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# WETLANDS
# ON
# LONG ISLAND

Prepared by
The Center for the
Environment and Man, Inc.
under
Sea Grant Project GH-63
National science Foundation

by
Ralph Green.

CEM-4103-460
February 1972

## Regional Marine Resources Council

A COMMITTEE OF THE NASSAU-SUFFOLK REGIONAL PLANNING BOARD.

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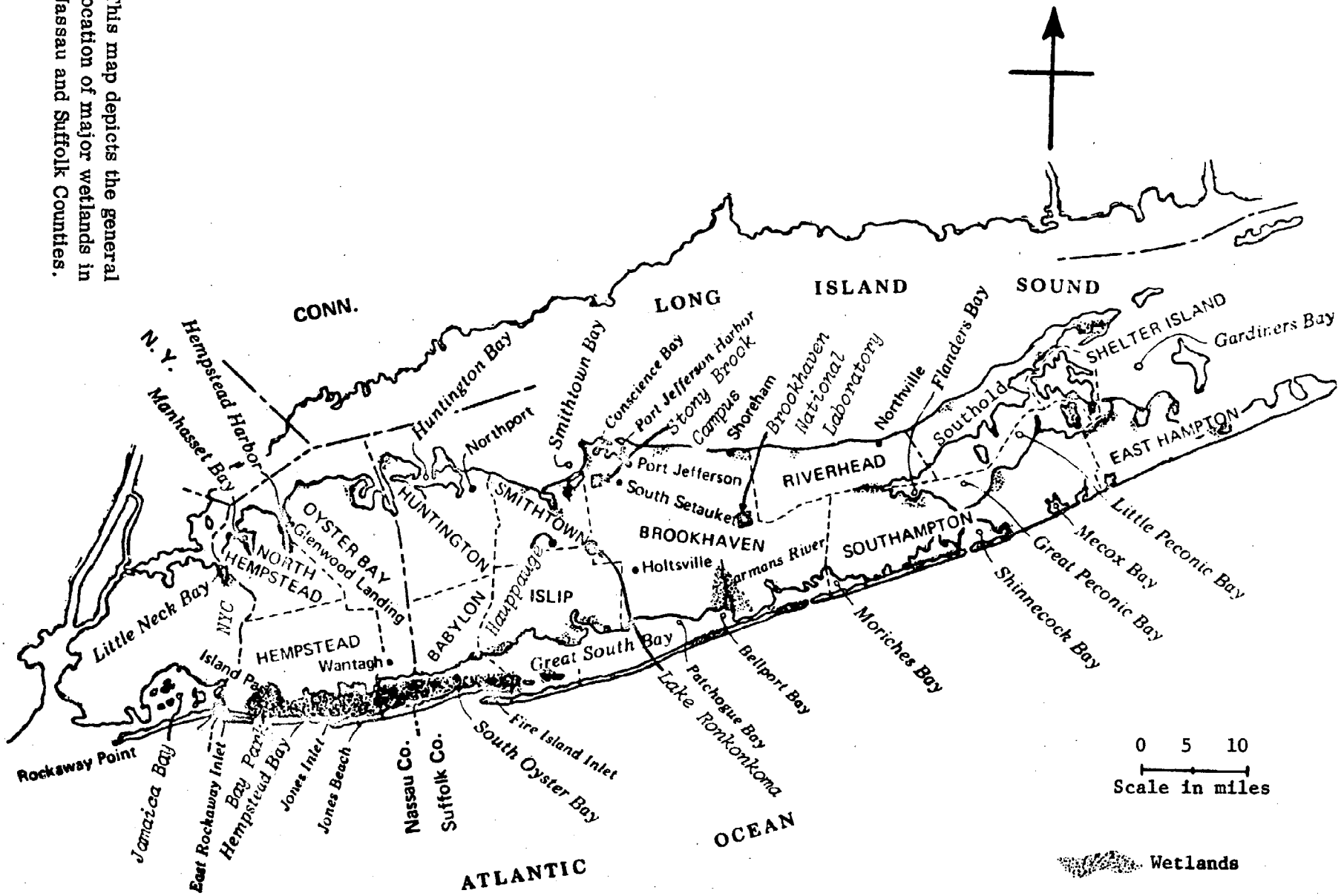
This map depicts the general location of major wetlands in Nassau and Suffolk Counties.



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## FOREWORD

This report is part of a series prepared by The Center for the Environment and Man, Inc., for the Regional Marine Resources Council of the Nassau-Suffolk Regional Planning Board under the continuing program: The Development of Methodologies for Planning for the Optimum Use of the Marine Resources of the Coastal Zone. The program is being funded in part by the Sea Grant Program of the National Oceanic and Atmospheric Administration, U.S. Department of Commerce, and is structured into six functional steps:

Functional Step One (Problems). Identifies, classifies and briefly analyzes the problems that confront planners and decision makers with regard to the area's marine resources.

Functional Step Two (Knowledge Requirements). Categorizes the data and knowledge necessary for making sound decisions with regard to the use of the marine resources.

Functional Step Three (State of the Art). Assesses the availability and adequacy of the necessary data and knowledge.

Functional Step Four (Knowledge Gaps). Determines necessary data collection and research activity.

Functional Step Five (Data Collection and Research Program). Formulates a priority-oriented, marine-related data collection and research program and monitors its implementation.

Functional Step Six (Management Information System). Develops a system for organizing the data and knowledge and provides analyzed information to marine resource planners.

Functional Steps One and Two were completed in previous reports of this series [1a, 1b and 1c] [1/].

The current report on wetlands is one of seven which together constitute Functional Step Three. Two of these seven reports were completed previously for coastal water quality standards [1d] and for estuarine models [1e]. Four reports addressing

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[1/] Citations in brackets are listed in Appendix A.

selected priority problems are currently being prepared simultaneously for integrated water supply and waste disposal [1g], coastal stabilization and protection [1h], dredging [1i], and wetlands [1j].

The current report and all previous reports will contribute to future reports in this series on the state of the art [1k] (Functional Step Three), a proposed research program [1ℓ] (Functional Steps Four and Five), guidelines for planning and policy formulation [1m], and a marine management information system [1n] (Functional Step Six).

In the preparation of this report, we are indebted to many individuals within and outside government. The staff of the Division of River Basin Studies of the U.S. Fish and Wildlife Service, Patchogue, New York, kindly furnished information, reports and comments. The staff of the New York State Department of Environmental Conservation, Ronkonkoma, New York, did likewise. Charles Banks Belt of South Hampton was helpful in providing background information on Long Island's wetlands and pertinent comments.

Views and conclusions contained in this report are those of The Center for the Environment and Man, Inc. They should not be interpreted necessarily as the official opinion or policy of the Marine Resources Council or the National Oceanic and Atmospheric Administration.

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# SECTION 1 - INTRODUCTION

## 1.1 PROBLEM DESCRIPTION

The problem considered in this report is how to recognize, preserve and enhance the usefulness of wetlands in Nassau and Suffolk Counties for ecological and for human purposes. The state of the art is assessed, research and data needs are identified, and guidelines are presented.

Wetlands are of concern on Long Island because of two competing facts. First, Long Island is adjacent to the country's largest concentration of people. This generates large and growing pressures for the use of natural resources in many differing ways—housing, beach use, and recreational boating. Second, the Long Island marine environment is a highly productive, important natural resource which has been increasingly changed, enhanced, and destroyed. These two facets in one area bring about conflicting pressures for preservation and use. This conflict is readily apparent in the area's coastal wetlands.

## 1.2 POTENTIAL USERS OF THIS REPORT

This report is prepared primarily for the use of the Regional Marine Resources Council and its parent body, the Nassau-Suffolk Regional Planning Board. As such, it is an overview and seeks to provide a perspective useful for formulating broad public policy. In developing this overview, considerable information is provided that should be useful to other bodies such as the town boards and conservation commissions. The report is developed in such a way as to maximize its contribution to later reports in this series. Although the data and some of the effects are specific to the study area, the methodology used and some of the conclusions reached should be applicable to wetlands planning elsewhere.

## 1.3 CHARACTERISTICS OF THE DECISIONS REQUIRED

The basic decision is how to manage the wetlands. Decisions are too often made on the basis of very narrow conception of their impact on wetlands. However, as this analysis attempts to show, wetland alterations take place in a physical and cultural framework that significantly alters both the benefits and the costs of an alteration project. Thus, the decisions made should take into account the demand for resources, economic value, impact on ecological systems, the effect on human activities and long term plans for development of the area.

## 1.4 APPROACH TO THE PROBLEM

In Section 2, the analysis consists of:

- Examining wetland relationships, to include wetland characteristics, natural functions, and man's uses.
- Examining wetland changes caused by nature and, especially by man, to include a consideration of wetland losses in the past, present and probable future.
- Identifying major wetland problems.
- Examining steps in the comprehensive wetlands management to include a temporary moratorium, a controlled inventory, an evaluation of qualitative features, a listing of preservation and enhancement techniques, and the preparation and implementation of a comprehensive wetlands plan.

In Section 3, important data collection and research needs are listed.

Section 4 provides a brief summary of basic considerations and suggests some guidelines.

## SECTION 2 - ANALYSIS

### 2.1 WETLAND RELATIONSHIPS

#### 2.1.1 Wetland Characteristics

Coastal wetlands are much more than just wet land. That simple definition connotes the idea that this is just land that needs to be drained or filled to convert it to dry land suitable for development and production. As will be stressed herein, wetlands are better viewed as highly developed, natural, productive living resources.

Unfortunately, the term "wetlands" is commonly employed ambiguously or inconsistently in wetlands studies and inventories. For the sake of consistency with inventory reports to be cited later, when we employ the term "wetlands" herein, we intend it to include Types 12—18, as described in Circular 39 of the U.S. Fish and Wildlife Service [2a] [1].

Actually, in the bi-county area only two of these types are currently plentiful—coastal salt meadows (Type 16) and regularly flooded salt marshes (Type 18). Some freshwater marshes (Types 12 and 13) on the upland fringe of the salt meadows were reported in a 1954 inventory [10]. However, because of their accessibility for development, these upland marshes have probably been, for the most part, lost during the past two decades. Henceforth, for brevity, unless otherwise indicated, we will use the term "meadows" to connote coastal salt meadows (Type 16), and the term "marshes" to connote regularly flooded salt marshes (Type 18). Figure 1 brings out in simplified form some of the distinctions between meadows and marshes, and their landward and seaward limits. On the ground, the transitions are not so sharply determinable. Although we make these definitional distinctions, both meadows and marshes are integral features of a coastal wetland. Water flux is the important element in the complex makeup of these wetlands; freshwater from surface and groundwater inflow mingles with brackish and salty waters.

About two-thirds of Long Island's wetlands are meadows and most of the remainder are marshes. Both are used as feeding areas for waterfowl. The value of the meadows for this purpose is greatly increased by the presence of shallow potholes. The marshes

[1] See Appendix B for descriptive extracts from Circular 39.

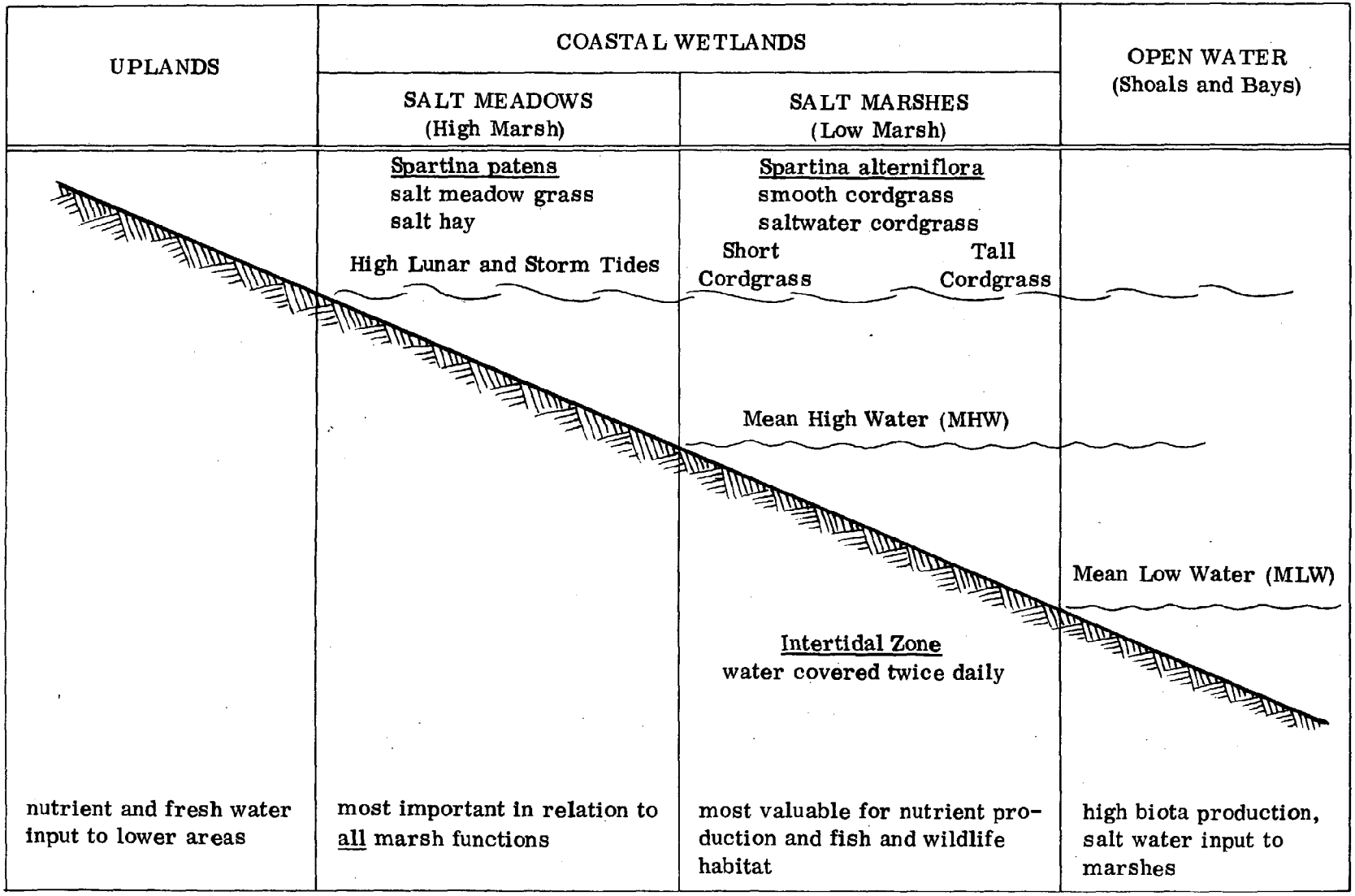


FIGURE 1. INTERRELATIONSHIPS OF LAND AND WATER FORMS MAKING UP THE COASTAL WETLAND COMPLEX

and adjacent shoal areas provide habitat, spawning and nursery areas, and nutrients for fish.

Mudflats, rocky areas and beaches are not included in the current definition of wetlands as depicted on Figure 1. However, they are part of the total wetlands complex. Open water exists in the coastal wetlands (though not shown on Figure 1). The streams, guts and potholes of the marshes and meadows are an integral and important component of the coastal wetlands.

Basic productivity of an ecosystem or community may be defined as the rate at which energy is stored by the photosynthetic and chemosynthetic activity mostly of green plants in the form of organic material which can be used for food. In general, there is a ten to one ratio for the various trophic (productivity) levels; one pound of a higher trophic level would have to consume about ten pounds of the next lower trophic level. Cord grass (Spartina alterniflora) is usually the major producing unit in marshes. Its annual production in tons dry weight per acre for Georgia has been reported as between 4.4 and 8.9 tons; for North Carolina, 2.9 tons; for Virginia, 3.0—7.0 tons; for Delaware, 2.0 tons; and for New Jersey, 1.3 tons [3]. A study of marsh plant productivity in Hempstead Bay, Long Island [51] found values of 2.3—3.7 tons per acre. Productivity measurements of a Rhode Island salt marsh [52] resulted in values of 2.2—3.5 tons per acre. Typically, other marsh vegetative species have lower production rates. Algae and phytoplankton in some studies are shown to have contributed substantially to the total productivity of vegetative matter [4, 51]. Organic matter is broken down mechanically by tidal and wave action into smaller pieces (detritus). The detritus is decomposed by microorganisms to provide nutrients for further vegetative growth and for animal species. Table 1 shows how the productivity of a Georgia wetland compared with other ecosystems.

### 2.1.2 Natural Functions

The natural functions of coastal wetlands can be placed in the following six categories [11]:

Hydrologic Function - The wetlands can serve as a storage area for tidal surges and for upland runoff in some cases. This is one of the areas where the freshwater and saltwater mix, resulting in dilution of salt concentration as well as storage.

TABLE 1 [5]

NET PRIMARY PRODUCTIVITY OF
VARIOUS CULTIVATED AND NATURAL ECOSYSTEMS

| Ecosystem | Grams/$m^2$/yr. |
|---|---|
| Sugar cane, average, Hawaii | 3430 |
| Tall Spartina salt marsh, Ga. | 3300 |
| Forest, pine plantation | 3180 |
| Forest, deciduous plantation | 1560 |
| *Sugar beets (Netherlands) | 1470 |
| *Rice (Italy and Japan) | 1440 |
| *Wheat (Netherlands) | 1250 |
| *Oats (Denmark) | 926 |
| *Corn (Canada) | 790 |

*Average in areas of highest yields.

Hydraulic/Hydrographic Function - Wetlands serve as a natural buffer when they reduce the impact of storm tides and waves on the adjacent higher areas. The peat materials and vegetation intercept the storm tides and wave shocks. Because of the wetland topography, there is usually a large areal extent of this type of material. The wetland complex helps to absorb the shock and reduce the gradient for the waves. It is a natural breakwater. The stalks of vegetation are extremely resilient and bend with waves while absorbing energy.

Sedimentation Function - Water moving across wetlands constantly stirs up the surface materials. Vegetation acts as a filter causing sedimentation on the wetlands. The source of the deposited sediments could be either upland or oceanside. The silt, sand, organic matter, pollutants, and other deposited materials all cause a rise in surface elevation. Countering this land rise is a very gradual rise in the sea level along the Atlantic coast [6, 7, 8], although the two rates may not be comparable. The wetlands, then, usually serve as a "sediment trap" for materials otherwise deposited in channels, saving in dredging frequency. In erosion prone parts of bays, such as along channels, wetlands can work in the opposite direction if not vegetated, by providing a primary source of channel-filling sediment, especially after storms.

Anti-pollution Function - The marsh and shoal areas in particular may serve beneficially as a biological and chemical oxidation basin where deposited organic and

inorganic materials are oxidized, decomposed, and digested while being converted into nutrients. The oxygen production of the marsh vegetation probably aids the microbial breakdown of this material, so there is some degree of pollution control being done by the marsh.

Basic Food Production - As mentioned earlier, there is primary nutrient production from wetlands vegetation with subsequent mechanical and chemical decomposition. As the vegetation dies, bacteria, plankton, fungi, etc. convert it into matter high in protein, minerals, carbohydrates and vitamins; this material circulated in the "nutrient trap." It should be realized then that the chemical elements, including all the essential elements of living matter, tend to circulate in the biosphere (biological complex) in characteristic paths from environment to organisms and back to the environment. These more-or-less-circular paths may be termed "inorganic-organic cycles" and are sometimes referred to as biogeochemical cycles.

Fish and Wildlife Habitat Function - This function includes breeding, nesting, resting, feeding and predator-escape functions for various forms and levels of fish and wildlife. Because of their temperatures, nutrient content and protective features, wetlands and adjacent waters are used by many species as nursing grounds.

### 2.1.3 Man's Uses

- Uses involving no alteration:

  Nursery - Provide nursery areas for fisheries.

  Open Space and Aesthetics - Wetlands offer some unique and valued open space and aesthetic qualities. They offer areas of quiet relief from the regular activity encountered every day and provide a peaceful landscape.

  Recreation - Coastal wetlands provide a wide range of active and passive recreation: hunting, fishing, hiking, bird watching and photography.

  Education and Research - Wetlands can provide a wide range of opportunity as outdoor laboratories and living classrooms. They are perfect areas for studying biological processes. In particular, Long Island's wetlands are adjacent to a large population and attendant research and educational institutions. Organisms which are important to man need further study and at least for a portion of their life cycle can be studied in the wetlands complex.

- Uses involving alteration:

  Transportation - Since coastal wetlands are at the land-water interface, channels are sometimes dredged through them for boating and they are sometimes converted into marinas. Roads connecting barrier islands with the mainland and the bridge abutments associated with these roads are frequently sited in wetlands.

  Residential - Highest residential land values usually occur adjacent to or on water frontage. Development of water frontage creates a low-maintenance open space with many kinds of recreational facilities. This space is so popular it can increase surrounding land values up to five or ten times normal value. In fact, on Long Island new waterfront plots of land can command a premium of about $5,000 to $15,000 over non-waterfront lands. If the land is bulkheaded, and this improvement is not maintained, property values will decline as erosion occurs.

  Commercial - Certain commercial activities must be located on the water's edge: boat launching facilities, marinas, servicing areas.

  Industrial - A few direct industrial uses are found in wetland areas, primarily on filled wetlands.

  Resource Extraction - Living resources such as finfish, shellfish, and muskrats are sometimes extracted commercially from wetland complexes.

  Waste Disposal - Liquid wastes from streams and groundwater seepage, solid wastes and spoil from dredging operations are sometimes deposited on wetlands. Many existing and proposed sewage treatment plants are build on filled-in wetlands.

### 2.1.4 Interrelationships

The wetland characteristics, natural functions, and human uses outlined above all interact. Figure 2 shows how the wetland characteristics, arrayed along the horizontal axis affect the natural functions and man's uses, arrayed along the vertical axis. Overall, it can be perceived how natural functions and man's uses of wetlands are related to each other through the characteristics of the wetland complex.

Figure 2 is a very generalized matrix; direct and indirect effects are implicit. The continuity of the wetlands complex (Figure 1) masks the directness. The assumption

**WETLAND CHARACTERISTICS — Salt Meadow**

| Natural Functions & Man's Uses of Wetlands | | Surface Material: Mech. Properties | Depth | Slope | Water: Groundwater flux | Streamflow | Channelization | Tidal Inundation | Salinity | Quality | Vegetation: Species | Density | Productivity | Animal Life: Species Diversity | Productivity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Natural Functions | Hydrologic | 2 | | | 1 | 2 | 2 | 2 | | | | 2 | | | |
| | Hydraulic/Hydrographic | 2 | | 2 | | 2 | 2 | 2 | | | 3 | 3 | | | |
| | Sedimentation | | | 2 | | 2 | | | | | 2 | 2 | | | |
| | Antipollution | | | | | 3 | 2 | | | 3 | | 1 | | 1 | |
| | Basic Food Production | | | | 1 | 2 | 2 | 2 | | 2 | 2 | 2 | 2 | 2 | 3 |
| | Fish & Wildlife Habitat | | | | 1 | 1 | | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 |
| | Thermal Exchange | | | | 1 | 1 | | | | | 1 | 1 | | | |
| Man's Uses | Education & Research | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| | Recreation | | | | | 2 | 2 | | | 2 | 2 | 2 | | 2 | |
| | Open Space & Aesthetics | | | | | | 1 | 1 | | 1 | 2 | 2 | | 2 | |
| | Residential | 1 | 2 | | 1 | 1 | 1 | 1 | | 1 | 1 | 1 | | | |
| | Commercial | 1 | 2 | | 1 | 1 | 1 | 1 | | | 1 | 1 | | | |
| | Industrial | 1 | 2 | | 1 | 1 | 1 | 1 | | | 1 | 1 | | | |
| | Resource Extraction | | | | | | | | | | | | | | |
| | Waste Disposal | | | | 1 | 1 | 1 | | | | | | | | |
| | Transportation | 2 | [illegible] | | 1 | 1 | 1 | 1 | | | | | | | |

**WETLAND CHARACTERISTICS — Salt Marsh**

| Natural Functions & Man's Uses of Wetlands | | Surface Material: Mech. Properties | Depth | Slope | Water: Channelization | Salinity | Turbidity | Dissolved $O_2$ | Temperature | Other Quality | Vegetation: Species | Density | Productivity | Animal Life: Species Diversity | Productivity | Microorganisms | Fish |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Natural Functions | Hydrologic | | | | 3 | | | | | | | | | | | | |
| | Hydraulic/Hydrographic | | 2 | 2 | 2 | | | | | | 3 | 3 | | | | | |
| | Sedimentation | | | 3 | 2 | | 3 | | | | 3 | 3 | | | | | |
| | Antipollution | | | | | | | 2 | 2 | 2 | | | | | | 3 | |
| | Basic Food Production | | | | 2 | | 1 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Fish & Wildlife Habitat | | | | 1 | 2 | 2 | 2 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 2 | |
| | Thermal Exchange | | | | | | 1 | | 3 | | 2 | 2 | | | | | |
| Man's Uses | Education & Research | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Recreation | | 2 | 2 | 2 | | | | 2 | 2 | 2 | 2 | | 3 | | | 3 |
| | Open Space & Aesthetics | | | | 1 | | 1 | | | 2 | 2 | 2 | | 2 | | | |
| | Residential | 1 | 2 | | 1 | | | | | 2 | 1 | 1 | | | | | |
| | Commercial | 1 | 2 | | 1 | | | | | 2 | 1 | 1 | | | | | |
| | Industrial | 1 | 2 | | 1 | | | | | 2 | 1 | 1 | | | | | |
| | Resource Extraction | 1 | 2 | | | | | | | | | | | 2 | 2 | | 2 |
| | Waste Disposal | | | | 1 | | | 2 | | | 1 | 1 | | | | | |
| | Transportation | 2 | 2 | | 1 | | | | | | | | | | | | |

**WETLAND CHARACTERISTICS — Shoal Area**

| Natural Functions & Man's Uses of Wetlands | | Surface Material: Mech. Properties | Depth | Topography | Water: Depth | Salinity | Turbidity | Dissolved $O_2$ | Temperature | Other Quality | Vegetation: Species | Density | Productivity | Animal Life: Species Diversity | Productivity | Finfish | Shellfish |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Natural Functions | Hydrologic | | | | | | | | | | | | | | | | |
| | Hydraulic/Hydrographic | | 3 | 3 | 3 | | | | | | | | | | | | |
| | Sedimentation | 3 | | 3 | 3 | | 3 | | | | | | | | | | |
| | Antipollution | | | | | | | 3 | 3 | 3 | 2 | | | | | | |
| | Basic Food Production | | | | | | | | | | 3 | | 3 | | | 3 | 3 |
| | Fish & Wildlife Habitat | | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | | |
| | Thermal Exchange | | | | 2 | | 1 | | 3 | | | | | | | | |
| Man's Uses | Education & Research | 1 | 1 | 1 | 2 | 2 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Recreation | | 2 | 2 | 3 | | | | 2 | 2 | 2 | 2 | | 3 | | 3 | 3 |
| | Open Space & Aesthetics | | | | | | 2 | | | 2 | 1 | | | | | | |
| | Residential | | | | 1 | | | | | | | | | | | | |
| | Commercial | | | | 1 | | | | | | | | | | | | |
| | Industrial | | | | 1 | | | | | 2 | | | | | | | |
| | Resource Extraction | 3 | 2 | 2 | | | | | | | | | | 3 | 3 | 3 | 3 |
| | Waste Disposal | | | | | | | | | | | | | | | | |
| | Transportation | 2 | 2 | 2 | 3 | | | | | | | | | | | | |

Magnitude of Effect

blank – insignificant
1 – low
2 – moderate
3 – high

Example (heavy outline): The productivity of animal life in a salt marsh is hereby judged to have a "high" (3) effect on the marsh's usefulness as a fish and wildlife habitat and for eduction and research, and an "insignificant" (blank) effect on the marsh's usefulness for thermal exchange and recreation.

FIGURE 2. NATURAL FUNCTIONS & MAN's USES AFFECTED BY WETLAND CHARACTERISTICS

is that relationships can exist in several places at different times, and to varying degrees.

## 2.2 WETLAND CHANGES

### 2.2.1 Natural Changes

As can be determined from the characteristics of wetlands, they are a dynamic rather than a static system. Erosion may occur from continued wave action; hurricane flooding and high winds may alter the flora and fauna as well as the topography; sedimentation may fill old potholes and channels; tides and fresh water flow may create new ones. In Maryland the net effects of forces—shoreline erosion and wind-blown sand—have been found to cause about a third of the state's coastal wetland losses observed over the past quarter of a century [40]. No similar data are available for Long Island.

### 2.2.2 Man-Caused Alterations

Dredging - Removal of material occurs frequently in open water, in shoal areas, and in the marshes; and infrequently in meadows. Dredging usually takes place in the biologically active shallow areas. Dredging is generally for land development, i.e., residential, commercial and industrial; or water development, i.e., navigation.

Ditching to eliminate shallow pools is a particular form of dredging applied to mosquito control. If the ditches are located in the intertidal zone, the amount of permanent water-marsh edge is increased. Small fish can remain in the salt marsh at low tide to eat mosquito larvae. In the higher meadows, ditching can reduce water levels enough to allow woody plant species to become established thereby improving the overall wildlife habitat. Ditching to drain small freshwater pools along the barrier beaches is disruptive to the local ecology. In addition, these pools are felt to be essential to the survival of indigenous young waterflowl [53].

Filling - This is the other component of the dredging operation. As indicated in some detail in another report of this series [1i], dredged material is sometimes deposited in shoal, marsh or meadow areas. It is sometimes possible to control the dispersal of filling material imaginatively so as to create new wetlands.

Bulkheading - This involves construction of a barrier between the open water and solid land. The result is to restrict the movement of water, and therefore, the movement and/or exchange of dissolved oxygen, salinity, temperature, nutrients, and life forms.

Insecticide Applications - Primarily done to control mosquito populations. DDT has been used extensively in the past on Long Island, in Suffolk County, in particular. This practice has been curtailed and other insecticides are now used.

Nutrient or Pollutant Loading - The freshwater inflow can carry any manner and variety of nutrients or pollutants. The wetlands may be capable of handling these materials, depending on the volume, concentration and composition of the loadings.

Freshwater Diversion - This applies to both the ground and surface waters. On Long Island most of the streamflow is derived from groundwater. Any change in the groundwater, such as that caused by overpumping, will deplete streamflow as well as groundwater inflow. The depletion would reduce the freshwater input, altering the bay salinity and other characteristics of the wetlands. An extensive sewering program with an ocean outfall would greatly reduce groundwater recharge and would affect bay salinities and wetland characteristics.

Figure 3 suggests how natural forces and human alteration methods can alter wetland characteristics. Several considerations should be kept in mind when considering this matrix. The forces and methods can each affect different portions of the natural environment; some characteristics would be affected by almost every form of alteration while others are sensitive to only a few; some alteration forms could ultimately impact on the entire wetland complex, while others are more specific.

### 2.2.3 Wetland Losses

As brought out earlier, the term "wetlands" differs greatly in meaning from state to state, from report to report, and often within reports. Even in reports which seek to preserve some consistency of definition, deviations are necessary to accommodate to material from previous studies. Even when the term is defined, ambiguous terminology is commonly employed, such as high tide, low tide, storm tides, six-foot depths, and important adjacent areas. It is frequently impossible to tell whether the wetland acreage includes or excludes internal channels, upland fringes and vegetated submerged areas. Difficulties are further compounded when inventory data of one decade are subtracted from differently or obscurely-defined data from an earlier decade to calculate the intervening wetland loss rate. The scope of this report does not permit the unravelling of these ambiguities. To provide a general perspective, however, we have selected what we consider to be the best of the data available to us; but the reader should withhold

**WETLAND CHARACTERISTICS — Salt Meadow**

| WETLAND ALTERATION METHODS AND FORCES | Surface Material: Mech. Properties | Surface Material: Depth | Surface Material: Slope | Water: Groundwater flux | Water: Streamflow | Water: Channelization | Water: Tidal Inundation | Water: Salinity | Water: Quality | Vegetation: Species | Vegetation: Density | Vegetation: Productivity | Animal Life: Species Diversity | Animal Life: Productivity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dredging | | 2 | | | | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | |
| Filling | 2 | 2 | 2 | | | 2 | 2 | | 2 | 3 | 3 | 3 | 3 | 2 |
| Bulkheading | | | | | | | | | | | | | | |
| Insecticide Applications | | | | | | | | | 3 | | | | 3 | 3 |
| Nutrient or Pollutant Loading | 2 | 2 | 2 | | | | | | 2 | 1 | 1 | 2 | 2 | 2 |
| Erosion | 1 | 2 | 2 | | | 2 | 2 | | 2 | | | | | |
| Sedimentation | 2 | 2 | 2 | | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| Fresh Water Diversions | | | | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 |
| Mere Presence | | | | | | | | | | | | | 3 | 3 |

**WETLAND CHARACTERISTICS — Salt Marsh**

| WETLAND ALTERATION METHODS AND FORCES | Surface Material: Mech. Properties | Surface Material: Depth | Surface Material: Slope | Water: Channelization | Water: Salinity | Water: Turbidity | Water: Dissolved $O_2$ | Water: Temperature | Water: Other Quality | Vegetation: Species | Vegetation: Density | Vegetation: Productivity | Animal Life: Species Diversity | Animal Life: Productivity | Animal Life: Microorganisms | Animal Life: Fish |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dredging | | 2 | 2 | 2 | 2 | | | | | 1 | | | 1 | | | |
| Filling | 2 | 2 | 2 | 2 | | 2 | | | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| Bulkheading | | | 2 | 2 | 2 | 2 | 2 | | 2 | | | 2 | | 2 | | |
| Insecticide Applications | | | | | | | | | 3 | | | | 3 | 3 | 3 | 3 |
| Nutrient or Pollutant Loading | | | | | | 2 | 2 | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 |
| Erosion | 1 | 2 | 2 | 2 | | 2 | | | 2 | | | | | | | |
| Sedimentation | 1 | 2 | 1 | 1 | | 1 | | | 1 | 2 | 2 | 2 | 2 | 2 | 2 | |
| Fresh Water Diversions | | | | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 2 |
| Mere Presence | | | | | | | | | | | | | 2 | 2 | | |

**WETLAND CHARACTERISTICS — Shoal Area**

| WETLAND ALTERATION METHODS AND FORCES | Surface Material: Mech. Properties | Surface Material: Depth | Surface Material: Topography | Water: Depth | Water: Salinity | Water: Turbidity | Water: Dissolved $O_2$ | Water: Temperature | Water: Other Quality | Vegetation: Species | Vegetation: Density | Vegetation: Productivity | Animal Life: Species Diversity | Animal Life: Productivity | Animal Life: Finfish | Animal Life: Shellfish |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Dredging | | | | | 1 | 1 | | | | | | | | | | |
| Filling | | | | | | 2 | | | 2 | | | | | | | |
| Bulkheading | | | | | | | | | 2 | | | | 3 | 3 | 3 | 3 |
| Insecticide Applications | | | | | | | | | 3 | | | | 3 | 3 | 3 | 3 |
| Nutrient or Pollutant Loading | | | | | | 1 | 1 | | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| Erosion | 1 | 2 | 2 | 2 | 1 | 2 | | | 2 | | | | | | | |
| Sedimentation | 1 | 1 | 1 | 1 | 1 | 1 | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Fresh Water Diversions | | | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Mere Presence | | | | | | | | | | | | | 2 | | | |

Magnitude of Effect

blank – insignificant

1 – low

2 – moderate

3 – high

Example (heavy outline): Insofar as the productivity of animal life in a salt marsh is concerned, the effects of insecticide applications are hereby judged to be "high" (3), the effects of nutrient or pollutant loading are judged to be "moderate" (2) and the effects of erosion are judged to be "insignificant" (blank).

FIGURE 3. WETLAND CHARACTERISTICS AFFECTED BY ALTERATION METHODS

final acceptance, at least until the inventory [9] currently being conducted by the State University of New York (SUNY) at Stony Brook (and not available to us) provides the necessary definitional control and precise data.

When the SUNY data become available, they should be reconciled, in the manner illustrated in Tables 2 and 3, to maintain correlation between the last survey (1964), the subsequent losses, and the current and programmed ownership pattern. For example, if wetland losses since 1964 are found by SUNY, on the basis of actual measurement, to be substantially greater than those reflected herein in Table 2 on the basis of the secondary evidence available to us, then the acreage of the remaining privately-owned wetlands reported in Table 3 should also be expected to drop substantially.

Despite the above definitional obscurity and inconsistencies in the use of the term "wetlands," it is possible to gain a general order-of-magnitude impression of the physical loss of wetlands acreage in the area.

In 1954, according to a survey of the U.S. Fish and Wildlife Service [2e], there were 43,215 acres of coastal wetlands in the New York City, Nassau and Suffold areas [2e]. About a quarter of this total were salt marshes (Type 18), about a half were salt meadows (Type 16), and about a quarter were shallow freshwater marshes (Type 12) upland from the salt meadows [2a, 10]. In the next ten years, 30 percent of these wetlands were physically lost! Most of the losses were felt in the more-easily-filled shallow freshwater marshes (Type 12). Total wetlands losses in Nassau and Suffolk Counties are reflected in Table 2.

A review of readily-available wetlands ownership data summarized in Table 3 indicates that about two-thirds of the bi-county wetlands were owned by conservation interests in 1968 and that this total might well exceed 80 percent by 1976 if the current wetlands acquisition program of Suffolk County is completed[1/].

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[1/] In 1968, the County announced a program to acquire 6,680 acres of coastal wetlands [12]. Comparing that program with the current (1972) status [13], it appears that very little of the 6,680 acres has been acquired, that about 40 percent is classified as "County Capital Program Acquisitions 1972—74" and that about 10 percent is classified as "Proposed Additional Acquisitions." Only about 3,500 acres of the original 1968 program thus appears in the 1972 program. Acquisition of the omitted 3,000-plus acres would substantially solve wetlands preservation problems on Long Island, because nearly all (say, 95 percent) of the coastal wetlands would then be controlled by conservation interests.

TABLE 2

COASTAL WETLAND LOSSES IN NASSAU-SUFFOLK

| | Nassau (acres) | Suffolk (acres) | Total (acres) | Annual Average Loss Rate (acres) | (%) |
|---|---|---|---|---|---|
| 1954 | 14,130 | 20,590 | 34,720 | | |
| Loss | -2,219 | -1,382 | -3,601 | 720 | 2.1 |
| 1959 | 11,911 | 19,208 | 31,119 | | |
| Loss | -2,416 | -2,200 | -4,616 | 923 | 3.0 |
| 1964 | 9,495 | 17,008 | 26,503 | | |
| Loss | - 300 | - 400 | - 700 | 200 | 0.8 |
| 1968 (Jan.) | 9,195 | 16,608 | 25,803 | | |
| Loss | | | - 500 | 143 | 0.6 |
| 1971 (April) | | | 25,303 | | |

Sources: 1954—1964 [2e]. 1964—1968 based upon estimates by Johnson [11]. 1968—1971 based upon dredging fill quantities estimated by Dowd after a review of all applications for dredging permits to the U.S. Army Corps of Engineers from January 1968 to April 1971 [1i].

TABLE 3

ESTIMATED WETLANDS OWNERSHIP

| | Estimated Acreage | |
|---|---|---|
| | 1968 | 1976 |
| National Wildlife Refuges and Seashores | 2,600 | 2,600 |
| State Wildlife Areas and Parks | 2,700 | 2,700 |
| Local and Private Conservation Areas | 12,100 | 15,600 |
| Privately Owned Areas | 8,400 | 4,100 |
| | 25,800 | 25,000 |

Sources: The 1968 entries are based upon scaling data from a map presented by Spinner [10] and adjusting slightly to agree with the 25,800 acres reflected in Table 2. About two-thirds of the "Local and Private Conservation Areas" reported for 1968 consists of acreage dedicated in Nassau County in 1965 under the Long Island Wetlands Act.

In summary, despite some data uncertainty, it is clear that wetlands were lost at a very rapid rate from the mid-1950's to the mid-1960's. Since then the loss rate appears to have dropped. As more of the remaining privately-owned wetlands come under conservation control, the loss rates should continue to drop.

If this perspective is confirmed by the inventory data currently being developed by SUNY [9], it will indicate that within this decade the emphasis should shift from "saving wetlands" to "What should we do (or not do) with the 'saved' publically-owned wetlands to better understand and enhance their values for ecological and human purposes?" The 25,000 acres of remaining wetlands represent over three percent of the total land area in the two counties.

## 2.3 WETLAND PROBLEMS

Public Participation - One of the major factors impacting on wetlands management is public interest. Without it, wetlands management will proceed on the hit-or-miss basis it frequently has in the past. Occasional outcries and public alarm will be generated by a few issues, but the overall sequence of events typically leads to continued incremental degradation, loss and unimaginative management of wetlands. With public interest, support and backing, and official commitment, a comprehensive plan for wetlands management can be undertaken with a higher degree of success and will result in an improved wetland environment.

Ownership - Wetlands management can be more effective if all wetlands, publically and privately-owned, are included. Most of the Nassau-Suffolk County wetlands had been publically-owned at one time. For a variety of reasons, some portion of these lands became privately-owned. Where titles are uncertain, such as is the case in parts of Suffolk County [14, 16], preservation and management of wetlands can degenerate into a mere holding action or unnecessary loss.

Funding - The Long Island Wetlands Act provides funds to aid in the development and management of wetlands owned and dedicated to conservation purposes by local governments. The average annual state expenditures are projected at $15,000 [15, 16]. With the town's matching funds only $2 per year is available for the "management" of each acre of wetland currently covered by this act. The basic intent of the act appears to have been preservation of the wetlands in the natural state in which they were found at the time of their dedication. Under such a concept, restoration and enhancement are unlikely to be given much consideration.

Local Control - At the local level there are problems with legislation. Several towns and villages have flood plain laws, dredge-and-fill laws and zoning ordinances developed under local home rule [17, 18]. Some facets of local control are beneficial. Action usually can be taken sooner at the local level than at the county or state level. Decisions made at the town level are probably most responsive to the needs of that community. However, there are a set of associated problems. There is no permanency to the local laws. They are flexible and can be changed. This is appropriate at first glance and the flexibility apparently is haphazard. From the regional viewpoint, there is no optimization of individual decisions to allow variances at the local level. Town and village decisions, on the other hand, are made with concern only at the local level. In addition to this limitation, decisions are often made at a personal level, with seemingly little regard for the town or village. Such practices are not in the public interest [19, 20, 21, 22].

Permits - Variances and permits are allowed which ultimately destroy the originally-protected wetlands. The U.S. Army Corps of Engineers receives applications for permits to dredge and fill for navigable waters [1i]. Applications are reviewed under a variety of perspectives. The applications are subject to public hearings and are also reviewed by the New York Department of Environmental Conservation and the U.S. Fish and Wildlife Service. As a matter of policy the Corps does not grant approval if either of these two agencies oppose the application[1/]. Permit systems are useful for control purposes; but, unaccompanied by a comprehensive plan (say one that envisions the creation of new wetlands) they are, by definition, an ad-hoc response to randomly-generated individual initiatives.

Speculation - A 1965 report [2e] examining the causes of coastal wetland losses in the preceeding decade indicated that, for 20 percent of the lost acreage, the ultimate use of the filled area was unknown. The fill, however, was largely spoil from hydraulic dreding. When there is no stated purpose for depositing the spoil material on the wetlands other than simply to dispose of the material, this fact is particularly disturbing

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[1/] A more detailed discussion of the Corps permit system is presented in another report in this series [1i].

to conservationists. Another disturbing aspect of this practice is an unstated interest in "developing" some of these filled lands. In a more recent report [1i], the maximum wetland acreage lost to hydraulic fill was estimated at about 150 acres annually during the period 1968—1971.

## 2.4 COMPREHENSIVE WETLANDS MANAGEMENT

Our purpose is the development of a comprehensive management scheme for the coastal wetlands of Nassau and Suffolk Counties. The important point is that coastal wetlands are part of a complex; they do not stand by themselves. Accordingly, focusing on a single wetland is not enough. We must consider all interactions, compare and rank them, and assign priorities for each by considering the entire system of coastal wetlands on Long Island. The management scheme should consider preservation, development, resoration and creation of wetlands, while keeping in mind the fact that few of man's coastal uses absolutely require a wetland site. In fact, some uses are enhanced by upland locations adjacent to open unspoiled wetlands.

The key elements of the management scheme include:

- a moratorium,
- a management-oriented wetlands classification system and inventory,
- an evaluation of the quality of each major wetlands complex geared to the degree to which it fulfills delineated natural functions and human uses,
- identification and evaluation of physical and non-physical wetlands management techniques,
- development of a comprehensive wetlands management plan integrating the inventory data, the quality evaluation, and the management techniques into a coherent plan,
- implementation procedures which can be used to actualize elements of an accepted plan.

### 2.4.1 Moratorium

A moratorium of two years length is proposed. Protection of all remaining wetlands for an extended period of time will counterbalance the long history of wetland "development." The wetlands management scheme should involve some form of public intervention which will result in a net gain from wetland alteration through consideration of the uniqueness of the resource, its future possibilities, and alternate means of solutions. Until this mechanism is operative, wetlands alteration must be

viewed with trepidation and prevented when possible. Hence, the moratorium on "development" to allow the necessary studies for the management scheme.

The moratorium should suspend all activities which destroy the functional integrity of the bi-county system of wetland complexes. Very strict review and permit procedures will probably be required to determine whether a given action threatens this functional integrity. Such wetland uses and actions as dredging, filling, bulkheading, home construction, road construction, sanitary land fills, direct and indirect discharge of pollutants, and pesticide applications fall into this category.

The point in establishing a two-year limit on the moratorium is to provide a period long enough to construct a management plan, yet short enough to keep pressure on wetland planners, thereby not allowing them to lose sight of their goal.

### 2.4.2 Classification and Inventory

To provide a basis for informed management, a wetlands classification system geared to management needs must first be developed and then the wetlands should be inventoried under that system.

A considerable number of items of data and knowledge requirements are presented here. Some of these data have been obtained previously for various wetland areas on Long Island, however, none of these data have been systematically collected for all components of the entire wetlands system on Long Island. Included should be those wetlands that have never been investigated.

Some of the basic management-oriented questions which could be posed in a classification scheme and answered by the inventory are listed below. Some of the questions have been answered for some wetlands on Long Island but few if any of them have been systematically and uniformly answered for all components of the island's wetlands system.

What are the coastal wetland resources?

Where are they located?
How large is each unit or parcel?
Who owns them or controls their use?
What are their values for taxes, for various forms of "development" use, for various forms of "natural" use?
What is the vulnerability of each parcel?
If vulnerable, when is it likely to be lost to "development"?
What unique attributes does each wetland have?
What recommendations or plans have been made for each parcel?
What current or proposed upland uses could or do affect each parcel?

What is the nature of the adjacent uplands?

Current and planned land use?
What are pressures for development?
Surface or groundwater flow to wetland?
Quantity and quality of flow?
What effect does upland water flux have on the wetland?
Who owns, manages or controls the use of these uplands?
How does the wetland affect the upland?

What is the nature of the contiguous ocean water?

What is the saltwater flux?
What about salinity, and other water quality parameters?
Frequency of inundation of wetlands?
What finfish and shellfish species are found?
What do they derive from each parcel of wetland?
Who owns or manages the bottoms and their attendant resources?

Description alone is not sufficient; rates of production should be considered. In other words, function as well as anatomy should be examined.

A wetlands classification and inventory project is outlined in a concurrent CEM publication [1ℓ]. Aerial photography should be considered in developing inventory techniques.

### 2.4.3 Quality Evaluation

There is a definite need to evaluate the manner in which specific wetland complexes satisfy the natural functions and man's uses indicated in Sections 2.1.2 and 2.1.3.

In a concurrent CEM publication [1ℓ], a project, Understanding Wetland Values, recommends a comprehensive list of beneficial uses of wetlands to quantitatively estimate how specific Long Island wetland complexes provide these benefits. The list of beneficial uses should include, but not be limited to:

- environmental enhancement such as nutrient recycling, nursery and wildlife habitat, upland protection and open space;
- social enhancement such as visual aesthetics, nature appreciation and certain forms of recreation; and
- land enhancement for residential, commercial, industrial, and recreational development.

It should be noted that some of these uses are incompatible with others. This project is given a high priority because of the need to sharpen understanding of how wetland

areas contribute to social, economic and environmental values. Without such a foundation, major decisions on the management, preservation, use, enhancement or development of wetlands will be largely intuitive.

Goals or objectives for desired coastal wetlands use need to be established for the entirety of the Nassau-Suffolk wetlands. This phase of the development of a wetlands management strategy is actually an inventory of the needs and aspirations of the bi-county area for wetlands. This is an expression of ideas from the public, private groups, public agencies and officials as to what they desire in the way of wetland uses and products. It should identify potential uses or needs that the wetlands can fulfill for man and the ecosystem to which he relates.

There is no intention to develop a full-fledged scheme for determining community wetland needs in this report. However, some of the major characteristics can be identified here. There are some communities of interest that have, or should have, a voice in determining wetland needs for the bi-county area. Persons and groups with diverse interests in wetlands include fishermen (finfish and shellfish), boaters, dredging crews, the consumers of fish products, the developers of filled wetland acreage, the occupants of such land, researchers, and trustees of these natural resources. As indicated above, some of these interests are individuals, others pertain to a group; some are typical of the private sector of the community; others are typical of the public sector. There is a local, regional, state and national character in many of these interests.

### 2.4.4 Wetlands Management Techniques

The implementation of the management scheme is a very crucial step in achieving viable results. Implementation involves a broad area of related subjects. They are related in that they all involve accomplishing something.

There are two general classes of implementation tools that can be used: those that are physical measures directly applied to the wetland specifically, and nonphysical measures which would apply to any piece of land. Some examples of each class are as follows:

- Physical Measures

  Spoil areas - Provide cross fencing, plant trees, maintain and repair bulkheads, and control dredging areas.

Boating facilities - Cease dredging at areas for mooring, expand existing facilities only with a minimum loss to the environment, build new mooring facilities offshore, consider the use of floating docks, and guard against overdevelopment of boating facilities.

Preservation - Preserve most of the remaining natural shoreline for aesthetic and economic reasons, restrict further dredging and filling of meadows and marshes, preserve islands as wildlife refuges, and stop depositing spoil on wetland edges.

Pollution - Strenuously enforce present statutes, require builders to install properly-located, effective treatment facilities for houses closer than 100 feet to the marine edge, maintain pond outlets to provide maximum tidal exchange, investigate sewer lines, promote zoning and flood plain legislation to protect shore areas, and minimize oil storage and dispersal facilities.

Navigation - Keep dredging more than 250 feet from wetlands, eliminate spoiling on adjacent marshes, encourage placing spoil on eroding beaches, riprap newly cut inlets up to at least mean highwater, and restrict shallow ( < 4 feet below mlw) dredging.

Storm buffer - Construct housing at a safe distance above highwater; avoid housing in wetlands that are part of the drainage basin or flood plains; and zone wetlands and flood plains as flood plains for beauty, preservation and buffer against storm tides.

Recreation - Restrict access to some areas to maintain seclusion, develop fishing piers in other areas, develop least productive areas for recreation, and institute integral planning and design.

Commercial/industrial/residential - Control future shoreline development with environmental consequences in mind, encourage builders to continue sound practices, locate bulkheading 15—30 feet inshore of the high-water line, use buffer areas of 10-feet width on each side of creeks, terminate fill areas with a gradual slope,and stabilize fill areas with grasses and shrubs.

Specific physical management recommendations are dependent on the characteristics and desired uses of a given wetland unit. A knowledge of all other units also is presupposed as a basis for making a recommendation on

physical management on a specific unit. The range of physical activities that can be undertaken is predicated on the uniqueness of the area, its present use or state relative to surrounding units and its importance for various functions and uses. The New York State Department of Environmental Conservation reports [34] make many recommendations as to physical measures that can be employed to enhance wetland values.

- Nonphysical Measures

  Acquistion - Results in the broadest range of future options:

  donation - little cost to the taxpayer, but rarely occurs;

  transfer - transfer of federal or state lands to a municipality;

  option exercise of tax delinquent land - retention of tax delinquent land by municipalities;

  condemination - exercise of eminent domain;

  taxing power - grant tax relief to present selected land uses;

  outright purchase - involves large sums of money and has been little used to date. A variation of this is the purchase-and-lease-back procedure.

  Zoning - Various types include cluster, agricultural, time and flood-plain zoning. Cluster zoning concentrates on development of one area leaving the balance of land to open space. Agricultural zoning prohibits residential development not related to farming needs. Time zoning requires development first on properties zoned for highest densities. Flood-plain zoning restricts development of areas with a variety of flooding or water conditions.

  Legal procedures/permits/review - Sufficient legal means are available to contest any ill-advised scheme to destroy open space including coastal wetlands. A large portion of present efforts to counteract wetland losses is currently directed at legal action for conserving habitat [23]. One technique some states have used has been the establishment of bulkhead lines to regulate filling or reclamation of privately owned tidelands. Florida has such a law and requires a biological, ecological

and often hydrographic study. Until these studies are completed, a statewide moratorium has been placed on dredging and filling [16].

Several coastal states require permits for dredging, filling and other coastal alternations. These laws go beyond the Corps' permits and state lands controls in that the wetland permits apply to privately owned uplands, not merely to state owned land and lands under navigable waters [24]. The Corps of Engineers exercises jurisdiction over all navigable waters. Navigability has been broadly interpreted by the Corps and the courts. The navigable waters extend at least to mean high water which would include the Spartina alterniflora marshes [12].

An effective agency needs authority to review all public projects and programs. There is generally no adequate comprehensive review machinery at any governmental level to protect the public interest in proper management of wetland complexes [1/]. An example of a step in this direction is Local Law No. 2 of Brookhaven establishing the Board of Waterways. The Board evaluates impacts of proposed construction on the wetland habitat and then advises the Town Supervisor and Council on each application.

Coordination - Little formal provision appears to be made for coordination of development activities and conservation efforts. The general pattern appears to be one of informal coordination among affected agencies. This needs to be improved. A formal organization of the appropriate agencies into a staff level management would have a three-fold purpose—first, coordinate inputs; second, provide for exchange of information and subsequent viewpoints; third, insure effective communications.

The various controls such as zoning, permits and acquistion also must have a means for coordinating the action and activities of the dif-

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[1/] Furthermore, without a comprehensive wetlands plan, such as the one advocated herein, even if such review machinery existed, it would have to act on an ad hoc, defensive basis.

ferent levels of government. One of the possibilities is to establish a coordinating body which would bring all the major areas together for coastal zone management and planning. County planning and management efforts must be conjunctive with town and village efforts. The coastal zone agency would strive to coordinate activities on the local (public and private) level with those on an area-wide level. This should also be coordinated with other types of planning and management; water supply, land development, transportation, special districts, recreation, etc.

For additional material on nonphysical tools, the reader is referred to Appendix C. The reader should also bear in mind the fact that the physical and nonphysical measures should be applied together to enhance and regenerate wetlands.

### 2.4.5 Plan Preparation

The establishment of a comprehensive management plan requires that input on the physical resource base and on how people desire to use these resources be analyzed and interpreted, and ultimately translated into a concrete management program.

Information on the wetlands resource has been given in Section 2.4.2, its value in Section 2.4.3 and some ideas of what tools are available for its control in Section 2.4.4. Preparation of a plan involves integrating this information into a practical, appropriate and manageable plan. Information on the requirements for a comprehensive plan in the coastal zone is plentiful. For the sake of readability, this information is summarized in this section; the reader is referred to Appendix D for concise summaries of selected publications by the following sources:

Marine Fisheries Commission [25]
"Science and Environment" [16]
"Conference on Evaluation of Atlantic Coast Estuarine Zone" [26]
Journal [27] (Science)
New York Department of Conservation Leaflet [4]
Seminar on Multiple Use of the Coastal Zone [39]
American Geographical Society [23, 10]
Virginia Institute of Marine Science [3]
Maryland State Planning Department [40]
Connecticut Arboretum [41]
North Atlantic Regional Water Resources Study, Appendix U [29]
Conservation Foundation [30]
League of Women Voters [19]

Massachusetts Institute of Technology [20]
New Jersey Mosquito Extermination Association [31, 32]
U.S. Department of the Interior, Fish and Wildlife Service [2n]
Environment Reporter [15]

The following, from a monograph by Ludwigson [15], sums up the essence of the above discussions.

"Multiple usage is a firmly entrenched concept along our coasts. The idea of restoring a pristine environment there ranks with the establishment of a continuous coastal industrial belt as pure pipedream." America's future coastal zone will be managed. This "means that there will be increased public willingness to become involved in making decisions on which activities will be permitted and which denied, and on such matters as coastal zoning." Increasingly, development applications will be scrutinized by citizens' organizations as well as by official agencies. These groups will use such criteria as anti-pollution measures and the traditional conservation protection. But aesthetics will be the principal new criteria to be met: do we want this activity here? Another new criterion will be based on an increased breadth and intensity of concern with economics: this proposed development will affect my business. The most important change of all is the "growth of regional and nationwide governmental organizations dealing exclusively with coastal zone management affairs." The institutional environment must be the primary concern of a comprehensive management program. This framework "includes the forms of law, political institutions, and organizational mechanisms, that man must use..." Once this framework is established, it will be easier to attempt to improve the biophysical and socioeconomic environments.

The following planning descriptors and planning responsibilities must be considered in preparing a comprehensive plan for the Nassau-Suffolk wetlands.

Using comprehensive as a planning descriptor leads to:

- The entirety of Nassau and Suffolk Counties is the fabric for the planning process.
- Plan for the entire wetland complex, not just the wetland or bay.
- All functions and uses of the wetlands system are to enter into the process.
- All public and private interests should contribute to the planning process.
- Consider the effect of other plans of development.

By adding integrated to comprehensive as a planning descriptor leads to:

- For some wetland components, a single best use can be identified to everyone's satisfaction.
- Other wetland components could fill several different needs.
- If compatible uses can be made of the same area, this should be done.
- Wetland components for which incompatible uses are desired have to be scrutinized closely.
- The various use alternatives for these wetlands should be evaluated as to their impact on the productivity or usefulness of the entire Nassau-Suffolk wetlands complex.
- Priorities can be established for each of these alternative activities; they will involve trade-offs.

Considering who is to be responsible for development of the plan leads to:

- In most states, the state is looked to as the coastal zone planning agency.
- The New York State Division of Marine and Coastal Resources is developing a program.
- The New York State Department of Conservation has competence in resource evaluation procedures.
- Most programs of the Federal Government operate through state agencies.
- The Nassau-Suffolk Counties contain almost all of the remaining viable coastal wetland areas of the state.
- The Nassau-Suffolk Regional Planning Board is an existing planning agency with the Regional Marine Resources Council as its coastal zone arm.
- The towns, not the counties or the state, own the majority of the wetland areas.
- The town and village governments have the actual land-use planning and zoning powers.
- Some towns and villages are more advanced in their own planning for wetlands use than others.
- Local based planning is typically more acceptable to those affected than are plans developed at a higher level of government.
- The home rule system on Long Island may restrict or slow any attempt at a comprehensive approach to wetlands management.
- Successful planning may require a multi-level government effort.

- Above all, the towns should establish their positions as TRUSTEES of their wetland resources rather than as OWNERS of same.

### 2.4.6 Plan Implementation

No plan can be put into effect without being acceptable and practical or feasible. The acceptability or feasibility aspects apply to both the desired uses of wetlands and to the specific physical and nonphysical tools for management; that is, what you are going to do, as well as how you are going to do it. A plan must be feasible from technical, social, financial, political and legislative standpoints.

Technical Feasibility - Technical methodologies are advancing at a rapid pace. This involves such capabilities as restoring damaged wetlands to a natural condition, collecting and treating all wastes, and assigning values to the natural functions of wetlands. If the plan is not presently possible, future technological developments should be kept in mind.

Social Acceptability - The Nassau-Suffolk Regional Planning Board discussed citizen participation as follows: "It is up to you, the citizen, to see its (plan) implementation—to study it, discuss it, modify it if necessary, and urge its acceptance upon all those whose decisions affect the quality of life on Long Island" [33]. The backing, support, and acceptance of the general public is indeed required for the wetlands plan as a whole and for its individual implementation methods. But elected officials and government employees are also required to act to achieve implementation of an adopted plan.

Financial Feasibility - Monies are required to support a planning process and/or management program. Funds should be generated for both. There is a variety of of methods to obtain said funds [3, 23]:

Bond issues
General fund appropriations
Specific appropriations
U.S. Land and Water Conservation Fund Act - matching funds
Long Island Wetlands Act - matching funds and professional assistance

Political Feasibility - A comprehensive wetlands plan for the bi-county area will require support and cooperation of all political subdivisions involved. In the past there have been expressions of distrust by various government officials of other levels of government. The towns do not feel the state or federal agencies can or are doing a

sufficient job; the higher government levels view local actions as insignificant or questionable [21, 22].

Assuming complete understanding and acceptance by the various levels of government, a related problem remains. Town A may balk at the wetlands plan or specific portions of it because it only has a small fraction of the total wetlands of the area. It sees no reason to support a regional plan that concentrates on towns because it is adequately managing its own wetlands. Outside intervention is not needed.

These attitudes will have to be addressed and the questions resolved before implementation of a wetlands management plan is possible. The key decision-makers in each community and the various levels of government will be major determinants of the political feasibility of any wetlands plan.

Legislative Feasibility - Although the legislative aspects are intimately involved with the political feasibility, they can be discussed separately. There is a separation of powers to the federal, state, county, town and village levels. There is also an overlap of powers in some instances. Legislation can be used to clarify the roles of each level of government and the intergovernmental relationships as well.

New or altered governmental agencies, commissions, and boards are created by legislative action. If the plan and its implementation requires something outside the responsibility of an existing governmental agency, some type of legislative action would be required.

Legislation can grant certain powers to a governmental agency. Some of the powers and laws were discussed earlier in Section 2.4.4 under Legal Procedures.

## SECTION 3 - DATA COLLECTION AND RESEARCH NEEDS

During the analysis in Section 2, the most problem-relevant information and knowledge were introduced, assessed for adequacy and employed where feasible. Inadequacies in the current state of this required information and knowledge were cited in many places.

This section provides a brief recapitulation of these inadequacies, in terms of the data collection and research effort needed to rectify them.

- Wetlands classification and inventory. There is a high-priority need to develop a uniform, carefully-defined system for classifying wetlands and shoal areas, and to inventory the bi-county area in accordance with that system. The classification system and inventory should provide the fundamental basis for managing the wetlands, an area representing about 3-1/2 percent of the bi-county area's land surface.
- Ecology-productivity analysis of wetlands. There is a need to quantitatively evaluate the ecological contribution of Long Island wetlands by type and location. Wetlands are essential to the ecological integrity of the Long Island area. Specific rates of vegetative productivity and relationships of productivity to various fish species are needed to classify the wetlands.
- Understanding wetland values. There is a need to develop a comprehensive list of beneficial uses of wetlands and quantitatively estimate how specific Long Island wetland complexes provide these benefits. Without such sharpened understanding the quality of each wetland complex—how much it contributes to social, economic and environmental values—major decisions on the management, preservation, use, enhancement or development of these complexes will continue to be made on a semi-intuitive, semi-informed basis.
- Wetlands management. There is a high-priority need to develop improved ways, such as a comprehensive plan, of managing wetlands and shoal areas in the bi-county area so as to sustain and enhance

the benefits which justify their setting aside primarily for conservation and amenities purposes.

- Other related needs. Other data collection and research needs, indirectly related to wetlands and developed in other reports of this series, relate to eelgrass control, the screening of dredging applications, inventories of land use regulations and major development plans, usage of dredged spoil areas, predictive inlet models and the feasibility of land use management techniques.

In a later report in this series [1ℓ], all these needs are developed in greater detail, assigned relative priorities in relation to needs developed in other reports and incorporated into a proposed problem-oriented marine research program for Long Island.

## SECTION 4 - GUIDELINES

### 4.1 SOME BASIC CONSIDERATIONS

Coastal wetlands may be considered a highly evolved and productive living resource. Water flux is the important element in the complex makeup of a coastal wetland. Classical coastal wetlands may be divided into marsh, meadow and shoal portions. Natural functions of these wetlands may include hydrologic, hydraulic/hydrographic, sedimentary, oxidative, food productive and habitable functions. Wetlands are widely used, often with disregard of the natural functions, for such purposes as education and research, recreation, open space and aesthetics, transportation, residential/commercial/industrial development, resource extraction and waste disposal. Potential interactions and points of conflict for various uses and functions may be determined from the relationships between wetland characteristics, natural functions and human uses.

Wetlands are typically a dynamic system with natural changes typically due to a wave action, hurricanes, sedimentation, high winds, tides, and freshwater inflow. Many of the wetland changes are not natural but are man-caused, among which are dredging, filling, bulkheading, insecticide application, nutrient/pollutant loading and freshwater diversion. Interactions between wetland characteristics and alteration forces and methods may be depicted. A sequence of events may illustrate interrelationships of functions and uses with alteration methods and forces. Wetland losses were substantial from the mid-50's to the mid-60's, however, more recently the estimated loss rate appears to have decreased.

Wetland problems are many and are fucused on the following areas:

1. public participation/official commitment—without which management will proceed on a hit-or-miss basis,
2. ownership—little can be accomplished until wetland owners are identified,
3. funding—state and town funds are inadequate,
4. local control—problems include home rule ordinances, impermanent local laws, personal decisions and suspicion of regional agencies,
5. permits—a lack of provisions for enforcement, monitoring, and legal tort action prevail.

A comprehensive management scheme should consider all interactions among wetland complexes, preservation, development, restoration and creation of wetlands, while keeping in mind that few of man's coastal uses absolutely require a wetland site. The key elements of the management scheme include:

- a moratorium,
- a management-oriented wetlands classification system and inventory,
- an evaluation of the quality of each major wetlands complex geared to the degree to which it fulfills delineated natural functions and human uses,
- identification and evaluation of physical and non-physical wetlands management techniques,
- development of a comprehensive wetlands management plan integrating the inventory data, the quality evaluation, and the management techniques into a coherent plan,
- implementation procedures which can be used to actualize elements of an accepted plan.

## 4.2 WETLANDS GUIDELINES

CEM recommends that the MRC adopt the following guidelines and recommend them to the Nassau-Suffolk Regional Planning Board:

Policy and Planning Guidelines

- Consider most wetlands in the bi-county area to be worth preserving.
- Establish, as a minimum, a two-year moratorium on wetlands development (e.g., dredging, filling, building).
- Publically acquire the remaining privately-owned wetlands as rapidly as possible.
- Establish a regional land-use control authority for planning and management of wetlands in the coastal zone.

Research and Analysis Guidelines

- Design and develop a management-oriented wetlands classification system.
- Continue and expand the inventories of each wetland unit in both counties based on the characteristics established in the above classification scheme.

- Establish the value (quality) of each major wetlands complex according to the degree with which it fulfills a set of delineated natural functions and human uses.
- Identify and evaluate physical and nonphysical wetlands management techniques.
- Develop a comprehensive wetlands management plan that integrates the inventory data on wetland characteristics, the quality evaluation, and the management techniques into a coherent plan for the island's wetland system as a whole and its individual wetlands complexes.

Council Responsibility and Activity Guidelines

The MRC, in conjunction with other cognizant agencies should:

- Assume responsibility for wetlands planning activity for the bi-county region, and initiate efforts to secure technical and financial assistance from appropriate state and federal agencies to conduct this activity.
- Initiate and guide the design of a wetlands management plan and be ready for implementation of this program within two years.
- Provide a coordinating function, and sponsor meetings, hearings, etc., to obtain input from all interested parties on the goals and specific objectives of wetlands management.

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## APPENDIX B

## WETLAND STUDIES

There have been several classes of studies conducted concerning the wetlands on Long Island. Appendix B contains both a list of reports resulting from these studies and a descriptive summary of their contents.

### STATE OF NEW YORK: CONSERVATION REPORTS

The New York State Department of Environmental Conservation (DEC) has conducted a series of wetland studies since 1965 for various towns and villages on Long Island. A listing of the pertinent information on the reports which were published is included in Table B-1.

TABLE B-1

NEW YORK STATE CONSERVATION REPORTS

| Study Requested for: | Wetlands Studied | Publication Date | Reference |
|---|---|---|---|
| Town of East Hampton | All wetlands | July 1965 | 34a |
| Town of Southampton | Eastern Shinnecock Bay | December 1966 | 34b |
| Village of Great Neck Estates | Village-owned marsh | February 1968 | 34c |
| Village of North Haven | All wetlands | 1968 | 34d |
| Village of Nissequogue | Nissequogue River | May 1969 | 34e |
| Town of Southampton | Western Shinnecock Bay | September 1969 | 34f |
| Town of Brookhaven | Southern Mount Sinai Harbor | 1969 | 34g |
| New York City | Udall's Cove | November 1970 | 34h |

Reports are in prepublication stages for the remainder of the wetlands of Southampton, for Shelter Island, and for Stony Brook Harbor.

Requests for these studies were initiated by the various villages and towns or their Conservation Advisory Commissions. This is not a regularly scheduled

activity of the DEC. At the present time, funds and manpower are not available for other studies of this type.

The specific objectives of the reports are to describe the significant natural values, to evaluate man's impact on these values, and to recommend courses of action. The result is to assist the townspeople to better appreciate their valuable wetland resources and thereby be better able to manage them.

Most of these reports follow a similar format. The individual wetland units in the study area are discussed in terms of:

- General Description
- Wildlife, Animal Life or Biology
- Man's Impact
- Recommendations

The major area of concern of these reports is the wet portions of the wetland complex. The adjacent uplands are infrequently mentioned, but the use of these uplands is often presented. The reports in general are objective but qualitative, with few numbers or densities, rates, etc., being presented.

FISH AND WILDLIFE SERVICE: SPECIFIC REPORTS

The U.S. Fish and Wildlife Service has produced a series of letter reports on Long Island wetlands under the authority of the Fish and Wildlife Coordination Act. A tabular summary is given in Table B-2.

TABLE B-2

FISH AND WILDLIFE SERVICE: SPECIFIC REPORTS

| Wetlands Studied | Purpose | Date of Report | Ref. |
|---|---|---|---|
| Moriches and Shinnecock Bays | Waterfowl resources | 11/2/65 | 2f |
| Moriches and Shinnecock Bays | Waterfowl habitat replacement | 12/17/65 | 2g |
| From Halsey Neck to Hook Pond | Waterfowl resources | 8/15/67 | 2h |
| From Hempstead Bay to Shinnecock Bay | Fish and wildlife aspects | 6/16/69 | 2i |
| Great South Bay Region | Waterfowl resources | 6/24/69 | 2j |

These brief letter reports were submitted to the U.S. Army Corps of Engineers to provide information pertinent to COE project studies. Briefly the F & W Service reports are single purpose studies.

The three waterfowl resources studies [2f,2h,2j] were undertaken to:

1) establish the location, extent and comparative importance of feeding and resting areas as determined by waterfowl utilization, and
2) to determine the biological factors influencing desirability and use as a prelude to mitigating and compensating for damages caused by the project (Fire Island Beach Erosion Control and Hurricane Protection Project).

Aerial surveys and ground observations were used to obtain data on the waterfowl utilization of the various areas. The relative importance of the feeding areas was classified as outstanding, high, moderate, and unclassified on the basis of the census data. Maps showing the location and value of the habitat as waterfowl feeding areas are included. The outstanding and high value areas are discussed.

The waterfowl habitat replacement investigation [2g] had the following objectives:

1) to locate suitable areas for replacement of waterfowl habitat which might be lost as a result of the project,
2) to investigate and evaluate potentials for acquisition, development, and management of suitable areas,
3) to formulate recommendations for acquisition of areas with best replacement potential.

An analysis of possible project effects indicated that damage to waterfowl feeding habitat would mainly involve feeding grounds for dabbling ducks. Limited

possibilities in the project area for replacement habitat in the project area caused the field survey to take in all of Suffolk County. Criteria used to select potential development sites are listed in the report. Topographic maps, aerial photographs, Regional Wetland Inventories (to be discussed later), and knowledge possessed by F & W Service personnel were all employed to select potential sites. The following breakdown illustrates the selection process:

48 wetlands were reconnoitered,

28 wetlands were examined carefully, and

6 wetlands were selected as having the potential for development for replacement purposes.

Each of the six selected wetlands are thoroughly described in the report.

The preliminary report on the fish and wildlife aspects of Great South Bay and adjoining bays [2i] was prepared in cooperation with the New York State Division of Fish and Game. The purpose of the report was to provide information pertinent to the development of a plan of study for a survey being undertaken by the COE. This particular report is broader than the reports described above, and it bears some resemblance to the New York Department of Environmental Conservation town and village reports discussed earlier. The area is described in general terms, the effects of dredging and filling are noted, estimates of the value of the shellfishing, finfishing are provided as are estimates of waterfowl usage, number of duck hunters and bird watchers. Recommendations as to usage of the area are presented. Some information gaps are also identified.

The following is a description of wetlands Types 12-18 excerpted from Fish and Wildlife Circular 39 [2e]. Entered in parentheses, below each description, is an estimate of the order-of-magnitude acreage of that type of wetland in 1954 in the New York State Atlantic coastal area (45,395 total

wetland acreage). The estimates are derived from an interpretation of the data reflected in the circular and in a later wetlands report by Spinner [10] which provided additional data from the 1954 survey.

COASTAL FRESH AREAS

Type 12 - Coastal shallow fresh marshes. The soil is always waterlogged during the growing season. It may be covered at high tide with as much as 6 inches of water. These marshes are on the landward side of deep marshes along tidal rivers, sounds, and deltas. Vegetation consists of grasses (reed, big cordgrass, maidencane), sedges (carex, spikerushes, threesquares, sawgrass), and various other marsh plants such as cattails, arrowheads, smartweeds, and arrow-arum.

Nationwide, these shallow fresh marshes rate the highest of the nine coastal types in their importance to waterfowl. They are used moderately for nesting in the North Atlantic and Pacific Coast States, and they constitute the most used wetland type along the Gulf Coast during the winter season.

(N.Y. State Atlantic Coast - 6,500 to 9,000 acres)

Type 13 - Coastal deep fresh marshes. The soil is covered at average high tide with 6 inches to 3 feet of water during the growing season. These marshes occur along tidal rivers and bays, mainly on the Atlantic and Gulf Coasts. Vegetation is mainly cattails, wildrice, pickerelweed, giant cutgrass, and spatterdocks, often with pondweeds and other submerged growths in marsh openings. In the Gulf region, water-hyacinth, alligatorweed, and waterlettuce may produce surface mats.

More than 85 percent of the total of this type is found in Louisiana, where 422,000 acres are of primary importance to waterfowl and 984,000 acres are of lesser importance. This type, where suitable vegetation dominates, is used much in fall and winter by feeding waterfowl.

(N.Y. State Atlantic Coast - Less than 2,500 acres)

Type 14 - Coastal open fresh water. Included in this type are shallow portions of open water along fresh tidal rivers and sounds that are considered vulnerable to reclamation for agricultural or industrial uses. Vegetation is scarce, or absent, in stained or turbid waters. At depths of less than 6 feet, pondweeds, naiads, wildcelery, coontail, waterweeds, watermilfoils, and muskgrasses are common. In some localities of the Gulf region, water-hyacinth forms mats on the surface. (Water depth up to 10 feet; marshy border often present.)

Nearly four-fifths of the acreage is on the Louisiana and Texas coasts, where 92,600 acres are of primary importance to waterfowl and 54,200 acres are of lesser importance. This type, although not abundant along the North Atlantic coast, is particularly valuable wherever present.

It is also used heavily in the San Francisco Bay region.

(N.Y. State Atlantic Coast - None)

COASTAL SALINE AREAS

Type 15 - Coastal salt flats. The soil is usually waterlogged during the growing season. Sites vary from those submerged only by occasional wind tides to those covered fairly regularly with a few inches of water at high tide. These areas are on the landward side of, or as islands or basins within, salt meadows and salt marshes. Vegetation is often sparse or patchy and consists mainly of glassworts, seablite, saltgrass, and, in the South, saltflat grass and saltwort.

Many salt flats were too small and too intermixed with other coastal saline types to be included as a separate type in the inventory. This is particularly true in the North Atlantic States where all salt flats necessarily were bypassed. Salt flats do not assume much importance, except in the Puget Sound and San Francisco Bay areas where they are used for feeding. They are abundant on the Texas coast (351,000 acres), where 14 percent are of primary importance to waterfowl.

(N.Y. State Atlantic Coast - None)

Type 16 - Coastal salt meadows. The soil is always waterlogged during the growing season but is rarely covered with tidewater. These meadows are on the landward side of salt marshes or bordering open water. Vegetation on the Atlantic and Gulf coasts includes mainly saltmeadow, cordgrass, saltgrass, blackrush, and, in fresher parts, Olney threesquare and saltmarsh fleabanes. On the Pacific Coast, carex, hairgrass, and jaumea often are present. (Water depth may have a few inches at high tide.)

Salt meadows are used as feeding areas in both the production and wintering zones. The presence of shallow potholes greatly increases the value of these meadows.

(N.Y. State Atlantic Coast - 24,855 acres)

Type 17 - Irregular flooded salt marshes. The soil is covered by wind tides at irregular intervals during the growing season. These marshes are along the shores of nearly enclosed bays, sounds, and rivers on the Atlantic coast from Maryland southward, including the Gulf coast. Vegetation is dominantly needlerush. Pure stands of needlebrush make poor waterfowl marshes, but where wigeongrass occurs in ponds or channels within the marsh, adjoining growths of needlerush provide protective cover to feeding ducks. Because of this interspersion of Type 17 with open water, these irregularly flooded salt marshes usually rate fairly high in value. (Water depth has a few inches at wind tide.)

(N.Y. State Atlantic Coast - None)

Type 18 - Regularly flooded salt marshes. The soil is covered at average high tide with 6 inches or more of water during the growing season. These marshes are along the open ocean in eastern Virginia, southern South Carolina, Georgia, and eastern Louisiana. Elsewhere, the type is found

mostly along sounds. Vegetation on the Atlantic and Gulf coasts is mainly saltmarsh cordgrass. On the Pacific coast, alkali bulrush, glassworts, and arrowgrass dominate. Permanent open water in these marshes may support wigeongrass, eelgrass, or sago pondweed.

This type is used very much by feeding ducks and geese, particularly along the Pacific and North Atlantic coasts where food-abundant ponds are present.

(N.Y. State Atlantic Coast - 11,530 acres)

The F&W Service and the DEC also cooperate in evaluating the environmental impact of proposed dredging projects. As an example, a proposal to dredge in Great South Bay [2k] is discussed.

An area specific report from the F&W Service was jointly prepared with the New York State Division of Fish and Game and carries the earliest date of any of these reports [2m]. A State-Federal Planning Committee for Preservation of Long Island Wetlands was formed in 1957 to explore ways and means of preventing wetland losses.

The objectives of a program developed by this committee were to perpetuate waterfowl wetlands and habitat. The objective focused on the south shore bays of Nassau County. Procedures to accomplish the objectives were outlined [21].

The towns of Oyster Bay and Hempstead asked for a report with recommendations for preservation, development and management; the joint report [2m] resulted. The wetland complexes of the two-town area are first described in general terms. It was recommended in the report that the towns set aside a portion of their remaining wetlands and dedicate them to fish and wildlife conservation and use. "Participation by these towns will provide an exceptional opportunity to demonstrate to other Long Island communities how their wetland fish and wildlife and associated resources may be preserved and developed for present and future generations."[1/]

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[1/] A total of approximately 16,000 acres of wetland complex of the two towns were ultimately dedicated to conservation purposes by 1967. Only a few other towns have dedicated a small amount of additional wetlands at the present time.

The report then provides a good quantitative description of each of the 17 management units for the wetland complexes. The following descriptors were used for each management unit:

- size
- location
- ownership
- type composition
- present or planned use
- recommendations

FISH AND WILDLIFE SERVICE: GENERAL REPORTS

These are the reports that have stirred much of the action to preserve wetlands on Long Island. This group of reports began in the middle 1950's with a nationwide wetlands inventory to determine the extent, type, and value of the remaining wetlands of the U.S. The report "Wetlands of New York," [2b], was published in May 1954. The wetlands were classified into types on the basis of physical characteristics. This report lists the acreage of various types of wetlands for each county of the state. An estimate of the value of the wetlands to waterfowl was made.

A national report, "Wetlands of the United States," [2a], was published in 1956. Again, the primary concern was with the value of wetlands to waterfowl and other wildlife.

In 1955 the wetlands of high and moderate value to wildlife were resurveyed to determine vulnerability to destruction. The vulnerability was classified as estimated danger of destruction within five years, or within the foreseeable future, or safe from destruction. A 1959 resurvey considered all wetlands of the original survey because all wetland habitat had been found to be of value to many forms of wildlife. This survey resulted in "A Supplementary Report on the Wetlands of the Long Island Region," [2d], in March 1961. Data were presented

showing the wetland acreage destroyed between 1955 and 1959 as well as the change in vulnerability classification of the wetlands for each county.

A resurvey of these areas in 1964 resulted in "Supplementary Report on the Coastal Wetland Inventory of Long Island, New York," [2e], in June 1965. This resurvey covered all marshes and determined the location and acreages of coastal wetlands destroyed during the previous five years and ascertained changes in vulnerability. The pattern of wetland destruction and increased vulnerability found earlier was repeated.

The Fish and Wildlife Service was assisted by the New York State Conservation Department in the preparation of these reports. These two agencies often work together on various wetland problems. The personnel of this Federal and State agency have a considerable amount of data on Long Island wetlands. Unfortunately, their various publications don't contain all of this knowledge. In carrying out various aspects of their work they have visited or surveyed or measured valuable characteristics of most of the wetland complexes in this area. Some of these data have been mapped on topographic sheets.

OTHER DATA AND KNOWLEDGE

The above two agencies could well serve as the starting point for a complete wetlands complex inventory. Their primary coverage is the wetlands and shoal water areas. Data on the adjacent uplands are more scattered. Soils data are available in "Soil Interpretations: Inventory and Analysis," [35]. A detailed soils survey map of Suffolk County was prepared and is available for study. The report discusses soil associations, soil interpretations for specific uses, descriptions of the mapping units and a table in the appendix with estimates of the limitations of each soil for various uses.

Information on land ownership is scattered and difficult to obtain. A newspaper article [14] indicates that Nassau County has an up-to-date, all

inclusive uniform tax map which greatly simplifies title searching. In Suffolk County, there is no county map; the records are kept at the township level. Wetland ownership has been determined for the Town of Huntington but extreme difficulties have been encountered in obtaining accurate and complete records of ownership in other Suffolk County towns [1b]. There are some wetlands in both counties with indeterminate ownership; this should be cleared up if future management programs are to be totally effective.

The New York State Office of Planning Services[1/] has conducted a wetland study with the assistance of the DEC and has prepared a draft report, "Long Island Wetlands Study," [36], which has not yet been finally reviewed. The OPC or OPS has had its difficulties in the last few years. Essentially, this office performed a State planning function, however, defeat of several state bills by the New York legislature, budget restrictions, and an apparent negative feeling toward state planning by some local government units has resulted in a decrease in the overall effectiveness of the program of this office. The office was changed from the OPC to the OPS with a considerable budget and personnel cut. The effect of all this is to create quite a doubt as to the eventual publication of the above study.

Scientists from the State University of New York at Stony Brook are currently conducting a study [9] that is more along the lines of what is desired. This study could be the basis of a classification scheme. Some 125-150 wetlands are being inventoried in a brief survey. Data collected include such characteristics as location, area, topography, hydrography, biota mapping, water flux, the nature of the surrounding land and water areas, drainage, pollution, exposure to the sea, and a description of the natural and man-made changes that are taking place. These data could be used in a modelling effort to simulate environmental changes

[1/] Formerly the Office of Planning Coordination.

due to various forms of usage of the wetlands.

The Open Space Institute has completed five open space reports (with much emphasis on wetlands and estuaries as open space) for areas towns and villages. These reports were written for the confidential use of local government officials and were not available to the CEM staff.

## APPENDIX C

## WETLANDS MANAGEMENT TECHNIQUES

This appendix contains further discussion on the use of non-physical tools, namely the techniques of acquisition, zoning, legal procedure, permits and review. In general, there are several subdivisions of each technique. The best combination for wetlands management may vary with the characteristics (economic, geographic, etc.) of the particular political subdivision, so that a best mix of techniques for wetlands management appears to be from a regional standpoint.

### ACQUISITION

The full package of property rights need not be acquired in all cases. Conservation or scenic easements may be obtained for some wetlands. Another partial acquisition method, purchase of development rights, can be used. A community can buy easements of certain parcels of land, paying the land owner to keep the land in its undeveloped state. This payment is a differential between the market value of the property in its present use and its value if it were developed for more intensive use. A 1960 amendment to the New York General Municipal Law permits local governments to acquire "interest in open space and areas." One of the problems, however, is that if the municipality wants to use the land for public recreation or public access it would have to acquire more than just easements which this represents. Usually there is a disparity in the value of property for undeveloped uses and its value based on development potential, and the difference payable under this sytem is almost the same as owning it in fee simple absolute[1/] in most cases, so this alternative does not seem very palatable [37]. However, it may be more palatable to individual property owners

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[1/] Fee simple absolute is a fee simple that has no limitation, qualification, or condition affecting it and is the maximum possible ownership in real estate under system of property founded on the English common law.

and to the local community if the landowners retain some interest in their land. On this basis of community interest and relations, acquisition of scenic easements may be the preferred method to preserve wetlands.

The objective of the scenic easement is to maintain the use of land in something that approximates the use at the time of acquisition. It is also possible to purchase development rights. Both of these devices, easement and development right, imply coordination with real estate taxing authorities so that the assessed value of the property for tax purposes will reflect its reduced market value. These tools are used to gain control over the use of large tracts of land without resort to large cost or placing a burden on taxing units. Within urban areas there is relatively little difference in the price of easement and the ownership. The ownership, of course, is much more flexible [37]. Compensable regulation is another variant. The land is to be retained in an undeveloped condition as mapped and the uses are established. The property owners are guaranteed that they can sell their land on the open market and will receive a price at least equal to the value of the land before the regulations went into effect. Other forms are development charges, which are fees or taxes imposed on an owner to develop his land or as a tax on that privilege. This could be a value increase charge, a fill fee, or something similar [16].

In speaking about open space in Suffolk County, Koppelman [37] stated, "Implementation involves acquisition and continuing operation. ...Conservation--this segment of the plan can be implemented by donation, outright purchase, conservation easements, purchase-and-leaseback development right." In order of recommended priority- these techniques were listed as donation acquisition of development rights and outright purchase of the fee simple. It was also recommended, as an interim measure, that the towns place the lands intended for conservation use in the lowest-density residential zone to restrict undue speculation and misuse.

In response to the conflict between real estate and wetland preservation, the Oceanographic Committee of the Nassau-Suffolk Regional Planning Board [38] stated that those lands having definite conservation value should either be acquired by the public, or they should be preserved through various modern land development practices such as cluster zoning or density zoning or easements.

"The rate of destruction and trends in vulnerability during the past decade indicates that the coastal wetlands will be largely destroyed before any great percentage of the resource is preserved. The alternatives are either an accelerated acquisition program undertaken cooperatively by all the conservation agencies or early and massive dedication under the Long Island Wetlands Bill with guarantee of perpetuity" [2e].

Most acquisition programs in the North Atlantic Region are based on voluntary purchase rathern than eminent domain. Purchase is the most effective way of combating destruction. There are some constraints on it though: (1) lack of sufficient funding; (2) increased price of wetland. Cost-sharing with federal government might help. Dedication of privately-owned wetlands to public agencies has occurred and should be encouraged. Better tax reduction incentives could encourage this. Similar dedications by individuals to private agencies could be made [29].

State acquisition is often supplemented by acquisition by private conservation groups and federal agencies. Low levels of funding for land acquisition or regulation programs have often hampered state estuarine conservation activities. Use of U.S. Land and Water Conservation Funds for estuarine acquisition represents a significant potential funding source [24].

The Land and Water Conservation Fund Act of 1965 provides money for acquisition for fish and wildlife, and park and recreation purposes by administering agencies at federal and state levels. Once lands and waters have

been included in special reservations administered by federal government agencies, there is little likelihood that they will be removed from such reservation. When federal land is declared surplus, it is offered to other federal agencies, state and local governments before it is offered to private individuals or concerns. Where the legislative appropriating process is slow and tedious, some individuals and organizations of the private sector have demonstrated they can fill a void in acquiring needed fish and wildlife habitat. There appears to be little time left for decision makers in regard to acquisition of scenic and natural areas to be preserved. Techniques that involve a buy now, develop later approach seem indicated. Acquisition becomes more difficult as the need grows greater [2n].

New York has a multi-faceted program for public land acquisition and for conservation of lands and public ownership. Under the Park and Recreation Land Acquisition Bond Act of 1960, the State Conservation Department was authorized to purchase wetlands throughout the state, and did in fact acquire one tract of nearly 200 acres of tidal marsh. Under the Fish & Game Law, the state may purchase land from any source and under the Conservation Law the Water Resources Commission may take land by eminent domain [16,24].

Several states have initiated acquisition programs at a more intensive scale than New York's [3].

The Audubon Society and Nature Conservancy are active in purchasing and preserving significant parcels of coastal zone marshes. Save the Wetlands Committee, Incorporated, is also involved in this activity. Until requirements for wetlands are known, prudence requires that as much habitat as possible be preserved. Few mistakes are easier to undo than acquiring too much land. Major areas recommended for acquisition and development usually cost more than planners feel is available from federal, state, or local sources. On Long Island, present

county and town plans propose to preserve almost all of the remaining salt marshes and associated habitat. Whether or not the expense of carrying this out will be too high for the local communities to handle is, as yet, unanswered. The Regional Plan Association is quoted as saying "a new principle of open space acquisition should be accepted: immediate public purchase of all open space that will be needed by the region when it is fully populated..." This will be cheaper than buying later [23].

Money to maintain a program of management and exercise control through acquisition is one of the basic elements needed for a coastal zone management system. This requires money from both the federal and state level and is dependent on public support [39, Adams]. A wetlands acquisition program proposed in various federal bills in 1966 and 1967 used a value of $1500 per acre for Long Island wetlands [21,22].

Costs of acquisition were mentioned in several publications. Dollars for acquisition by governments may not be sufficient.

Lands acquired by the government can be sold by the government. Easements can be abandoned. By-laws can be repealed or modified at town meetings. Public lands can be developed publicly as well as privately. The mere fact of public ownership or other restrictions on development, while perhaps a necessary condition to inhibit development, is not sufficient under certain circumstances [20].

ZONING

The question of the appropriate government level at which zoning should be done has received variable comment. Traditionally, local governments have had the authority to regulate land use [3]. "Zoning should continue to be the responsibility of local government. ...Each county Planning Commission should be given review powers over critical areas such as the shoreline, adjacent wetlands, and proposed county parks." [33].

Town management has often been claimed to be ineffective. There is some recognition of the importance of estuaries and wetlands to fish and wildlife but town officials often give in to demands for building space and more estuarine habitat is lost. Building up the town tax base often rules out consideration of preserving natural open space. Planning for orderly development has been haphazard; the villages and towns control zoning and the officials of the local community are under pressure to rezone to accommodate industry and housing.

Elevating the zoning level may be more fruitful than leaving it to the local government units which have the short term outlook. Zoning of land use by direct exercise of the police power at the state level is effective when it is tied to specific resource problems which effect the public welfare. For example, in Virginia, zoning powers derive from the state whose responsibility it is to prepare a series of guidelines for the zoning of wetlands, shorelines, and shallows. Where local or regional zoning authorities fail to act in an adequate manner, the state should be prepared to assume zoning responsibilities directly [3]. Michigan also oversees local zoning of its delineated, coastal fish and wildlife area [54]. Zoning by its nature removes value from certain lands and transfers the value to other lands [2n].

No matter what the level of government is, town, county or state, there remain several obstacles.

There is a basic question facing all forms of land use regulations, as to what extent private property can be subjected to government controls. All regulations are subject to a test of reasonableness which has been defined in terms of four elements:

1) Is the regulation reasonably related to protectable legislative goals, such as health or safety?

2) Does the regulation provide equal treatment for similarly situated landowners? The presence of comprehensive planning

may be a major factor in the determination of discrimination between similarly situated landowners.

3) To what extent does regulation reduce use and value of the owner's property?

4) Does the regulation produce a benefit for the public which ordinarily would be acquired by condemnation?

In the sphere of land use regulation when economic and non-economic values have come into conflict, the economic value has most often been paramount. Traditional zoning in other forms of land use regulation have often proven to be ineffective but it is not for unavailability of techniques. One criterion for judging the effectiveness of land use regulation in our coastal and estuarine zone will be whether the regulation is effective over the full geographical range in which the problems exist [16].

There are other issues. A principal constitutional issue in such zoning laws or ordinances is whether the application of the law may amount to an uncompensated taking of property without due process of law. In addition, there is the traditional view of the courts that every property owner must be afforded--a reasonable range of alternative uses which he can make of his property. Most courts are reluctant to authorize the sterilization of land through zoning when a major purpose of the zoning regulation appears to be preservation of open space. Some efforts to use local zoning for coastal marshland preservation have encountered serious legal problems in several states [24]. The state of New York has held that zoning for purely aesthetic purposes may constitute a valid exercise of the police power. Wildlife and open space uses can be protected by town regulation [23]. But discriminatory zoning to achieve preservation objectives is often not the best solution to the conflict between home building or marina construction and wetlands preservation [38].

LEGAL PROCEDURES, PERMITS AND REVIEWS

With respect to legal procedure, some of the state laws designed to protect and conserve ecological values are briefly discussed below [3].

Maine - a wetlands control board passes on all removal, fill, dredging or sanitary sewage disposal proposals involving coastal wetlands.

New Hampshire - a Water Resources Board passes on all excavation removal, filling or dredging proposals.

Massachusetts - the Director of Marine Fisheries may impose such conditions as he deems necessary on dredging or filling operations to protect shellfish or marine fisheries. The Department of Natural Resources may restrict or prohibit dredging, filling, removing or otherwise altering or polluting coastal wetlands.

Rhode Island - the Department of Natural Resources may designate coastal wetlands or parts thereof, the ecology of which shall not be disturbed.

Connecticut - the Water Resources Commission regulates dredging of sand and gravel from lands under tidal and coastal waters. Shore erosion, navigation, and living resources must be considered. The Commissioner of Agriculture and Natural Resources will inventory all wetlands. Once inventoried, all draining, dredging, excavation, dumping and filling and erection of structures on lands designated as wetlands shall be regulated by the Commissioner.

New Jersey - the Board of Commerce and Navigation must pass on all plans for development of waterfront which involves construction or alteration of a dock, wharf, pier, bulkhead, bridge, pipeline or any other similar or dissimilar waterfront development. The Marshland Law was recently enacted.

New York - no expressed wetlands protection laws per se, but it requires considerations other than navigation in granting permits and leases. Department of Environmental Conservation is required to ascertain the probable effect on the use of navigable waters for navigation, the health, safety and welfare of the people, and the effect on the natural resources of the state likely to result from channel excavation or fill [16]. This is under New York Conservation Law 429B. (This law doesn't apply in Nassau and Suffolk Counties.)

Considering permits, the permit system regulation can set forth types of development permitted, can control locations and can designate shoreline locations. A comprehensive plan could be the basic regulatory document with permits issued on the basis of its objectives, standards and other provisions rather than criteria set forth in regulations implementing the plan [16]. A state agency could require permits, would review permit applications sent to other agencies, would

hold public hearings and could deny permits for uses detrimental to the public interest [19].

In California, interim permit controls over dredging and filling of coastal marshlands have been adopted by a Regional Agency to forestall development during the planning period of the agency's program [19]. In a report to the Governor on Virginia wetlands, Wass and Wright [3] recommend that the Virginia Marine Resources Commission, as the present legal lead agency for management of coastal resources, should be given the statutory authority to approve, modify or disapprove plans for all proposed modifications or alterations to coastal wetlands, whether governmentally or privately owned. Such modifications and alterations should include dredging, ditching, diking, filling, bulkheading, construction of piers and wharfs, and any other activities which effect the ecology of coastal wetlands or the estuarine flora and fauna associated with coastal wetlands [3].

Compliance with official use and management plans [15] can be considered a form of review. The county official map is a planning device that can preserve areas by declaration of public intent. The map is a declaration of public intent but it doesn't provide for compensation to owners who are adversely affected [37]. A variant consists of higher government review of local government action and veto if the local action is inconsistent with the higher government's adopted plan [15].

A major administrative factor is the need for effective enforcement against detrimental practices. The majority of government bodies can be classed as being basically regulatory, operational or advisory. Some activities are or should be regulated by an environmental construction and control team [38]. "The plan should serve as a guide to budgetary and planning decisions by all departments of county government. The counties should have the right of first refusal on any properties delineated on the plan for park or conservation uses. Local governments are urged to cooperate by not enacting zoning actions contrary to this purpose" [33].

## APPENDIX D

## WETLAND MANAGEMENT CONCEPTS

This appendix presents supplementary comments extracted from 20 selected sources pertaining to coastal zone management, particularly as it relates to wetlands. It is an extension of Section 2.4.5, Plan Preparation, in the main report.

The Marine Fisheries Commission stated in 1966 that policies for the use estuarine areas should be based on the natural resources and the many and varied human uses made of these areas [25]. In addition, five management guidelines are discussed:

1. Objectives
2. Inventory
3. Research
4. Controls
5. Action

The 1969 report to Congress on "Science and Environment," by the Commission on Marine Science, Engineering and Resources [16], states: "Just as land-use regulation has developed to an imaginative sophisticated art, so also must regulation of water use. Conservation and development are inseparable parts of the same planning and regulatory challenge facing our states and localities." In discussing a national program for the management and development of coastal waters and land, the same source lists the following functions of a Coastal Zone Authority:

1. Planning - Develop a comprehensive plan to coordinate use of the land and water resources.
2. Public Regulation - Effective management requires government action. Regulation and acquisition are possible means of implementing a plan.

3. Zoning - A regulatory tool which tries to minimize interference between users of resources in a community.
4. Regulation by Permit - Criteria are established for various types of use and development. Permits could be issued to allow these uses.
5. Acquisition - This could be easement or fee simple acquisition as an alternative to regulation through the above controls. "The first goal of coastal acquisition would be marshlands...".
6. Research - Effective management and understanding of the coastal zone requires a continuing program of monitoring, inventory and in-depth studies.

The summary report of the "Conference on Evaluation of Atlantic Coast Estuarine Zone" [26], in 1968, lists the following points among their conclusions:

1. No realistic means exist to quantify aesthetics.
2. Long term planning followed by sound action is the only approach to estuarine management for the benefit of all persons concerned.
3. Management should not be limited to habitat values.
4. Coastal wetlands should be retained in direct ownership (by government?) to preserve future options.
5. Zoning and legislative restrictions have limited value on preservation since they are stop-gap methods.
6. Because of the many variables involved, it is difficult to obtain an average dollar value for wetlands.
7. Some monetary values of estuaries may be useful in influencing legislators and other decision-makers.

8. Management objectives on development or preservation of estuaries must be stated in terms comprehensible to the decision-makers.
9. Modifications of estuaries should be approached conservatively.
10. The interchange of ideas among various disciplines is of major value.
11. A holding action to prevent immediate exploitation of an estuary may be activated by obtaining the highest possible evaluation of estuarine areas by all disciplines concerned.

At this same conference, George Spinner indicated that planning agencies found it difficult to get cooperation from conservation agencies in long-range land-use planning. The major problem appears to be a "narrow perspective resulting in the lack of long-range goals on the part of the conservation groups and the need for a system to compare broad term conservation values, both economic as well as aesthetic, with other uses of the coastal area." Roland Clement, in the same proceedings, indicates that an ecologist should learn "to identify his factors so well that he can state how much of an estuarine zone can be sacrificed to other uses without destroying the ecosystem." Later he advocates a full social accounting of proposed estuarine alternations that would involve "identifying the full range of values, and having them accepted as bona fide costs of production..." [26].

John Bivens [26] suggests taking "your message to those in position to do something about it", but the message must be in terms familiar to the person receiving it, instead of in the technologist's jargon. He also lists three basic phases for the planning process:

1) an inventory-data collection and analysis,
2) preparation of a comprehensive plan,
3) plan implementation with various tools and methods.

The inventory phase is an assessment of current conditions as they developed from past policies and practices. The collected data are analyzed and interpreted to determine the meaningful elements. The comprehensive plan is prepared on the basis of the analysis and interpretation. The following are components of the planning phase:

1) establish objectives,
2) clearly articulate the objectives,
3) involve as many people as possible in setting the objectives.

These components provide for evaluation of the planning phase, provide for a concensus to be reached, and provide a sense of involvement in the process. In addition, a balanced planning effort will account for both conservation and development in arriving at an equitable solution.

Dr. David Wallace views the situation as "the complex problem of balancing the multiple-use of our marine environment." In discussing some of these multiple uses he concludes that "ownership has been one of the critical matters in New York, both in terms of preservation and protection of our wetlands and of the development of our shellfish resources" [26].

A natural resource planner himself, Robert August feels that planners have not been "paying attention to how we implement what we suggest we are going to do and what we suggest is the right thing to do." He sees three types of knowledge as applicable to natural resources:

1) biological facts
2) political facts
3) knowledge of the political processes

August then develops a give-and-take method for natural resource decision-making based on the above knowledge; trade-offs based on mutually satisfying decision-making [26].

On the other hand, Bruce Wilburn feels that the conservationists can't win by playing economic games against a potential marshland developer [26]. He suggests starting with a set of objectives instead of with a value for an estuary:

1) Identify objectives that might be appropriate for the local community.
2) Test these objectives in the political arena to define priorities.
3) Formulate alternative uses of the estuary that are consistent with the high priority objectives.
4) Evaluate the costs and benefits associated with each alternative.

Given the interdependency and interactions that occur in the wetlands complex, Peter Hunt feels that "all parties affected must be considered en masse." As previous speakers suggested, he says the first step is to determine "the potential uses of an estuary or what needs can it fulfill for man." Given this shopping list of potential uses then describe the area or the system you are talking about. The remainder of his paper discusses benefit measurement. He questions "the validity of dollars as a unit of benefit" when determining the value of an estuary. Money has a different utility to different people, hence it may or may not be an acceptable measure of benefit, particularly those derived from public assets [26].

At the same conference [26], Dr. Niels Rorholm listed and discussed three needs decision-making requires in relation to coastal zone uses:

1. A goal:
   a) Might be stated in the broadest sense as the optimum economic and social development of people.

b) It has to be stated in relation to people.

c) Majority decisions aren't always best so it may be necessary to tell people what they need in the future.

d) It is also important to worry about closing out future options for long periods of time. Holding actions could be needed to keep options open.

2. Facts or data: the social and economic costs and benefits of various uses:

   a) Economic net value.

   b) Biological output.

3. A framework for analysis that recognizes the interactions between various uses and that also relates measures of output or value to the purpose of the investigation:

   a) A hydrographic and physiographic account of the resources--a quantitative and qualitative evaluation of the resources.

   b) List the possible uses and products of the coastal zone including the interactions.

   c) An accounting of the social-economic framework in which these resources are to be used.

   d) Devise an optimum combination of the various products and uses.

   e) Involve the local power structure in the planning and execution.

In a 1969 article, Eugene Odum applied some ecological concepts to the problems of multiple use [27]. The overall strategy of ecosystem development is "directed toward achieving as large and diverse an organic structure as is

possible within the limits set by the available energy input and the prevailing physical conditions of existence (soil, water, climate, and so on)." Nature's strategy is directed toward a mature state with a high ratio of total biomass to production. Man's usual strategy is to achieve the inverse of this ratio (high production) by developing and maintaining early ecosystem types and stages. When viewed in the context of multiple-use, it is impossible to optimize both strategies at the same time and place. The multiple-use problem is to compromise some way in achieving the characteristics listed in Table D-1.

TABLE D-1

CONTRASTING CHARACTERISTICS OF ECOSYSTEMS*

| Young | Mature |
|---|---|
| Production | Protection |
| Growth | Stability |
| Quantity | Quality |

*After Odum [27]

There are two possible solutions indicated. The first is to provide for moderate or intermediate levels of each of the six characteristics from all landscape units. Odum refers to this as compromise. The second solution is to compartmentalize the landscape to simultaneously maintain both young and mature systems as separate units. Odum continues the compartmentalization concept several more steps to reach the multiple-use system depicted in in Figure D-1 which links growth-type, steady-state, and intermediate-type ecosystems with urban and industrial systems.

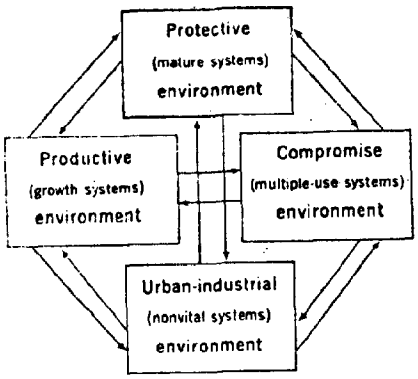


Figure D-1. Compartment model of the basic kinds of environment required by man, partitioned according to ecosystem development and life-cycle resource criteria.[1/]

[1/] After Odum [27].

In a 1961 article, Odum [4] stresses three points in reference to biotic production of estuaries:

1) "Because of the importance of tidal action in nutrient cycling and production, the entire estuarine system, including marshes, flats, creeks and bays, must be considered as one ecosystem or productive unit."

2) "Emphasis on management but be on utilization rather than on production." There are two courses of action we may take to derive more from estuaries:

   a) simplify the food chain so as to derive more of the most readily harvestable products, or

   b) learn to harvest what comes naturally.

   He feels we need a little of both approaches.

3) "Some sort of unified planning is overdue. Estuarine conservation districts established for areas having a natural unity is one answer. These could be modelled after the highly successful soil conservation district program..."

Dr. John Krutilla [39] feels that a comprehensive management system should be more than an implementing device. Basically, the decision process needs to present the right questions in a criteria context. This can be achieved by:

1) raising basic policy issues,
2) generating objective data and knowledge,
3) assessing the consensus of the community where subjective values are concerned.

The Marine Resources Committee of the Atlantic Waterfowl Council initiated a project under the directorship of George Spinner to devise a plan for the Atlantic coastal zone marine resources [23].

The specific purpose of the project was to:

1) collect all available resources data for the Atlantic coastal zone and put them in a usable form for planners and decision-makers;
2) provide some guidelines for site selection for various coastal zone uses in such a way that excessive amounts of valuable marine resource habitat wouldn't be destroyed.

Spinner quotes Richard H. Pough as follows: "Clearly identify the remaining crucially important high yield areas that must not be disturbed, to publicize their location, and ask for the cooperation of industry in avoiding them."[1/]

The report discusses a procedure to determine the amount of natural habitat to preserve for all uses:

1) Establish the need for the various marine resources expressed by current and estimated future demands.
2) These expressed needs can be translated into acreage and dollar requirements.

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[1/] The writer feels that the resultant plan did not achieve any of these three purposes.

3) The availability of suitable areas is a limitation.

4) Consideration must be given to alternative uses of this available space.

The required decisions among the alternative courses of action could be based on:

1) Monetary values--fiscal decisions that are narrowly political with little reference to biological values.

2) Conservation of remaining resources.

3) Allocation of management responsibility.

What is required is a method that accounts for all habitats and all uses, present and proposed, and which evaluates a proposed change by its effect on the entire wetlands system. Biological, sociological, and economic information and data would have to be collected. All uses must be described and the limits of both quantity and quality must be circumscribed:

1) Consider shifting demand.

2) Determine multiple-use opportunities.

3) Consider the changing total environment.

4) Determine the impact on the environment.

The Spinner report culminated in a series of maps [10] depicting areas which should be preserved for future generations until further study indicates how many can be safely used for other purposes. Complete preservation of all remaining areas was considered impractical. The advice and counsel of public and private conservation organizations aided the selection of areas for preservation. These areas are shown on the maps of Folio 18 which accompanied the report. The areas "are not further identified because this might affect present or future acquisition proceedings. Their inclusion indicates their importance in the overall conservation plan. ...For planning purposes from the conservation

standpoint, it shouldn't be necessary in the foreseeable future for any development to infringe on any coastal wetlands shown on the maps."

Goals of marsh management are discussed in a report on wetlands of Virginia [3]. "The obvious aim of a management objective is to do that which produces the most benefit, tangible and intangible, to the most people." Most of Virginia's marshlands are privately owned. Control of the productivity of these wetland complexes is largely determined by private owners who have their own ideas of what constitutes best use. "In the absence of public ownership, public benefits or rights are rarely given major importance in planning and management."

The current accelerating trend of alteration of Virginia's wetlands will ultimately lead to the loss of these irreplaceable resources.

> Such a loss is needless and can be averted through careful evaluation and planning (emphasis added). Before wetlands are altered, all pertinent values must be examined and the decision based on the impact of alteration to the public as a whole. It is folly to destroy wetland which has a high value and significant public importance and put in its place housing or industry. The value of a marsh must not be computed solely in the cold monetary values of the economist but must also consider the right of the public to enjoy a marsh, the ecological importance of marshes, the benefits the economy derives from marshes and which could not otherwise be had, and that the swapping of a unique resource for the commonplace is hardly a good bargain. Unless it can be shown that there is no alternative site for the proposed alteration and that the overall benefits from alteration far outweigh the disadvantages, it should not be tolerated.

A report on wetlands of Maryland [40] suggests that improved coordination between resource management agencies and their programs could better balance development against destruction of natural environmental values. "Improved wetlands management might be realized by formally organizing the appropriate agencies from all levels into a staff level management advisory committee." The purposes of the advisory committee would be to:

1) coordinate inputs,

2) provide for exchange of viewpoints and information,

3) insure effective communications.

An effective conservation program to protect Connecticut's remaining tidal marshes should attack the problem on many fronts [41]:

1) Get as much wetlands as possible into the hands of suitable private conservation groups and government agencies.

2) The wetlands in public ownership should be protected through vigorous action.

3) Control of dredging and filling will require continuous action.

4) Real estate development should be excluded from tidal wetlands by zoning.

5) A long-range education program for the general public is essential.

In Appendix U of the North Atlantic Region Water Resources Study [29], the following major causes of wetland destruction are listed:

1) Lack of understanding of the values and significance of wetlands.

2) Economic pressures for development.

3) The short-range planning of local government.

In a 1968 issue devoted to estuaries, the Conservation Foundation Letter [30] indicates a "need for action now based on present knowledge and wisdom if we are to save and manage our estuaries in the long-range public interest." Estuaries will continue to be developed but this doesn't have to be the "same old haphazard and unplanned development." The following specific actions were listed:

1) "Every coastal state should declare a moratorium on tampering with major estuaries and at the same time create conservation and development commissions--

   a) to study each estuary,

   b) prepare a comprehensive and enforceable plan for the estuary,

   c) and then present the alternatives to the people and local governments involved."

2) "Conservation and environmental values in general should be included in determining if permits shall be issued for dredging and filling of estuaries."

3) "A national inventory of estuaries should be undertaken to determine which ones should be included in a nationwide scheme of protected estuaries."

4) "Customary techniques of computing cost-benefit ratios should be reassessed...We remain at the mercy of development accounting which measures costs against benefits without including the cost of degrading the environment or the benefits of leaving the environment alone."

The League of Women Voters [19] discussed estuarine protection under the following headings:

1) Effective Administration

   a) Coordination of government agencies

   b) Control through various types of authority

   c) Adequate funding for programs

2) Public Policy

The discussion of public policy is pertinent to this presentation on planning and goals of management. A clearly defined and enunciated public policy on estuarine protection could be helpful if adequate provisions are made for implementation of the policy. "Estuarine protection does not automatically mean locking up an area and preventing development; there are compatible uses." But, "every estuary need not fulfill all possible uses." A careful study of each estuary can determine compatible and incompatible

uses. "Multiple uses will not everywhere be the best use. Reserving some estuaries for particular purposes will preserve environmental variety and prove a sounder economic decision than uncontrolled urban and industrial development for all estuaries... Public policy need be neither preservation of all estuaries not already severely damaged--and their restoration to pristine purity--nor exploitation of all estuaries for the fastest, largest economic return." It can be to provide for many of the conflicting demands.

"The chief obstacle to putting a feasible public policy into effect is the difficulty of reaching an acceptable compromise between private rights and expectations and the collective interest of the public" [19].

In a report on the economic aspects of the coastal zone [20] are some specific references to planning for marsh development. "Decisions as to marshland development are now controlled primarily at a local level and few towns have formulated clearly defined and agreed upon goals for long-range development. They thus act on a case-by-case basis with little or no attempt to view the individual cases as part of a larger pattern."

The significant uncertainties associated with marshland values suggests that all proposals to develop wetland complexes "should be subjected to searching scrutiny." A marsh that is filled or dredged for development has lost its natural values, perhaps forever, perhaps for fifty years or more. "If we eschew development and leave the marshlands in their natural state pending our gaining better understanding of the true worth of marshlands, we have not foreclosed later development."

Proposals to develop marshland should take full account of the irreversible aspects of these projects. "Developers should take full account of the adverse effects upon the public good as well as the positive benefits to be achieved. Projects should not be approved when there is an alternative possible, even if the latter were somewhat more costly."

A purpose of planning is to solve the social problem of how to maximize the net present value of all the projects and not simply to maximize the net present value of each individual project.

In a paper on mosquito--wildlife associations of coastal marshes, Ferrigno [31] suggests, "Probably the most significant association is not a biological but a social one. Cooperation of the different agencies involved is the best approach to the multiple use of our marshlands. Cooperation not only helps to understand one another's problems, but provides the knowledge of experts from the different fields, and encourages results acceptable to all interests." In a later paper [32], he reemphasizes the point, "Skillful management can best be achieved through well-coordinated programs based on the knowledge of salt marsh ecology and effects of man-made changes on these ecosystems."

In the National Estuary Study [2n], it is pointed out that each of the three federal studies of estuaries have concluded the national interest could be best served by "reinforcing the planning ability of the several states... The charge given to state planning is similar to the directives given to comprehensive land and water resource planning agencies. It is assumed that the state... will present a uniform, rational statement which takes into account all the competing interests in the finite estuary resources possessed by that state. However, this plan "will very much reflect the political strength of the competing clientele groups at the state level... The state plan will also be under severe pressure to reflect the more provincial development goals of some sub-state regions."

Perhaps the most comprehensive overview of estuarine planning and management is presented by Ludwigson in the Environment Reporter [15]. The following summary of his monograph will close out this general discussion of the wetlands planning process.

"Multiple usage is a firmly entrenched concept along our coasts. The idea of restoring a pristine environment there ranks with the establishment of a continuous coastal industrial belt as pure pipedream."

America's future coastal zone will be managed. This "means that there will be increased public willingness to become involved in making decisions on which activities will be permitted and which denied, and on such matters as coastal zoning." Increasingly, development applications will be scrutinized by citizens' organizations as well as by official agencies. These groups will use such criteria as antipollution measures and the traditional conservation protection. But aesthetics will be the principal new criteria to be met: do we want this activity here? Another new criterion will be based on an increased breadth and intensity of concern with economics: this proposed development will affect my business. The most important change of all is the "growth of regional and nationwide governmental organizations dealing exclusively with coastal zone management activities."

The institutional environment must be the primary concern of a comprehensive management program. This framework includes the forms of law, political institutions, and organizational mechanisms that man must use. "Once this framework is established, it will be easier to attempt to improve the biophysical and socioeconomic environments."

Ludwigson's report contains an appendix on a proposed national estuarine pollution program. While this is not the main interest (national or pollution) of the current study, there are many applicable points in that appendix. The proposed program also recognizes the primacy of state responsibility. There are seven elements of a comprehensive program:

1) Mutually agreed-upon policy, objectives and functions.

2) Legislative authorization for functional activities.

3) Development of basic knowledge needed for effective management.

4) Provisions for planning and implementation.

5) Active administration in terms of regulation, control and coordination.

6) Financial and manpower resources.

7) Public awareness and acceptance.

The best use of the wetlands complex can be achieved through a balanced program which should:

1) encourage economic development and resulting land uses so as to preserve the maximum of the resources and to insure the largest number of beneficial uses;

2) give preference to estuarine-dependent land use over uses that don't require shoreline locations;

3) conserve the environment to sustain and enhance the nursery value, wildlife habitat value and commercial fisheries value;

4) develop and provide access for outdoor recreation and aesthetics;

5) reduce the adverse effects of man's use to an acceptable minimum;

6) accept preservation as one means of providing an opportunity for future options.

A program of management for the coastal zone should be based on the following objectives and guidelines:

1) The views of all interests should receive equitable consideration in management decisions.

2) Adequate planning is necessary. This can be based on an optimum resource utilization scheme for each area based on objective value identification and appraisal. This would require:

a) the determination of specific uses for each wetland component, and

b) the determination of comparative values.

The following criteria must be considered in determining the value of a specific use:

a) multipurpose use,

b) preservation of habitat essential to living resources,

c) use for estuarine dependent activities,

d) conservation of non-renewable resources.

3) Implementation.

4) Service activities to assist planning, regulation, and use.

5) All levels of government should participate in management.

With regard to the various levels of government and the interests mentioned above, Ludwigson discusses the responsibilities of the various government levels and interest groups. The state's residual sovereignty flavors the apportionment of responsibilities. In general, the state:

1) retains primary authority and responsibility for the prevention and control of water pollution;

2) holds title to wholly or partially submerged lands and is responsible for their administration;

3) possesses primary authority (directly or through local governmental units) to decide uses of shorelines and adjacent uplands;

4) determines authority of local governments;

5) controls exploitation of fisheries and other living resources;

6) decides interstate cooperation;

7) presides over the common law.

The state has immediate responsibility to:

1) implement water quality standards;

2) use existing authority to halt or minimize undesirable physical modification of estuaries;

3) coordinate the management program;

4) evaluate the impact of upstream resource development on the estuarine zone;

5) review the jurisdictional relationships between state and local government units dealing with land-use planning;

6) review wetland management capabilities of state and local government units to strengthen effectiveness;

7) formulate and put into operation a comprehensive program for estuarine management.

Some of the long-range responsibilities of the state involve an extension of the above responsibilities. Other state responsibilities in the comprehensive planning area include:

1) preparation of an official use and management plan for each estuary--

a) use public hearings at critical stages in the process,

b) coordinated with other government agencies and interests,

c) coordinated with management plans for other resources and areas;

2) clarify questions about title and land-use regulation through legislative and judicial proceedings.

Although local government units are the major interface between people and government, they have often had little input to comprehensive coastal zone

planning. "For the most part local governments have not made a significant contribution toward bringing about balanced uses of the estuaries and their related land resources... The local governments, inadequately staffed and frequently too small to encompass an entire estuarine area, lacking funds, and receiving little guidance, coordination, and supervision from the states, often have been subjected to severe economic and political pressures to proceed with unplanned or limited purpose development (emphasis added) without an adequate appraisal of the long-range adverse impacts on the estuarine and coastal environment."

A more effective role for the local government units would include:

1) sounder land and water use planning and zoning,
2) active participation in regional, state and federal management programs,
3) various implementation practices.

The various public and private interests should be involved in political and governmental processes to support and implement a sound management program. They can also:

1) appraise and improve the government management program,
2) give advance considerations to the effects of any actions they might propose on other uses.

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