteenth Coastal Engineering Conference.* Vol. II, 1976, pp. 1093-2205. The second volume deals with the human problems associated with coastal sediment movement as caused by waves and longshore currents. A number of papers examine sediment transport and formation of coastal features in selected areas and under a variety of conditions. Other articles discuss the implications to man's activities of continual natural sediment transport along the coastal zone. Measures to protect human interests such as harbors and channels are looked at, as well as the associated impacts of such measures. Of particular interest are chapters describing the effects of breakwaters, jetties, sediment bypass systems, beach nourishment, offshore structures, harbors, and marinas.

American Society of Civil Engineers, *Proceedings of the Fifteenth Coastal Engineering Conference.* Vol. III, 1976, pp. 2206-2914. Volume III examines coastal erosion prevention structures in detail with respect to type, design, applicability and effectiveness. Physical as well as vegetative strategies are discussed.

American Society of Civil Engineers, *Proceedings of the Fifteenth Coastal Engineering Conference.* Vol. IV, 1976, pp. 2915-3641. Volume IV, subtitled *Coastal, Estuarine, and Environmental Problems,* looks into environmental impacts in the coastal zone, other than those discussed in the first three volumes. Topics include pollutant discharge and distribution, natural energy damping and dissipation effects of tidal estuaries, and the effects of wave oscillations in harbors of variable dimension.

American Society of Civil Engineers, *Ports '77 — 4th Annual Symposium of the Waterway, Port, Coastal and Ocean Division of ASCE,* Vol. I, II, 1977. Both volumes contain papers pertaining to harbor and port planning, design, maintenance, traffic routing and environmental considerations. Articles discussing dredging processes, natural and man-made wave dissipation systems, and environmental assessment of ports and harbors proved particularly valuable.

American Society of Civil Engineers, *Proceedings of the 21st Annual Hydraulics Division Specialty Conference, Hydraulic Engineering and the Environment,* 1973. Though interest is given primarily to freshwater hydraulic relationships, articles pertaining to channel flow requirements for fish are important, particularly in considering structures placed in the coastal zone which may effect spawning activities of anadromous and catadromous fish species.

American Society of Civil Engineers, *Proceedings of the 25th Annual Hydraulics Division Specialty Conference, Hydraulics in the Coastal Zone.* 1977. The *Proceedings* contains papers discussing various natural and man-made aspects of hydraulic relationships in the coastal zone. Surface, as well as groundwater issues, are considered. Of particular interest are articles discussing wave minimization and diffraction techniques, and the use of removed material from maintenance dredging operations.

American Society of Civil Engineers, *Proceedings of the Specialty Conference on Dredging and Its Environmental Effects,* 1976. The *Proceedings* is an extensive collection of papers concerning the variety of environmental impacts associated with dredging and attendant disposal of dredge spoils.

American Society of Civil Engineers, *Fifth Symposium of the Waterway, Port, Coastal and Ocean Division of ASCE — Coastal Sediments '77.* Articles concerned with sediment movement, hydraulics, and man's attempts to influence coastal processes are examined through a variety of case studies and models. Of primary interest are articles discussing the use and effects of groins, jetties, beach filling and low cost stabilization techniques.

Clark, J., ed., *Barrier Islands and Beaches,* Technical Proceedings of the 1976 Barrier Islands Workshop, Annapolis, Maryland, May 1976. These proceedings outline the evolution and dynamics of barrier islands, spits and beaches, emphasizing their importance in the maintenance of coastal ecosystems. The report is extremely effective in illustrating the physical and vegetational dynamics of barrier beaches, showing how the two processes relate, and describing the vulnerability of barrier beach environments to man's impacts, particularly effects of "permanent developments."

APPENDIX D
Selected References Annotated

Clark, J. (ed.), *Coastal Ecosystem Management* A Wiley-Interscience Publication, 1977. This book analyzes coastal environments, identifies major conflicts (providing solutions), develops a complete management methodology (relating guidelines and standards), and provides extensive literature references and a "hard-data" appendix.

The Conservation Foundation, *Physical Management of Coastal Floodplains: Guidelines for Hazards and Ecosystems Management,* Task One Report, 1977. The Report describes nine general "places of concern" associated with coastal zones and evaluates responses of each to various cultural incursions and natural hazards. Impacts resulting from a cross section of human activities are considered for each of the nine coastal environment types described. The Report is a good general statement of the natural processes and the man/environment conflicts which typically occur in the coastal zone.

Davis, R. A., Jr. and Ethington, R.L., eds., *Beach Nearshore Sedimentation,* Pub. No. 24, Society of Economic Paleontologists and Mineralogists, 1976. One paper, "Wave Climate Models for the Continental Shelf: Critical Links Between Shelf Hydraulics and Shoreline Processes," stresses the importance of coastal bathymetry upon surface wave processes. Historical changes in shoreline configuration and in beach grain size variation along the eastern U.S. coastline are shown to be in large part, related to shoreline wave heights and wave energy which, as Munk and Traylor (1947) conclusively demonstrated are in turn related to variations in continental shelf bathymetry.

Davis, D. P., Jr., *Evaluation of Tying Materials for Floating Tire Breakwaters,* Marine Technical Report No. 54, April 1977, University of Rhode Island. The paper is the result of in-situ testing of twelve different tying materials for a floating tire breakwater located in Narragansett Bay, Rhode Island. The results of the testing indicated that rubber conveyer belt edging with nylon fasteners is superior to other materials tested.

Moul, E.T. *Marine Flora and Fauna of the Northeastern United States. Higher Plants of the Marine Fringe.* NOAA Technical Dept., NMFS Circular 384. 1973. This botanical reference provides an excellent means to identify plants of the coastal zone. Illustrations provide a useful means to "key out" the various species of plants.

Teal, J. and Teal, M. *Life and Death of the Salt Marsh* Little, Brown and Company, 1968. The easy-to-read style of this book offers a wealth of substantive information about the creation of salt marshes., their ecology and conservation.

U. S. Army Coastal Engineering Research Center, *Shore Protection Manual,* Vol. I, 1977. As first in a three volume series, Volume I qualitatively discusses the natural processes involved in beach dynamics and the effect of man and quantitatively describes wave motion and littoral processes such as transport and sedimentation. Particularly helpful in providing necessary background and detail on the mechanics of waves, currents, tides, winds and physical relationships of the littoral zone.

U. S. Army Coastal Engineering Research Center, *Shore Protection Manual,* Vol. II, 1977. Volume II is a thorough examination of structural measures used for the restoration or protection of beaches, particularly those which have been influenced by man's impacts. It is most useful in comparing the design and applicability of the numerous structural means which have historically been used in attempting to stabilize shorelines and inlets and to protect harbors and backshore areas.

U. S. Army Coastal Engineering Research Center, *Shore Protection Manual,* Vol. III, 1977. The third volume of the three part series contains the appendices and indices for the first two volumes. Included is a glossary, symbol listing and various tables and plates relating mostly to wave mechanics.

University of Rhode Island, Marine Publication Series No. 2. *Coastal and Offshore Environmental Inventory.* 1971. This report encompasses the geographic area corresponding roughly to the Middle Atlantic Bight, which includes the coastal and shelf areas between Nantucket Shoals to Cape Hatteras, North Carolina. A review of the state of knowledge of physical, chemical, and biographical oceanography within this region is provided.

Yasso, W. E. and Hartman, E. M., Jr., *Beach Forms and Coastal Processes,* New York Sea Grant Institute, April 1976. Provides insights into sedimentation and erosional processes along the heavily urbanized coast of New Jersey and Long Island. Describes the formation of natural coastal features, discusses man's impacts upon coastal processes and examines various shore protection and rejuvenation strategies. Most helpful in outlining effects of jetties and sand dredging and filling.

APPENDIX E
Other Legislation Applicable to Resource Areas

Applicants filing under the Wetlands Protection Act, M.G.L. Chapter 131, section 40, as amended, are cautioned that compliance with the Regulations under this Act, and the guidelines contained in this Guidebook does not relieve compliance with all other applicable federal, state or local statutes or by-laws.

Conservation Commissions should advise Applicants, or Applicants should otherwise be aware that many coastal communities have local zoning or non zoning bylaws that regulate or prohibit alterations of wetland areas within their towns, and that provision must be met to comply at the local level prior to expenditure of planning and engineering funds to comply with state or federal requirements that might be less stringent. An Applicant should familiarize him or herself with *all* applicable legislation and formulate a project in a coastal environment that responds to all technical requirements of planning and design.

Examples of such state law which *may* be applicable are the:

- Coastal Restriction Act, M.G.L. CH. 130, s. 105
- Ocean Sanctuaries Act, M.G.L. CH. 132A, ss. 13-16, 18
- Mineral Resources Act, M.G.L. CH. 21, ss. 54-58
- Massachusetts Clean Waters Act, M.G.L. CH. 21, ss. 26-53
- Waterways Laws, M.G.L. CH. 91
- Massachusetts Environmental Policy Act, M.G.L. CH. 30, ss. 61-62H
- Scenic Rivers Act, M.G.L. CH. 21, s. 178

Also, for projects on Martha's Vineyard, Applicants should be aware of the act establishing the Martha's Vineyard Commission which is Chapter 637 of the Acts of 1974. For information concerning the special requirements outlined in the Act, contact:

The Martha's Vineyard Commission
Box 1447
Oak Bluffs, Massachusetts 02557
(617) 693-3453

On the federal level, several significant pieces of legislation regulate activities in areas covered by this Guidebook:

- Clean Water Act of 1977, especially section 404
- River and Harbor Act of 1899, section 10

In Massachusetts, Applicants should contact the Corps of Engineers at the address below, *prior to* developing a plan that will alter the coastal environment. Request Publication EP-1145-2-1 dated 1 November 1977 which is titled *U. S. Army Corps of Engineers, Permit Program, A Guide for Applicants.*

Chief Regulatory Branch
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, MA 02154
(617) 894-2400, extension 332

Alga (pl. algae): The simplest of all green plant forms, having neither roots, stems, or leaves. Algae range in size from microscopic single cells to branching forms one hundred feet or more in length. Larger marine forms are known as seaweeds.

Aquifer: A land layer which is both porous and permeable, i.e., which stores water, and also permits water to seep easily through it to the next land layer, that can be economically removed and used for human purposes.

Bedrock: The bottom-most level of a typical landform, consisting of solid, hard rock.

Benthos: The community of bottom-dwelling life.

Berm: A nearly horizontal upper part of the beach or one sloping away from the ocean.

Biota: The plant and animal assemblage of a biologic community.

Bivalve: Possessing two valves, or shells. Bivalve molluscs include oysters, clams, and similar animals.

Brackish: Used to describe waters that are mixtures of fresh and salt water. Coastal marshes and estuaries generally contain such moderately salty (15-25‰) water.

Carrying Capacity: The degree to which coastal land and water can sustain human use and activity.

Coastal Zone Management: A comprehensive program for the orderly guidance of development within the coastal zone in order to balance long-term economic, environmental, and social interests.

Coastal Zone (Massachusetts): For management purposes, the Massachusetts coastal zone is defined as a part of the 74 coastal cities and towns located along the 1200 miles of Massachusetts coastline and extending three miles out to sea.

Community: All the plants and/or animals of a particular habitat.

Construction Standards: Minimum standards which must be met, according to local, state and/or federal legislation and/or regulations, in the construction of facilities on land or water.

Consumer: Any living thing that is unable to manufacture food from non-living substances but depends instead on the energy stored in other living things.

Contiguous to: In actual contact with.

Continental Shelf: A shallow portion of the sea floor adjoining continents and extending from the low-tide level seaward to a break in slope, generally 300 to 700 feet below sea level. Widths vary from less than a mile to several hundred miles.

Crustaceans: The large class of animals that includes crabs, lobsters, shrimp, and similar forms. Crustaceans typically live in water and are characterized by jointed legs, segmented bodies, and hard external skeletons.

Decomposers: Living plants and animals, but chiefly fungi and bacteria, that live by extracting energy from the decaying tissues of dead plants and animals. In the process, they also release simple chemical compounds stored in the dead bodies and make them available once again for use by green plants.

Detritus: Particles of the decaying remains of dead plants and animals; an important source of food for many marsh animals.

Diversity: The variety of species present in a biological community.

Drumlin: Elongated oval hill formed of glacial till accumulated beneath a slowly advancing glacier. The long axis of the hill and steeper frontal slope mark the direction of movement of the subsequently vanished glaciers.

Ecosystem: The complete ecological system operating in a given geographic system in which a biological (living) community and its non-living environment interact.

Environment: All the external conditions, such as soil, water, air, and organisms, surrounding a living thing.

Environmental: Relating to all the conditions, circumstances, and influences surrounding and affecting the life, development, and survival of an organism or group of organisms.

Erosion Zone: Areas prone to erosion by wind, running water, ice, or waves.

Estuary: A semi-enclosed body of water with an open connection to the sea that is measurably diluted by freshwater drainage.

Fauna: A collective term for the animal species present in an ecosystem.

Filter Feeders: Animals such as clams and mussels that obtain food by filtering or straining it from the surrounding waters.

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).

Flora: A collective term for the plant species present in an ecosystem.

Flushing Rate: The rate at which the water of an estuary is replaced (usually expressed as the time for one complete replacement).

Food Chain: The passage of energy and materials in the form of food from producers (green plants) through a succession of plant-eating and meat-eating consumers. Green plants, plant-eating insects, and an insect-eating fish would form a simple food chain. See also *Food Web.*

Food Web: A system of interlocking food chains. Since few animals rely on a single food source and since a given food is rarely consumed exclusively by a single species of animals, the separate food chains in any natural community interlock and form a web.

Glacial Drift: Sediment accumulated as a result of glaciation, under a glacier, at its margins or beyond, as glaciofluvial and glacial marine deposits.

Glacial Till: A "boulder clay," an unsorted and unstratified sediment deposited directly by a glacier in moraines or drumlins and not reworked by melt-water.

Grain Size: A measure of the size of a material or rock particle that makes up sediment.

Groundwater: Underground body of water consisting of water that is drawn downward by gravity through the soil.

Gut: A narrow, deep channel characterized by rapid currents.

Habitat: The place of residence of an animal species or a community of species.

Hydrologic Cycle: The complete cycle of circulation of water on the surface of the land, in the soil, underlying rocks and in the atmosphere; the interchange of water substance between earth, atmosphere and ocean.

Hydrology: System of water circulation on the land, in the soil and underlying rocks, and in the atmosphere.

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, see also *Vertebrate.*

Littoral Processes: The movement of sediment, including sand, gravel, or cobbles along the coast caused by waves or currents.

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.

Molluscs: A major group of animals with soft, boneless bodies and, usually, shells. The group includes snails, clams, mussels, and oysters.

Moraine: A deposit left by a glacier at its terminus (terminal moraine), along the side of a valley glacier (lateral moraine), down the glacier from the junction of tributaries (medial moraine), and as a thin glacial deposit over most of the glaciated area (ground moraine). Moraines are generally ridges, but a ground moraine may form a level plain.

Mud: Material consisting mostly of silt and clay-sized particles (less than 0.06 millimeters) but often containing varying amounts of sand and/or organic materials. It is also a general term applied to any fine-grained sediment whose exact size classification has not been determined.

Nursery Area: A place where larval, juvenile, or young stages of aquatic life concentrate for feeding or refuge.

Nutrient: In the ocean, any one of a number of inorganic or organic compounds or ions used primarily in the nutrition of primary producers. Nitrogen and phosphorus compounds are examples of essential nutrients.

Panne: A shallow depression containing water left by receding tides. The water is usually too salty to support vegetation, but sometimes mats of blue-green algae, stunted grasses, or showy flowers form. Pannes and creeks are the principal physical features of saltwater marshes.

Peat: Partly decayed organic matter formed in boggy areas where high acidity and a lack of oxygen limits decomposition.

Percolation: Downward flow or infiltration of water through the pores or spaces of rocks or soil.

Permeability: The ability of land to accommodate the percolation of water through it.

Perturbation: The disturbance of the quality of natural resources caused by human activity or use.

Photic Zone: Area penetrated by light.

Photosynthesis: The process by which green plants convert carbon dioxide and water into simple sugars. Chlorophyll and sunlight are essential to the series of complex chemical reactions involved.

Plankton: The minute plants and animals that float or swim near the surface of a body of water. The enormous quantities of plant plankton (phytoplankton) and animal plankton (zooplankton) in water provide an important food source for many aquatic animals.

Porosity: The land's capacity to absorb water.

Producers: Green plants, the basic link in any food chain. By means of photosynthesis, green plants manufacture the food on which all other living things ultimately depend.

Productivity: The rate of biomass production over a period of time.

Recharge: The replenishment and repurification of the groundwater body caused by the percolation of water through the land.

Resuspension: The return of settled, deposited sediment to a state of suspension in the water body.

Salinity: A measure of the quantity of dissolved salts in sea water. Formally defined as the total amount of dissolved solids in sea water in parts per thousand (‰) by weight when all the carbonate has been converted to oxide, the bromide and iodide to chloride, and all organic matter is completely oxidized.

Salt Water Intrusion: Salt groundwater which mixes with the fresh groundwater supply in coastal areas.

Sand: Loose material which consists of grains ranging between 0.0625 and 2.0 millimeters in diameter.

Sedge: A kind of plant resembling the grasses. However, sedges usually have solid triangular stems in contrast to the round hollow stems of grasses. The floating mats of bogs are often composed of sedges.

Sediment: Solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water, or ice and has come to rest on the earth's surface either above or below sea level.

Sedimentation: The settling out of solids by gravity.

Seepage: Water that flows through the soil.

Sewage: The total organic waste and waste water generated by residential and commercial establishments.

Shrub: A woody plant, usually less than twelve feet tall, having many stems rising from the ground.

Slope: The degree of incline of land, expressed as vertical change divided by horizontal change.

Spit: A small, elongated point of land or narrow shoal, mostly sand, projecting into a body of water from the shore.

Storm Run-Off: Water which flows along the surface of the land toward the sea during a storm.

Succession: The gradual replacement of one biotic community by another, eventually leading to a more or less stable community.

Swamp: A form of wetland characterized by moss and shrubs, or trees such as maples, gums, and cypresses. Swamps usually have better drainage than bogs. Sometimes they succeed marshes in shallow water basins, and they also may develop in sluggish streams and floodplains.

Terminal Moraine: Debris deposited at the end of a glacier and forming a ridge remaining to mark a particular glacial stage after the glacier has melted back or vanished.

Tidal Inlet: A breach in a coastal barrier generally opened by a major storm and maintained by tidal flow.

Topography: The configuration of a surface area including its relative elevations and the position of its natural features.

Topsoil: The uppermost level of a landform, consisting of soils, and above which might be a protective layer of vegetative covergrass, shrubs, or trees.

Turbidity: The amount of particulate matter suspended in water.

Vegetative Cover: A protective layer of grass, shrubs, or trees which lies above the topsoil.

Vertebrate: An animal with a backbone. The group includes fishes, amphibians, reptiles, birds, and mammals.

Watershed: A land surface which slopes downward toward a stream bed or toward the sea, and along which water flows.

Water Table: The upper level of the underground reservoir of water.

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