CHARLOTTE HARBOR
AQUATIC PRESERVES MANAGEMENT PLAN

Cape Haze, Gasparilla Sound-Charlotte Harbor,

Matlacha Pass and Pine Island Sound

Aquatic Preserves

Adopted May 18, 1983

Department of Natural Resources

This page intentionally
left blank

CHARLOTTE HARBOR
AQUATIC PRESERVES MANAGEMENT PLAN

Adopted

May 18, 1983

By the Board of Trustees of the Internal

Improvement Trust Fund

Governor	Bob Graham
Secretary of State	George Firestone
Attorney General	Jim Smith
Comptroller	Gerald A. Lewis
Treasurer	Bill Gunter
Commissioner of Agriculture	Doyle Conner
Commissioner of Education	Ralph D. Turlington

Dr. Elton J. Gissendanner, Executive Director
Department of Natural Resources

Division of Recreation and Parks

Bureau of Environmental Land Management

Preparation of this report was primarily supported by a grant from the U.S. Office of Coastal Zone Management, National Oceanic and Atmospheric Administration, and, the Florida Department of Environmental Regulation, the Office of Coastal Management, through the Coastal Zone Management Act of 1972 as amended.

This page intentionally
left blank

STATE OF FLORIDA

BOARD OF TRUSTEES OF THE INTERNAL IMPROVEMENT TRUST FUND

RESOLUTION

WHEREAS, the Board of Trustees of the Internal Improvement Trust Fund is charged with the acquisition, administration, management, control, supervision, conservation, protection, and disposition of all lands title to which is vested in the Trustees under Chapter 253, Florida Statutes; and

WHEREAS, Chapter 258, Florida Statutes, directs that state-owned submerged lands within aquatic preserves be set aside forever in their essentially natural or existing condition for the benefit of future generations; and

WHEREAS, the Trustees are charged with the adoption and enforcement of reasonable rules and regulations to carry out the provisions of Sections 258.35 through 258.46, Florida Statutes, regarding the regulation of human activity within the aquatic preserves so as not to unreasonably interfere with lawful and traditional public uses of the preserves; and

WHEREAS, Section 16Q-20.13, Florida Administrative Code, mandates the development of management plans for aquatic preserves; and

WHEREAS, the Trustees desire to serve the public by effectively planning, managing and protecting aquatic preserves; and

WHEREAS, the Trustees recognize the importance and benefits of protecting the natural resources and preserving the natural ecosystem of the aquatic preserves

This page intentionally
left blank

in the Charlotte Harbor area, and

NOW THEREFORE BE IT RESOLVED that the Board of Trustees of the Internal Improvement Trust Fund hereby adopts the Charlotte Harbor Aquatic Preserves Management Plan; and

BE IT FURTHER RESOLVED that the Trustees designate the Cape Haze Aquatic Preserve, the Gasparilla Sound-Charlotte Harbor Aquatic Preserve, the Matlacha Pass Aquatic Preserve and the Pine Island Sound Aquatic Preserve as "wilderness preserves", wherein the primary management objective will be the maintenance of these ecosystems in an essentially natural state; and

BE IT FURTHER RESOLVED that the Charlotte Harbor Aquatic Preserves Management Plan shall serve as a fundamental policy guideline for the Trustees and other state and local agencies having jurisdiction relative to maintaining the Charlotte Harbor Aquatic Preserves system, and shall provide the overall policy direction for the development and implementation of all administrative rules and programs related to the management of state-owned submerged lands within the Cape Haze, Gasparilla Sound-Charlotte Harbor, Matlacha Pass and Pine Island Sound Aquatic Preserves; and

BE IT FURTHER RESOLVED that the Department of Natural Resources, Division of Recreation and Parks, is hereby designated as agent for the Trustees for purposes of aquatic preserve planning and management.

IN TESTIMONY WHEREOF the Board of Trustees of the Internal Improvement Trust Fund have hereunto subscribed their names and have caused the Official Seal of the Board of Trustees of the Internal Improvement Trust Fund to be hereunto

This page intentionally
left blank

affixed in the City of Tallahassee, the Capital, on this the 18th day of May, A.D., 19 83.

Governor

Secretary of State

Attorney General

Comptroller

Treasurer

Commissioner of Education

Commissioner of Agriculture

(SEAL)
Board of Trustees of the
Internal Improvement Trust
Fund

As and Constituting the State of
Florida Board of Trustees of the
Internal Improvement Trust Fund

This page intentionally
left blank

TABLE OF CONTENTS

This page intentionally
left blank

Table of Contents (Continued)

This page intentionally
left blank

Chapter I

INTRODUCTION

This management plan addresses the four aquatic preserves (Cape Haze, Gasparilla Sound-Charlotte Harbor, Matlacha Pass, and Pine Island Sound) in the Charlotte Harbor estuarine system (Figure 1) in southwest Florida, approximately 80 miles southeast of Tampa Bay and 80 miles west of Lake Okeechobee. The surface water area of the four aquatic preserves encompasses over 200 square miles or approximately 90% of the surface water area in the Charlotte Harbor estuarine system. The entire estuarine complex is within Charlotte and Lee Counties. The incorporated cities in the area include Cape Coral, Ft. Myers, Punta Gorda, and Sanibel, and the unincorporated area of Port Charlotte.

The estuarine complex is bordered on the west by a chain of barrier islands, which include: Gasparilla Island; Cayo Costa; North Captiva Island, Captiva Island; and Sanibel Island, north to south respectively. Pine and Little Pine Islands lie between Pine Island Sound and Matlacha Pass, somewhat east of the middle of the southern half of the complex. Within the entire complex are thousands of islands, many with no upland area. Mangrove trees are by far the most dominant vegetation of the estuarine complex. Extensive marine grassbeds are found in the shallow bays and sounds.

The climate in this region is subtropical, with an annual rainfall of approximately 53 inches. Generally, the majority of this rainfall occurs between June and September (Taylor, 1974). The area's spring season is

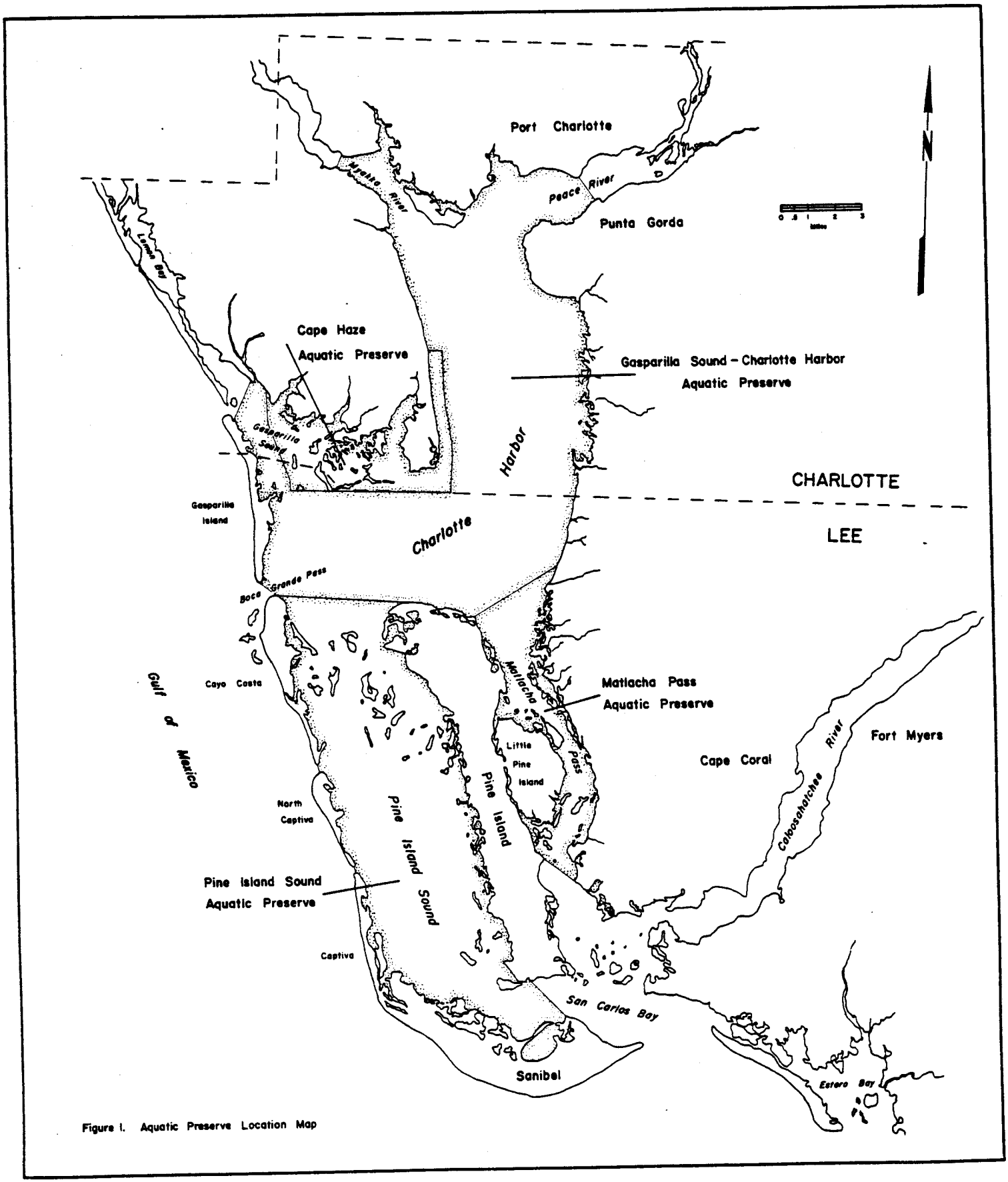

Figure I. Aquatic Preserve Location Map

generally dry with little or no rainfall. This area, along with south Florida in general, has experienced drought periods, with the years of 1981-1982 being one of the worst. This part of the state has generally less rainfall than the rest of the state. The subtropical climate is an important factor for the great diversity of animal and plant life within the Charlotte Harbor area.

The Charlotte Harbor estuarine system may be subdivided into smaller regional or local waterbodies. These waterbodies include Charlotte Harbor (proper), Gasparilla Sound, Matlacha Pass, Pine Island Sound, and San Carlos Bay. The three major tributaries supply freshwater to the estuarine system, the Caloosahatchee, Myakka, and Peace Rivers, and there are two major connections (Boca Grande Pass and San Carlos Bay) to the Gulf of Mexico, plus several smaller passes. The Charlotte Harbor estuary has been described as the least contaminated estuary system in the state of Florida (Wang and Raney, 1971.)

The Estero Bay Aquatic Preserve has been omitted from this plan due to its geographical and hydrological separation from the Charlotte Harbor estuary. The Estero Bay area is also distinctively different in the type of development pressures it receives and will receive in the future.

This plan was written by the Department of Natural Resources, Division of Recreation and Parks, Bureau of Environmental Land Management staff. Funding for the plan was by a coastal management grant (CM-44) through the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of Coastal Zone Management, and the Florida Department of Environmental Regulation, Office of Coastal Management.

These four aquatic preserves are designated and managed as wilderness preserves. The basis of the overall management will be on maintaining the existing wilderness condition. As more information becomes available site specifically, essentially natural conditions shall be identified and resources restored to that condition where possible.

This plan advocates multiple use approach to management due to the extensive and diverse uses within the four aquatic preserves. The uses include boating, fishing, swimming, commercial fishing, and bulk petroleum storage terminal facilities. The nature of these various uses, as such, have a tendency to cross the artificial boundaries of the four aquatic preserves. These similar geographical and ecological characteristics of the four aquatic preserves within the Charlotte Harbor estuarine system promote management of the four preserves under the direction of one plan.

Due to the current limitation of onsite staff resources, the aquatic preserve management program in these four aquatic preserves will be restricted in the scope of operations. Field personnel will be borrowed from the Charlotte Harbor and Cayo Costa State Reserves on an interim basis. However, the program will fill the need for active management in the preserve and should provide the framework for future program growth. The administrative support for this management program will be the Division of Recreation and Parks, Bureau of Environmental Land Management's staff in Tallahassee known as the "central office". Onsite experience and additional resource information will likely require modifications, (i.e., additions and deletions) of the program and plan, and both are designed to accommodate such changes or at least identify areas needing improvement.

Initially the resource inventory will be heavily dependent on the Department of Transportation (DOT) vegetation and land use mapping, and existing scientific and other literature. As the program proceeds with the presence of onsite managers, a better knowledge of the resources within the preserves and how man interacts and affects them will develop.

This plan is divided into chapters according to their management application. Chapter II cites the authorities upon which this management program and plan are built. Chapter III (Major Program Policy Directives) highlights the major policy areas that are within this plan. Chapter IV presents a brief resource description in overview with a brief description of the contents of the appendices which have more detailed information on the resources.

Chapter V presents the management objectives of both the onsite managers, which actually work in the preserves and the administrative staff in Tallahassee.

Chapter VI (Management Implementation Network) not only addresses the inter-government applications of how this plan will interface with local, regional, state, and federal agencies and programs but also with nongovernment organizations, interest groups, and individuals.

Chapters VII through IX address the various uses, from public to private to commercial. Chapters X and XI address the use of the aquatic preserves for scientific research and environmental education, respectively.

Chapter XII (Identified Program Needs) is an internal management correction section identifying problems and needs in the progressive improvement of the aquatic preserves management plan.

Chapter II

MANAGEMENT AUTHORITY

Chapter 258, F.S., clearly establishes the proprietary management overview role of the Governor and Cabinet, sitting as the Trustees of the Internal Improvement Trust Fund. Throughout this Plan, the Trustees of the Internal Improvement Trust Fund are variously referred to as the "Trustees" or the "Board". Furthermore, all management responsibilities assigned to the Trustees by this plan may be fulfilled directly by the Governor and Cabinet or indirectly via staff or agents of the Trustees, pursuant to delegations of authority, management agreements, or other legal mechanisms. All subsequent references to the Board or Trustees should, therefore, be presumed to potentially include staff and designated agents, in addition to the Governor and Cabinet.

In many respects, the authorities currently available supporting aquatic preserve planning and management are the cumulative result of the publics' awareness of the importance of Florida's environment. The establishment of the present system of aquatic preserves is a direct outgrowth of public concern with dredge and fill activities rampant in the late 1960's.

In 1967, the Florida Legislature passed the Randall Act (Chapter 67-393, Laws of Florida), which set up procedures regulating previously unrestricted dredge and fill activities on state-owned submerged lands. That same year the Legislature also provided statutory authority (Section 253.03,F.S.) for the Board of Trustees of the Internal Improvement Trust Fund (the Governor

and Cabinet) to exercise proprietary control over state-owned lands. In 1967, this governmental focus on protecting Florida's productive estuaries from the impacts of development led to the Governor and Cabinet imposing a moratorium on the sale of submerged lands to private interests. In that same year, this action was followed by the creation of an Interagency Advisory Committee on Submerged Lands Management. In late 1968, that Committee issued a report recommending the establishment of a series of aquatic preserves. Twenty-six separate waterbodies were addressed in the original recommendation.

Also in 1968, the Florida Constitution was revised, declaring in Article II, Section 7, the state's policy of conserving and protecting the natural resources and scenic beauty of the state. That constitutional provision also established the authority for the Legislature to enact measures for the abatement of air and water pollution.

It was not until October 21, 1969 that the Governor and Cabinet acted upon the recommendations of the Interagency Advisory Committee and adopted, by resolution, 18 of the waterbodies as aquatic preserves. Other preserves were similarly adopted at various times through 1971.

Prior to the October 1969 action by the Governor and Cabinet, the Legislature had created the Boca Ciega Aquatic Preserve. This was followed by Legislative action in 1972, 1973 and 1974, creating the Pinellas County, Lake Jackson and Biscayne Bay Aquatic Preserves, respectively.

In 1975, the Legislature established a Florida Aquatic Preserve Act

(Codified in Chapter 258 of the Florida Statutes), thereby bringing all existing preserves under a standardized set of maintenance criteria. Additional acts were passed subsequent to the 1975 action, culminating with the addition of the Cockroach Bay Aquatic Preserve in 1976 and the Gasparilla Sound-Charlotte County Aquatic Preserve to the system in 1978.

The primary authorities available to staff in implementing management directives affecting aquatic preserves are found in Chapters 258 and 253, Florida Statutes. These authorities stipulate a lead responsibility for the Governor and Cabinet, sitting as the Board of Trustees of the Internal Improvement Trust Fund. Acting as "agents" for the Trustees, the staff of the Bureau of Environmental Land Management (BELM) is able to review all requests for uses of or directly affecting state-owned sovereignty submerged lands within aquatic preserves. The review and subsequent staff comments are primarily geared toward the environmental consequences of any proposed use of state-owned submerged land. The review is conducted within the confines of the criteria contained in the "maintenance" provisions for aquatic preserves in Chapter 258, Florida Statutes.

Formal review comments are provided to the Department of Natural Resources, Division of State Lands by the Bureau of Environmental Land Management for inclusion in the comments and recommendations accompanying agenda items for Trustees consideration. This mechanism allows the Governor and Cabinet, sitting as owners of the land, to evaluate public interest and project merits within the context of environmental impact upon the preserve.

Chapters 16Q-21 and 16Q-20, Florida Administrative Code, are two administrative

rules directly applicable to the Department of Natural Resources/Trustee's actions regarding allowable uses of submerged lands, in general, and aquatic preserves specifically. Chapter 16Q-21, F.A.C. controls activities conducted on sovereignty submerged lands, and is predicated upon the provisions of Sections 253.03 and 253.12, F.S. The stated intent of this administrative rule is:

"(1) To aid in fulfilling the trust and fiduciary responsibilities of the Board of Trustees of the Internal Improvement Trust Fund for the administration, management and disposition of sovereignty lands;

(2) To insure maximum benefit and use of sovereignty lands for all the citizens of Florida;

(3) To manage, protect, and enhance sovereignty lands so that the public may continue to enjoy traditional uses including, but not limited to, navigation, fishing, and swimming;

(4) To manage and provide maximum protection for all sovereignty lands, especially those important to public drinking water supply, shellfish harvesting, public recreation, and fish and wildlife propagation and management;

(5) To insure that all public and private activities on sovereignty lands which generate revenues or exclude traditional public uses provide just compensation for such privileges; and,

(6) To aid in the implementation of the State Lands Management Plan."

Chapter 16Q-20, F.A.C. addresses the aquatic preserves and derives its authority from Sections 258.35, 258.36, 258.37, and 258.38, F.S. The intent of this rule is contained in Section 16Q-20.01, F.A.C., which states:

"(1) All sovereignty lands within a preserve shall be managed primarily for the maintenance of essentially natural conditions, the propagation of fish and wildlife, and public recreation, including hunting and fishing where deemed appropriate by the board and the managing agency.

(2) The aquatic preserves which are described in Sections 258.39, 258.391 and 258.392, F.S., and in 16Q-20.02, F.A.C., were established for the purpose of being preserved in an essentially natural or existing condition so that their aesthetic, biological and scientific values may endure for the enjoyment of future generations.

(3) The preserves shall be administered and managed in accordance with the following goals:

(a) To preserve, protect, and enhance these exceptional areas of sovereignty submerged lands by reasonable regulation of human activity within the preserves through the development and implementation of a comprehensive management program;

(b) To protect and enhance the waters of the preserves so that the public may continue to enjoy the traditional recreational uses of those waters such as swimming, boating, and fishing;

(c) To coordinate with federal, state, and local agencies to aid in carrying out the intent of the Legislature in creating the preserves;

(d) To use applicable federal, state, and local management programs, which are compatible with the intent and provisions of of the act and these rules, to assist in managing the preserves;

(e) To encourage the protection, enhancement or restoration of the biological, aesthetic, or scientific values of the preserves, including but not limited to the modification of existing man made conditions toward their natural condition, and discourage activities which would degrade the aesthetic, biological, or scientific values, or the quality, or utility of a preserve, when reviewing applications, or when developing and implementing management plans for the preserve;

(f) To preserve, promote, and utilize indigenous life forms and habitats, including but not limited to: sponges, soft coral, hard corals, submerged grasses, mangroves, salt water marshes, fresh water marshes, mud flats, estuarine, aquatic and marine mammals, birds, shellfish and mollusks;

(g) To acquire additional title interests in lands wherever such acquisitions would serve to protect or enhance the biological, aesthetic, or scientific values of the preserves.

(h) To maintain those beneficial hydrologic and biologic functions, the benefits of which accrue to the public at large.

The State Lands Management Plan, adopted on March 17, 1981, by the Governor and Cabinet, sitting as the Board of Trustees of the Internal Improvement Trust Fund, contains specific policies affecting aquatic preserves and their resources. In addition to a basic restatement of Legislatively established management policies, the Plan also establishes policies concerning spoil islands, submerged land leases, "Outstanding Native Florida Landscapes", unique natural features, submerged grassbeds, archaeological and historical resources, and endangered species. All of these issues provide management guidance to the aquatic preserve program.

Other Department of Natural Resources management authorities applicable to aquatic preserves include fisheries and marine mammal management and protection, and beach and shore preservation programs outlined in Chapters 370 and 161, F.S. Land acquisition programs conducted under the Environmentally Endangered Lands authorities of Chapter 259, F.S., or the Conservation and Recreation Lands Program authorized by Chapter 253,F.S. will enhance the protection of the natural resources of the aquatic preserves. The public acquisition of the adjacent upland properties enable their management in a manner compatible with the goals and objectives of the aquatic preserve management program.

Chapter 403, Florida Statutes, is an important adjunct to Chapter's 253 and 258, F.S. This governs, in part, the State's regulatory programs affecting water quality. The Department of Environmental Regulation, through a permitting and certification process, administers this progam.

Section 253.77, F.S. requires that all state regulatory agencies, such as the Department of Environmental Regulation, have evidence of approval of the requested use from the Trustees, prior to issuing permits for projects utilizing state owned land. This statutory directive provides an avenue for staff comments on potential environmental impacts of projects in aquatic preserves through the Department of Environmental Regulation permitting process. Additionally, the Department of Environmental Regulation has designated, by administrative rule, a series of waterbodies with stringent use criteria called "Outstanding Florida Waters" (OFW). The inclusion of all aquatic preserve waters within this classification greatly enhances the protective provisions of Chapter 258, F.S. As the designated "306" Coastal Zone Management Agency, the Department of Environmental Regulation also provides a source of funding for data collection and planning in areas such as Charlotte Harbor, as well as being the state agency responsible for implementing the "federal consistency" provisions of the federal Coastal Zone Management Act.

The Department of Environmental Regulation's administrative rules of primary significance to the aquatic preserve management program include Chapters 17-3 and 17-4, Florida Administrative Code. Both rules are based upon the authorities contained in Chapter 403, F.S. Chapter 17-3, F.A.C. addresses water quality standards and establishes the catagory of "Outstanding Florida Waters", while Chapter 17-4 F.A.C. addresses permit requirements.

In December, 1982 a Memorandum of Understanding (MOU) between the Department

of Environmental Regulation, the Department of Natural Resources, and the U.S. Army Corps of Engineers was executed. This MOU clearly establishes a process whereby the proprietary concerns of the Trustees, under the auspices of Chapter 253, F.S., can be integrated into the Department of Environmental Regulation/Corps of Engineers joint permit processing system.

Other opportunities for environmental review and input into activities potentially affecting aquatic preserves are afforded by the Department of Community Affairs, and the Department of State, Division of Archives, History, and Records Management. The Executive Office of the Governor also provides a mechanism for public input into federal projects via the State clearinghouse process.

The Department of Community Affairs is statutorily responsible for administering the "Development of Regional Impact" (DRI), and "Areas of Critical State Concern". The DRI program, authorized by Section 380.06, F.S., was established by the Legislature to provide a review and monitoring procedure for those development projects potentially affecting more than one county. The Areas of Critical State Concern program is mandated by Section 380.05, F.S. This program is intended to protect regional or state wide resources from poorly conceived development through the state regulation of development actvities.

The Department of Community Affairs is also the designated Coastal Zone Management "308" Agency, and, as such, is responsible for discharging the "Coastal Energy Impact Program (C.E.I.P.)". This program will be very important to Florida's aquatic preserve program should oil and gas be

discovered in commercial quantities on the Florida Outer Continental Shelf.

Chapter 267, F.S., establishes the state policy regarding preservation and management of Florida's archaeological and historical resources. This responsibility is legislatively assigned to the Department of State, Division of Archives, History and Records Management, which holds title to those cultural resources located on state-owned lands. This also applies to sovereignty submerged lands, including aquatic preserves.

The Department of Health and Rehabilitative Services, under their public mandate, administer two programs directly affecting the aquatic preserve management program. These programs are (1) septic tank regulation, usually administered by county health departments and (2) arthropod (mosquito) control programs, usually implemented through local mosquito control districts. Each of these programs holds the potential of creating significant impacts upon the aquatic preserves. Establishment of close working relationships between the aquatic preserve staff and the Department of Health and Rehabilitative Services will be a necessary element of the aquatic preserves management program.

Each of these referenced programs may provide an effective means of protecting aquatic preserves and their ecologically sensitive resources. Appendix A contains a compendium of the appropriate statutes and administrative rules.

CHAPTER III

MAJOR PROGRAM POLICY DIRECTIVES

This plan contains a number of management policy issues that are discussed either generally or definitively. This section highlights those major policy areas that comprise the basic thrust of this management effort. Adoption of these policies will provide specific staff direction in implementing the day-to-day aquatic preserve management program.

(A) Prohibit the disturbance of archaeological and historical sites within the aquatic preserves, unless prior authorization has been obtained from the Board of Trustees and the Division of Archives, History, and Records Management, and such disturbance is part of an approved research design or authorized project.

(B) Manage all submerged lands within the aquatic preserves to ensure the maintenance of essentially natural conditions, the propagation of fish and wildlife, and public recreation opportunities.

(C) Develop an inventory, and map natural habitat types within the aquatic preserves, with emphasis on those habitat types utilized by threatened and/or endangered species.

(D) Protect, and where possible, enhance threatened and endangered species habitat within aquatic preserves.

(E) Prohibit development activities within aquatic preserves that adversely impact upon significant grass beds, unless a prior determination has been made by the Board of overriding public importance with no reasonable alternatives, and adequate mitigation measures are included.

(F) Prohibit the triming and/or removal of mangroves and other natural shoreline vegetation within the aquatic preserves, except when necessitated by the pursuit of legally authorized projects.

(G) Provide research and educational opportunities for scientists and other interested researchers within the framework of a planned research program in the aquatic preserves.

(H) Acquire, where feasible, privately owned submerged lands located within the boundaries of the aquatic preserves pursuant to the authorities contained in Section 253.02(4) F.S.

(I) Prohibit the drilling of oil and gas wells, the mining of minerals, and dredging for the primary purpose of obtaining upland fill, within the aquatic preserves.

(J) Prohibit non-water dependent uses of submerged lands within aquatic preserves except in those cases where the Board has determined that the project is overwhelmingly in the public interest and no reasonable alternatives exist. This prohibition shall include floating residential units, as described in Section 125.0106, F.S.

(K) Prohibit storage of toxic, radioactive, or other hazardous materials within the aquatic preserve.

(L) Prohibit mosquito control practices within aquatic preserves that require habitat modification or manipulation (i.e. diking, ditching) unless failure to conduct such practices would result in a threat to public health.

(M) Limit pesticide and biocide use within the aquatic preserves to those that are approved by E.P.A. for wetland and aquatic application.

(N) Prohibit the construction of new deep water ports within the aquatic preserve boundaries.

(O) Insure that artificial reef construction does not adversely impact environmentally fragile areas within the aquatic preserves and that the construction will maintain the essentially natural condition while enhancing the quality and utility of the preserve.

(P) Manage state-owned spoil islands within aquatic preserves as bird rookeries and wildlife habitat areas.

(Q) Encourage public utilization of the aquatic preserves, consistent with the continued maintenance of their natural values and functions.

(R) Develop a well coordinated aquatic preserve management mechanism that recognizes and utilizes local government programs and authorities.

(S) Require through the efforts of DER and the water management districts the maintenance of the naturally high water quality of the estuary and ensure the natural seasonal flow fluctuations of fresh water into the estuary.

(T) Formally recognize and designate the Charlotte Harbor Aquatic

Preserves as wilderness preserves in accordance with the provisions of Section 16Q-20.13(d), F.A.C.

(U) Apply the management criteria contained in the adopted Charlotte Harbor Aquatic Preserves Management Plan to all subsequent legislative additions of land to these aquatic preserves.

(V) Encourage the assistance of federal, state, and local government agencies in implementing the aquatic preserve management plans, especially in the areas of protection of natural and cultural resources and the enforcement of applicable resource laws and ordinances.

Chapter IV

RESOURCE DESCRIPTION

The combination of the climate and extensive, diverse water bodies and vegetation make this estuarine complex one of the most productive in the state. A wide variety of fish and wildlife take advantage of and contribute to this productivity. Approximately 40% of the state's endangered and threatened species are found within this area (Barnett et al., 1980). This estuary also supports a variety of commercial and sport fisheries, which substantially add to the economy of the area. All of these factors help to make the Charlotte Harbor area a very attractive place, as the growing human population of the area will attest.

Detailed information on the resources, such as species lists, water quality information, archaeological and historical site information, life histories, geological background, and supporting maps, and cultural resource information are located in Appendices C and D. The resource information presented in this chapter is intended to be generally descriptive of the major management functions and of the area surrounding the estuarine complex.

A. Geologic Features and Landforms.

The Charlotte Harbor estuarine complex began to form approximately 5,000 years ago when a rise in sea level flooded the mouths of the Myakka and Peace Rivers. This flooding caused sediments to be deposited in a series of

deltaic formations which began the in-filling of the present estuary. This process also formed the present barrier island chain which began development as a spit of land at the north end near the present Gasparilla Island. The river sediments and those of the littoral drift, helped create the chain of barrier islands with Sanibel Island at the southern end. The five major barrier islands (Gasparilla, Cayo Costa, North Captiva, Captiva, and Sanibel) of the present time, have joined, separated into additonal islands, and changed shapes continuously since this beginning (Herwitz, 1977).

Pine Island is believed to be a remnant of the original mainland, that was isolated by a southerly shift in the river flow. Then, as sediments built up at the present location of Little Pine Island and the evolving shape of Sanibel Island restricted water flow, the estuary broke through to the Gulf, creating a deep channel near the present Boca Grande Pass. This pass eventually shifted to its present position (Herwitz, 1977). Other passes have been opened and closed by storm events and other natural forces that are still acting on the system today. Both Cayo Costa and North Captiva Island have had new cuts through them in the last year.

B. Community Associations.

The plant communities of the four aquatic preserves are a major factor in the continued health of the natural systems of these preserves. This section will also reference some of the major animal species associated with these plant communities. This section is further subdivided into mangrove, marine grassbeds, saltwater marsh grass areas, and tidal flats. A final subsection addresses the endangered species within these aquatic preserves.

Each community is presented separately although in reality these communities are sometimes mixed or overlap.

1. Mangroves. These four species of trees in the Charlotte Harbor area represent the dominant vegetational association within the estuary. The mangroves range in size from twelve to sixty feet high and generally inhabit the inner low energy shorelines of the Charlotte Harbor estuary system. The four dominant tree species of mangrove associations occurring here are the red mangrove (*Rhizophora mangle*) both in and near the water at low tide level; black mangrove (*Avicennia germinans*) generally inland of, but sometimes mixed with reds; white mangrove (*Laguncularia racemosa*) generally upland of but also mixed with blacks; and buttonwood (*Conocarpus erectus*) upland of and mixed with whites. These mangrove association species generally indicate areas of frequent (red mangrove) to infrequent (white mangrove) saline inundation.

There are many variations of the mangrove community within the Charlotte Harbor area. The major variation is the fringe mangrove which occurs along the shorelines of the bays, harbors, lagoons and other waterways. All four species can appear in this variation, both in zones and mixed as described above. There are also significant areas of overwash mangrove areas, where the mangroves are standing in water with little or no associated uplands. This variation is generally domininated by red mangroves. (Odum et al., 1982). There are a few other variations that appear in more inland areas both along natural drainage channels and sometimes isolated from the normal tides. These have a wide variety of mangrove species mixture and also might include

scrub or dwarfed forms of the mangroves. Communities that become completely isolated from tidal influence often lead to the death of the more saline tolerant species as the waters or soils become less saline. The mangrove species have various root structures, (i.e., prop roots and pneumatophores-the aerating root spikes of the blacks) and extensive underground root mats which capture and stabilize sediments in the estuary. The fringe communities function as an erosion control buffer in other areas.

The extensive root networks recycle nutrients and minerals from the anaerobic soil substrate. These contributions are finally returned to the estuary as detritus from the mangrove leaves, a major input to the estuary's food chain and productivity (Heald and W.E. Odum, 1970). The mangrove canopy and root tangle also provides valuable habitat for many marine and estuarine organisms (Savage, 1972). The entire community also functions to buffer the uplands from storm tides and winds, and as a storage area for those waters. The mangrove community types and various locations indicate that they can adapt to many situations, but they are susceptible to both natural and man-induced disturbances. The natural disturbances can come from freezing temperatures, hurricanes, new pass formations or a rise in sea level. Past freeze damage in the Charlotte Harbor area is still visible, indicating that even years after the events some of the species (red and white mangroves) are still not fully recovered. Hurricane damage, although not experienced in the recent past, is a potential threat to these communities. Some of the more upland areas of the preserves contain the remains of mangroves killed directly or indirectly by hurricanes.

Man's influence on the mangrove communities is not fully understood as the natural forces that cause the direct removal or killing of the trees. The effects of changing the upland drainage, both by bulkhead placement and use of interceptor waterways, need much more study.

Protection of the extensive mangrove communities (see Appendix D for DOT acreage under code 612) in the four preserves of the Charlotte Harbor area will be a major task of this plan's management activities. The majority of the mangrove communities in the preserves are already in public ownership either by their location on sovereign lands or on other publicly owned lands (national wildlife refuges, state reserves, wilderness areas and other land programs). The policies and practices of this management is addressed in Chapter V, Section B.

Other vegetation associated with the mangrove communities include: salt grass (*Distichlis spicata*); black needlerush (*Juncus roemerianus*); spike rush (*Eleocharis cellulosa*); cordgrasses (*Spartina spp*); glass wort (*Salicornia spp.*); sea purslane (*Sesuvium portulacastrum*); salt wort (*Batis maritima*); and sea ox-eye (*Borrichia frutescens*).

The tree canopies and root tangle provide habitat for various animals. These community types are utilized by a wide variety of invertebrates, fishes, amphibians, reptiles, mammals and birds. (See Table 1)

Table I

ANIMAL LIFE ASSOCIATED WITH THE MANGROVE COMMUNITY

Mammals
- marsh rabbit
- marsh rice rat
- raccoon
- bobcat

Birds
- yellow-crowned night heron
- green heron
- white ibis
- Florida clapper rail
- belted kingfisher
- fish crow
- parula warbler
- yellow-rumped warbler
- yellow-throated warbler
- red-winged blackbird

Reptiles
- diamond back terrapin

Fishes
- tarpon
- bay anchovy
- rainwater killifish
- sheepshead killifish
- mosquitofish
- sailfin molly
- snook
- gray snapper

Invertebrates
- mangrove tree crab
- fiddler crab
- blue crab
- oysters
- shrimp
- snails

Source: Barnett, et al, Fish and Wildlife Resource of the Charlotte Harbor Area. 1980.

2. Marine Grassbeds. Marine grasses are submerged flowering plants which stabilize sediments, entrap silt, recycle nutrients, provide shelter, habitat and substrate for animals and other plant forms, provide important nursery grounds, and are important direct food sources (Odum, 1974; Wood et al., 1969). The grassbeds are very productive, possibly the most productive habitat within the estuary. They are important not only for their productivity but also for the important animal life associated with the community. These beds also serve as a food source for the endangered manatee (*Trichechus manatus*), important nursery areas for juvenile forms of shellfish, and as substrate for many algal species fed by invertebrates which are in turn eaten by the fishes. Many commercially important fishes spend at least part of their life in these grassbeds (Zieman, 1982).

The three most common marine grasses found in the Charlotte Harbor area are turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), and Cuban shoal grass (*Halodule wrightii*). In areas of low salinity, such as near the mouth of freshwater rivers and streams, widgeon grass (*Ruppia maritima*) is found. Generally, the most prevalent areas of grassbeds in the four aquatic preserves include all of Cape Haze area, the northern and eastern portions of Pine Island Sound, all of Matlacha Pass and the eastern edge of Charlotte Harbor. For a more detailed mapping of marine grassbeds refer to DOT Vegetation and Land Use Maps in Appendix D. The more dense areas of grassbeds in the estuarine complex are usually in shallow water with a fairly constant salinity. These shallow areas are prime fish habitat and vulnerable to damage by boating activities. Thalasia can take from two to five years to revegetate once disturbed by boat

propellers or other impacts (Zieman, 1976). The marine grassbeds are sensitive to turbidity and as a result are vulnerable to dredging activities.

Marine grassbeds are a primary vegetation community and will be used as a key indicator in measuring the natural condition of the aquatic preserves. Protection of marine grassbeds will be a major consideration in the field and administrative review of use proposals (See Appendix D, DOT Mapping Codes 901-904).

Approximately 66 species of algae which grow on marine grasses has been reported along the west coast of Florida (Ballantine and Humm, 1975). The invertebrate fauna associated with these grassbeds can be rich and diverse, depending on the specific area. Table II lists the animal life commonly found within or generally associated with this community. There is a need for more data on the animal life associated with marine grassbeds.

Table II

ANIMAL LIFE FOUND IN MARINE GRASSBED AREAS OR

GENERALLY ASSOCIATED WITH THIS COMMUNITY*

Mammals
- bottle-nosed dolphin
- manatee

Birds
- common loon
- horned grebe
- brown pelican
- double crested cormorant
- magnificent frigatebird
- pintail
- green-winged teal
- blue-winged teal
- American wigeon
- northern shoveler
- canvasback
- lesser scaup
- ruddy duck
- red-breasted merganser
- osprey
- American coot
- herring gull
- Forster's tern
- least tern
- royal tern
- Caspian tern
- black skimmer
- belted kingfisher

Reptiles
- diamondback terrapin

Fishes
- bull shark
- ladyfish

Fishes (continued)
- tarpon
- scaled sardine
- striped anchovy
- sea catfish
- gafftopsail catfish
- rainwater killifish
- gulf killifish
- marsh killifish
- longnose killifish
- sheepshead minnow
- sailfin molly
- gulf pipefish
- crevalle jack
- snook
- gray snapper
- pigfish
- spotfin mojarra
- silver jenny
- silver perch
- spotted seatrout
- sand seatrout
- spot
- southern kingfish
- red drum
- sheepshead
- pinfish
- striped mullet
- white mullet
- tidewater silverside
- lined sole

* There has been little data generated to substantiate a close association with some of these animals.

Source: Barnett, et al. Fish and Wildlife Resources of the Charlotte Harbor Area. 1980.

3. Saltmarsh grasses. The saltmarsh grass communities in the Charlotte Harbor area are also important to estuarine productivity. In this part of Florida, these communities are generally forced out by the dominant mangroves. The saltmarsh grass community appears in the transitional area between the mangroves, freshwater marshes and saltbarren areas. This community also becomes more dominant in the brackish upper reaches of the Myakka and Peace Rivers outside the aquatic preserve boundaries. Some of these transitional areas are also at an elevation (i.e., landward of the mean high water line) that technically puts them outside of the aquatic preserve boundaries (unless the lands are state-owned).

The dominant species in this community are the cordgrass (*Spartina alterniflora*) in the lower zones of the marsh, needlerush (*Juncus roemerianus*) dominating the wider midzone, and salt grass (*Distichlis spicata*) and slender cordgrass (*Spartina patens*) in the innermost zones which are only rarely inundated. Other vegetation also associated with this community includes saltwort (*Batis maritima*), glasswort (*Salicornia virginica*) and key grass (*Monanthocloe littoralis*).

This community can also have mangroves, cabbage palms, and exotics mixed within the vegetation. The type of vegetation present varies with the degree of tidal inundation, the influence of other vegetation, the amount of disturbance by ditching and diking, and the amount of freshwater drainage from the uplands. The saltmarsh grass community recycles nutrients, contributes to the estuarine productivity, and provides shelter and habitat to a variety of animal life (see Table III).

Table III

ANIMAL LIFE COMMONLY ASSOCIATED WITH SALTMARSH GRASS COMMUNITIES

WITHIN THE CHARLOTTE HARBOR AREA

Mammals

marsh rabbit
marsh rice rat
hispid cotton rat
raccoon

Reptiles

diamondback terrapin
garter snake

Fishes

bay anchovy
rainwater killifish
gulf killifish
marsh killifish
sheepshead minnow
mosquitofish
striped mullet

Birds

great blue heron
great egret
snowy egret
Louisiana heron
Florida clapper rail
least sandpiper
black-necked stilt
ring-billed gull
laughing gull
Forster's tern
least tern
black tern
tree swallow
barn swallow
common yellowthroat
red-winged blackbird
sharp-tailed sparrow

Source: Barnett, et al. Fish and Wildlife Resources of the Charlotte Harbor Area. 1980.

4. Tidal Flats. These areas in the estuarine complex describe a side variety of habitat in the complex that does not have a dominant vegetation but may have sporadic vegetation from the previous three communities or no vegetation (vascular) at all. These areas do have extensive algal growth areas. The tidal flats are used primarily by shore and wading birds as feeding and loafing areas (Barnett et al., 1980). These areas are also valuable for invertebrates, including crabs, oysters, clams, and worms.

These areas include: estuarine beaches, areas waterward of the mangroves, spoil areas, shoal areas, and mud flats. These areas are important to the estuary in as much as they contribute to the algal production. The mollusc, crustacean, and worm communities feed on both the algae growths and plant materials from the other plant communities of the estuary. The bird life is dependent on these areas for feeding and some of these flat areas surround the colonial nesting sites in the estuarine complex. The role of these various tidal flat areas is not fully understood but is is known that these areas are important habitats (see Table IV).

TABLE IV

ANIMAL LIFE COMMONLY ASSOCIATED TO TIDAL FLATS

OF THE CHAROLTTE HARBOR AREA

Mammals

raccoon

Birds

brown pelican
great blue heron
yellow-crowned night heron
white ibis
roseate spoonbill
semipalmated plover
Wilson's plover
ruddy turnstone
spotted sandpiper
greater yellowlegs
lesser yellowlegs
willet
red knot
least sandpiper
dunlin
western sandpiper
sanderling
short-billed dowitcher
black-necked stilt
herring gull
ring-billed gull
laughing gull
Forster's tern
least tern
Royal tern
sandwich tern
Caspian tern
black skimmer
fish crow

Source: Barnett, et al. Fish and Wildlife Resources of the Charlotte Harbor Area. 1980.

5. Endangered Species. The combination of the sub-tropical climate, diverse vegetation and habitats, and wide variety of waterbodies in the Charlotte Harbor area has resulted in a high incidence of endangered animal species. This region has over 40 percent of the species listed as endangered, threatened, or of special concern in the State of Florida (Barnett et al., 1980). Approximately 33 percent of these state-wide species have been identified within the four aquatic preserves (Table V).

There are only two threatened/endangered plant species within the Charlotte Harbor area which may have been identified on lands within the four aquatic preserves. These plant species are the threatened Florida Coontie (*Zamia floridana*), and the endangered prickly apple (*Cereus gracius*) (Ward, 1978), as designated by the official State of Florida plant list (Section 581.185, F.S.). These two plant species are found on shell deposits and mounds on islands and upland areas within and associated with the aquatic preserves.

There are four additional plant species that are not on the official State of Florida plant list, but described as endangered or threatened in other lists. The endangered iguana hackberry (*Celtis iguanaea*) and spiny hackberry (*Celtis pallida*) are associated with shell mounds and located on Sanibel Island. The threatened Sanibel lovegrass (*Eragrostis tracyi*) and endangered wild cotton (*Gossypium hirsutum*) are also found in these areas (Ward, 1979).

Table V

SPECIES OF THE CHARLOTTE HARBOR AREA

WHICH ARE CLASSIFIED AS ENDANGERED, THREATENED, OR OF SPECIAL CONCERN

ENDANGERED

Reptiles

Atlantic green turtle	(*Chelonia mydas mydas*)
Atlantic hawksbill turtle	(*Eretmochelys imbricata imbricata*)
Atlantic Ridley turtle	(*Lepidochelys kempii*)
Leatherback turtle	(*Dermochelys coriacea*)

Birds

Wood stork	(*Mycteria americana*)
Everglade kite	(*Rostrhamus sociabilis plumbeus*)
Peregrine falcon	(*Falco peregrinus*)
Southeastern snowy plover	(*Charadrius alexandrinus tenuirostris*)

Mammals

West Indian manatee	(*Trichechus manatus*)

THREATENED

Reptiles

Atlantic loggerhead turtle	(*Caretta caretta caretta*)

Birds

Eastern brown pelican	(*Pelecanus occidentalis carolinensis*)
Bald eagle	(*Haliaeetus leucocephalus*)
Southeastern kestrel	(*Falco sparverius paulus*)
Roseate tern	(*Sterna dougallii*)
Least tern	(*Sterna albifrons*)

Table V (continued)

Mammals	
Mangrove fox squirrel	(*Sciurus niger avicennia*)
SPECIES OF SPECIAL CONCERN	
Fishes	
Common snook	(*Centropomus undecimalis*)
Reptiles	
American alligator	(*Alligator mississippiensis*)
Birds	
Little blue heron	(*Florida caerulea*)
Snowy egret	(*Egretta thula*)
Louisiana heron	(*Hydranassa tricolor*)
Reddish egret	(*Dichromanassa rufescens*)
Roseate spoonbill	(*Ajaia ajaja*)
American oystercatcher	(*Haematopus palliatus*)
Marian's marsh wren	(*Cistothorus palustris marianae*)

Adapted from: Barnett, et al. *Fish and Wildlife Resources of the Charlotte Harbor Area*, 1980, and Florida Game and Fresh Water Fish Commission, *Official lists of Endangered and Potentially Endangered Fauna in Florida*, 1983.

C. Archaeological and Historical Sites

The coastal Lee and Charlotte County area is extremely rich archaeologically. There are over seventy archaeological and historic sites already recorded within the present boundaries of the Charlotte Harbor EEL tract and the five aquatic preserves in Lee and Charlotte Counties. In addition, a nearly equal amount of the sites are recorded within the adjacent upland areas. It is stressed, however, that most of the area has not been surveyed for such sites that an estimated 100-200 presently unrecorded sites will be located along the coastline of the uplands, on islands, and in inundated contexts. They will include both Native American and European encampments and villages, as well as shipwrecks; although, the majority will be prehistoric shell kitchen middens.

The resource base for this region has been estuarine in nature for the past 7-8000 years. Prior to that time the sea level was lower and what is today recognized as Charlotte Harbor was a river valley drainage for the Peace River, while the Pine Island Sound-Carlos Bay area drained the Caloosahatchee River.

While there are many recorded sites, the prehistoric cultural sequence for the coastal areas of Lee and Charlotte Counties, Florida is still incompletely understood, particularly the earlier pre-ceramic occupations. Part of the problem centers on the fact that there has been an overall 30-50 meter rise in sea level in the past 10-12,000 years. Thus, the majority of the coastal sites from these earliest periods lie drowned on the bottom of the Gulf of Mexico and extensive bay system comprising the aquatic preserves.

The Earliest occupation of the area, the Paleo-Indian Period to around 12,000 years before present (B.P.). Sites from this period are likely to be present on relic river levees and coastal dunes now inundated or buried on the lowest levels of more recent sites. No sites with Paleo-Indian remains have yet been recorded within the preserves. The closest recorded sites are Warm Mineral Springs and Little Salt Springs in southern Sarasota County, around eight kilometers north of Charlotte Harbor. Evidence from these sites indicates the Indians hunted now extinct Pleistocene megafauna during a period of time when the climate was more temperate and arid than today.

The Paleo-Indian period gradually evolved into what has been called the Archaic Period. The Archaic Period has been divided into Early, Middle and Late Stages based on changes in artifact types. We know much more about overall Archaic subsistence strategies and specialized extraction activities than we do about the preceding Paleo-Indian Period. It was a time of adaptation to local environments. Aside from the well known Little Salt Springs and Warm Mineral Springs sites located in nearby Sarasota and the Bay West Site in Collier County, all of which were then interior sites around water sources during drier, lower sea-level times, there are identified drowned, former coastal and river edge habitation and quarry sites in Pinellas, Hillsborough and Sarasota Counties, as well as farther northward along the Gulf Coast and the Atlantic Coast. Farther south along coastal Collier County, the lowest level of many of the identified large shell middens are recorded as extending to a meter or more, below the

present sea level. While research to address the issue has not yet been conducted, there is little doubt that comparable now inundated, former coastal sites are located along the bottom lands or form the foundation of some of the mangrove islands.

The Archaic Period spanned the period from 10,000-3,000 years ago. It was during this period that there was a major shift in the subject area from arid interior through river valley drainage to coastal estuarine environment. This shift is reflected in the overall subsistence strategy. During the Early Archaic Period, food remains at such sites as Warm Mineral Springs and Little Salt Springs, indicate that sloth, bog lemming, dire wolf, and mastadon were hunted. By the Middle Archaic period, pond snail is a common food item, while by the Late Archaic the emphasis has shifted to the exploitation of the eastern oyster (Cassotrea virginica). Also, by the Middle and Late Archaic Periods, emphasis was being placed upon the manufacture of wooden and shell tools.

Around 3,500 to 4,000 years ago, sea level approached its present level and climatic conditions have generally stabilized. From the Late Archaic through the Spanish Periods, native American subsistence patterns changed little. Shellfish and fish taken from the estuaries almost exclusively comprise food refuse remains by volume. Upland game, and wild and domestic plant resources appear to be of minimal importance, while marine mammals, birds and turtles are of secondary importance; although, the volume of available protein per individual is greater than in the more numerous shellfish.

The material culture of the native Americans in the Southwest Florida area changed little following the introduction of sand tempered ceramics around 2,500 years ago until the introduction of Spanish material during the 1500's and later. Goggin (1949) defined three ceramic periods in South Florida: Glades I, II and III. Glades I (ca. 2400-2000 years ago) marks the appearance of sand-grit, plain ceramics. Glades II (ca. 2000-900 years ago), continues plainwares and includes the manufacture of several incised decorative styles. In Glades III (ca. 900-300 years ago), check stamping replaces incising as the primary decorative technique, and European items are introduced late in the period.

The Calusia Indians were the historic representatives of Glades III culture.

Early in the 1500's Spanish explorers began visiting southwest Florida. Spanish slavers from Cuba also routinely visited the area. Later Spanish and English sources note that Charlotte Harbor was used as a place to secure water and restock ship provisions. Later in the 16th century, Pedro Menendez de Aviles explored Charlotte Harbor and its vicinity and attempted to establish in Calusa chief Carlos's village a mission under the direction of Father Juan Rogel. However, the Calusa rose in rebellion, once Menendez left, and burned the village, leaving the Spaniards little choice but to abandon their settlement. From 1561 to around 1700 there was little Spanish or English activity in the area. However, as a result of Creek and Yamassee raids as far south as Lake Okeechobee, the remnant of the once powerful Calusa migrated to Cuba and/or were absorbed by other Indian groups. The end of the Glades tradition coincides with the removal of the Calusa from South Florida around 1720-1750.

At the conclusion of the second Spanish Period (1821), there were no permanent settlements in southwest Florida. There were only a few Cuban fishermen and their Indian employees and families living in isolated villages along the coast. Increasingly from around the beginning of the 1800's Seminole moved into the area to trade and eventually establish encampments. By the 1820's and 30's the Cuban fishermen had grown to depend on the Seminole as a major part of their work force and married Seminole women. Charlotte Harbor was a major focus of Spanish fishing efforts. Covington (1959) reports that by 1831 there were four major fishing "ranchos," all with their own sloops for transporting dried salted mullet, manatee lard and probably other produce to Cuba. These four camps reportedly contained 130 men-half of whom were Indians, about 30 Indian women and some 50-100 children.

From 1831 to the present the history of the area is too involved for this brief presentation. There are various documents and publications narrating this more recent period.

D. Water Resources.

Water is the resource whose characteristics most directly affect this estuary's habitability and healthiness for the plants and animals naturally adapted to living there. The extensive water resources of the four aquatic preserves within this dynamic estuary system are the major reason for managing all four preserves in one plan.

The basic characteristics for the Charlotte Harbor estuary's water vary naturally in response to the daily, seasonal, and long term forces which make estuarine habitat conditions among the most dynamic on earth. Added to this are the many and varied conditions found on each of the three rivers flowing into the estuary. The Caloosahatchee River is connected to Lake Okeechobee, which contains water from the center of the state. The Caloosahatchee also has extensive agricultural development, and the urban areas surrounding Ft. Myers. The Myakka drains a relatively undeveloped basin that is just beginning to feel development pressures. The Peace River has phosphate mining operations and agricultural development within its basin area.

With reference to water quality, the Charlotte Harbor Resource Planning and Management Committee, Technical Advisory Committee's Technical Appendices concluded in their studies in 1980 from existing data that:

1. Levels of pH are within normal limits.

2. More data are needed on biocides, including heavy metals. Aldrin, dieldrin, and Baytex have been reported in dangerous concentrations in Gasparilla and Pine Island Sounds.

3. Dissolved oxygen depletion is a present and growing problem in canal systems and nearshore habitats.

4. There may be evidence that Charlotte Harbor's nutrient content has increased through time, due to human activities.

5. Oils and grease exist in notably high levels within parts of the estuarine complex. The presence of more volatile (and toxic) fractions is probable.

6. Salinity and temperature regimes are typical of a substantial estuary but are optimal for the amplification of pollution effects.

7. Turbidity has not been a system-wide problem due to minimal dredging. Short-term effects of causeway and channel construction mediated by turbidity, have been severe and some will remain so over long periods.

8. Based on shellfish data, coliform counts are unacceptably high for large areas within the complex.

These conclusions were based on the available water quality data which has substantial information gaps in the Charlotte Harbor area. There has also been little work on the effects of the interaction of water quality parameters, which is important in estuarine systems. The available data does not reflect long term study in the Charlotte Harbor estuary with detailed water quality information. The U.S. Geological Survey's Charlotte Harbor Study (see Chapter VI) will be the first major attempt to get water quality data system-wide over a fairly long period.

The technical Advisory Committee also identified sensitive areas within the estuary system which were of particular concern with regard to water quality. These sensitive areas are identified as follows:

1. Gasparilla Sound, valued for its nurseries, fisheries, and recreation; listed because of pesticide, and dredge and fill hazards.

2. All the tidal creeks, valued as habitat, nursery, and nutrient assimilation functions; listed because of use in land drainage and upland development.

3. Myakka River Estuary, valued for its productivity, scenic and scientific value; listed because of the of upland development and upstream activities, and a relative lack of information.

4. All tidal systems, valued for their real estate and navigational uses; listed for being "worst-case" water quality areas and hazardous to human health.

5. All"Interceptor" or "Spreader" Waterways, valued for the proven utility of retention in nutrient assimilation, but listed for lack of data, loss of valuable resources when retention structures displace native coastal habitat instead of disturbed uplands, consequences as problem areas if they fail, or as regional precedents if they function.

6. Pine Island Sound and Matlacha Pass, valued for their recreational and fisheries value; listed because of their hydrographic position between Charlotte Harbor proper and San Carlos Bay, and vulnerability to upland development and overuse.

7. All major sources of freshwater to each estuary.

8. Mangroves, seagrasses, and marshes.

The general conclusion of the above information is that there is not now available sufficient water resource data to understand how the system operates or identify the water quality problems existing now and for the future. It is believed that the USGS study will go a long way toward filling the data gaps and gaining knowledge of how the system works.

E. Cultural.

This section addresses the human influence and development of this area, which affects the aquatic preserves. The Charlotte Harbor area has been the site of enormous subdivision development during the past thirty years. The Port Charlotte development covers almost 200 square miles inland from Charlotte Harbor, between the Myakka and Peace Rivers. The projected population of Charlotte County, if this and the other subdivisions presently platted in the county were occupied, would be nearly 1,000,000 people. The 1980 U.S. census population for Charlotte County was 58,460.

Cape Coral, a subdivision north of the Caloosahatchee River and east of Matlacha Pass, covers approximately 96 square miles. An estimated 400,000 people may one day inhabit that presently incorporated city. The 1980 U.S. census population for Lee County was 205,266. The Ft. Myers-(Cape Coral)-Lee County area has been identified in a number of reports as the fastest growing area in the United States.

Port Charlotte and Cape Coral are only two examples of the massive upland development surrounding these four Charlotte Harbor aquatic preserves. The population potential of these developments is a major reason for the need of a viable aquatic preserve management plan.

Not only do the preserves have enormous population pressures to contend with, but the major rivers flowing into the estuary are under their own development pressures. The Peace River has experienced phosphate slime pond spills (Estevez et al., 1981). There are extensive agricultural, mining and

residential developments upstream of the rivers, north and east of Charlotte and Lee Counties.

The Charlotte Harbor estuarine system has the complexities of these existing human developments plus potential future impacts to deal with, in addition to the dynamic natural forces involved.

Chapter V

RESOURCE MANAGEMENT

A. Introduction

The main objective of the resource management plan in the aquatic preserves is to protect the resources of the aquatic preserves for the benefit of future generations (Section 258.35 F.S.). This part of the management plan addresses the policies and procedures both onsite and administrative personnel will pursue. The onsite management will involve Department of Natural Resources' field personnel assigned to the aquatic preserve. The administrative management will involve Bureau of Environmental Lands Management personnel (both in the field and in Tallahassee) and Division of State Lands personnel, cooperating in the review of applications for use of state-owned lands and related activities surrounding the preserves. The field personnel will be interacting with various government and non-government entities, interest groups, and individuals.

B. Onsite Management Objectives

The onsite management objectives are reflected by the activities that the field personnel become involved in (i.e., observation, research, public interaction, emergency responses etc.), to protect the resources within the aquatic preserves. Other activities such as the interaction with other government and non-government entities are covered in more detail under Chapter VI (Management Implementation Network). The field personnel's duties,

are with respect to management of the various uses the aquatic preserves, dealt with in more detail in Chapters VII through XI. The field personnel will generally be involved in all management activities concerning the aquatic preserves of Charlotte Harbor.

1. Plant Communities

The communities of aquatic and wetland plants within the four Charlotte Harbor preserves perform five major functions vital to the health and productivity of the estuarine system:

a. they tend to stabilize geologic features in the face of dynamic forces (i.e., currents, tides, winds, and waves, which often act in concert to both erode and deposit);

b. they create, from recycled nutrients and solar energy, the organic material that fuels the estuarine food chains to support the area's renowned fisheries, colonial waterbird rookeries, raptors, and migratory waterfowl;

c. they provide protected fisheries habitat for spawning and juvenile development;

d. they provide roosting and nesting habitat for water birds; and

e. they physically buffer estuarine waters from contaminated and channelized runoff from uplands within the estuarine watershed and in some cases buffer the uplands from storm waves and winds.

The management objectives for plant communities will be to maintain these functions. Because these plant communities are critically important to the

estuary the field personnel will develop a program to work toward the restoration of plant communites now damaged or destroyed by human activities and to prevent such damage in the future.

Management Policy

a. Field Familiarization and Documentation. Aquatic preserve field personnel will become familiar with the plant species and communities present in the four aquatic preserves, and locations of their occurrences.

b. Literature Familiarization. Field personnel will assemble a library of existing pertinent literature concerning the species and communities present in these aquatic preserves. Staff will become familiar with the ranges, life histories, ecological requirements, productivity, importance to water quality, contribution to landform stabilization, wildlife habitat provision, fisheries habitat provision, and fisheries food production of the plant communities within the four aquatic preserves.

c. Preparation of Guidelines for Management of Endangered Species. Field personnel, based on their field observations and literature reviews will develop a set of maps (7.5 minute quadrangles) showing the locations of threatened and endangered plant populations within the four aquatic preserves. A set of management guidelines for each species, outlining the habitat requirements and the methods to sustain and/or restore these habitats should be developed. Field personnel, in the course of documenting the occurrence of threatened, and endangered animals, will develop maps showing the locations and types of plant communities used by these

animals for nesting, roosting, feeding, resting, spawning, etc. Literature information and personal observation will then be used to develop guidelines to maintaining (or restoring if necessary) the "critical habitat" required by each species.

d. Monitoring of Plant Communities for Natural Changes. Field personnel will become familiar with the use of remote sensing, both DOT and Landsat imagery, for the study and monitoring of plant communities, and will use this remote sensing in conjunction with field observations to monitor and document natural changes such as:

1. freeze damage to and recovery of mangrove communities;
2. wind and wave damage to mangrove communities from storms and hurricanes;
3. accretion-related seaward extension of mangrove communities;
4. erosion-related landward retraction of mangrove communities;
5. depositional burying of sea grass communities;
6. invasions of exotic plant species and revegetation by native species after exotic removal projects;
7. pathogen damage to and recovery of plant communities.

e. Identification of Areas and Communities in Need of Restoration. Field personnel will, as time permits, systematically survey areas in the four aquatic preserves to determine the location, nature, and extent of environmental damages from human activities and assess the possibility of restoring each of the sites according to whether the site is publicly or privately owned, and the cost and effort required.

f. Protection of Plant Communities. Field personnel shall protect the plant communities from the various uses of sovereign lands within these aquatic preserves according to the following guidelines.

1. Field personnel in their biological reports, shall not recommend for approval any proposed use for sovereignty submerged lands when the plant communities in the proposed use area appear to be jeopardized.

   i. Pruning of mangroves shall only be permitted for access from the mean high water line to a dock or pier. The destructive clearing of mangroves in sovereignty lands shall be strictly prohibited;

   ii. Sea grass communities shall not be removed or shaded to such an extent as to cause the death of a significant area of the community or subjecting sea grass communities to unacceptable turbidity, decreased light penetration, and propeller damage.

2. Field personnel shall be notified of applications for uses of submerged lands within these aquatic preserves by the Bureau of Environmental Land Management central office. No applications will be approved within Class 1 and 2 Resource Protection areas without a thorough review by the field personnel. The field personnel will inspect the site and assess the potential impacts to the plant communities, and then convey their recommendations to the central office as required.

3. Field personnel will initiate various educational programs and supplement existing educational programs designed to increase public

awareness of the damage propellers and other recreational, private and commercial uses can inflict on seagrass communities. Among the alternatives that should be considered are:

i. Brochures consisting of nautical charts of preserve waters marked to indicate shallow waters with grassbeds highly susceptible to propeller damage;

ii. The publication of a brochure indicating power-boat trails through channels which are now only locally known.

iii. Public education lectures to boating and fishing groups, such as the U.S. Coast Guard Auxillary's public courses in boating safety and seamanship.

4. Field personnel will develop an exotic plant control and removal plan after monitoring the rate and extent of invasion by exotic species, such as Brazillian pepper, Australian pine, and melaleuca.

5. In cooperation with the Southwest Florida Regional Planning Council, field personnel will familiarize themselves with the results of a study under the Coastal Energy Impact Program now in the process of assessing the potential impacts of an oil tanker spill or drilling rig accident on the natural resources of the Charlotte Harbor area aquatic preserves.

g. Restoration of Plant Communities. Field personnel will consult with professionals in the wetlands restoration/revegetation field to determine the advisability of using healthy beds of marine grasses as a stock source to restore damaged grassbeds. They will develop guidelines for restoring marine grassbeds in the four aquatic preserves.

Field personnel will identify mangrove forests with good accessibility within the four aquatic preserves where a high density of mangrove seedlings could serve as a nursery stock source for transplanting to restoration sites. Field personnel will consult with professionals in the wetlands restoration/revegetation field concerning proven procedures for transplanting and nurturing mangroves, and will develop guidelines in restoring mangrove communities in the four aquatic preserves.

In the event that plant restoration is required as the result of a permit application with DER, or as the result of any other process, the field personnel will be responsible for monitoring the restoration activity. This might include advising the individuals involved in the actual restoration work on the best techniques under the available restoration guidelines. The field personnel will monitor the viability and mortality of the restoration project after the work is completed.

h. Identification of Research Needs. Field personnel will identify research needs concerning plant communities within the aquatic preserves with special emphasis given to data needs that would increase the capability of field personnel to manage plant communities under environmental stress, and to determine threshold tolerances for plant community health and diversity in relation to degraded environmental conditions.

i. Coordination with Other Researchers. Field personnel will become familiar with research projects being conducted within the four aquatic preserves by state and federal agency biologists and non-government researchers, and will offer logistical and professional assistance with

data collection in the field, as time permits. This familiarization and assistance should lead to better understanding of both other agencys' personnel and a better awareness of the data findings and uses. The research liaison will also be addressed in Chapter X (Scientific Research).

2. Animal life

The richness of the animal life of the Charlotte Harbor estuarine system is a major reason for the designation of the four aquatic preserves. The commercial and recreational fisheries are some of the best in Florida. The fish, shrimp and crabs within these aquatic preserves are valuable resources, on which these fisheries depend. The extensive areas of undisturbed wetlands are excellent habitat for many types of wildlife. These wildlife include an extensive list of endangered species, migratory waterfowl, colonial waterbird nesting colonies, marine mammals, and hundreds of other marine and estuarine invertebrates and vertebrates.

The objective for the management of the animal life within the four aquatic preserves will be for the protection of the animal life by preserving the habitat and living conditions in the most natural condition possible.

Management Policy

a. Field Familiarization and Documentation. Field personnel will become familiar with the major animal life in each habitat in the four aquatic preserves. This identification process will include the location, number, season of siting, weather conditions and any other factors which may be necessary to build a working knowledge of the animal species, and their interaction and occurrence in the aquatic preserves.

b. Literature Familiarization. The field personnel will assemble a library of existing literature concerning the major animal species and communities within the aquatic preserves. The field personnel will become familiar with life histories, ecological requirements, position in the community, habitat and other factors necessary to their management.

c. Preparation of Guidelines for the Management of the Endangered Species Within the Aquatic Preserves. The field personnel will become familiar with the guidelines of the Florida Game and Fresh Water Fish Commission, U.S. Fish and Wildlife Service, Department of Natural Resource's Division of Marine Resources, National Marine Fisheries and any other applicable agencies and nongovernment organizations involved in the management of endangered species. These guidelines will be used in conjunction with the field familiarization, documentation, and possible mapping to develop management guidelines for each endangered species within the aquatic preserves. Special guidelines shall be developed and implemented for the management of areas within aquatic preserves that are identified as critical habitat of an endangered species.

d. Monitoring of Animal Species for Changes Due to Natural Causes.

Field personnel will study and monitor changes in animal species that are caused by natural phenomena, such as:

i. freezes;

ii. storms and hurricanes;

iii. changes in habitat due to changes in plant types; and

iv. geologic or hydrologic changes including erosion, estuarine

current flow changes, and any other physical changes.

e. Protection of Animal Life From Human Uses of the Aquatic Preserves. Field personnel, during the process of resource impact analysis in the review of use applications in or affecting the preserve, shall consider the protection of animal species. The review shall also consider the potential effects of the proposed use on the plant communities as they function as habitat for the animal life and uses that may cause a disturbance in the natural activities and functions of the animal life (e.g., air pollution, excessive noise or bright lights affecting a bird rookery). The field personnel should be notified of any activities (e.g., seismic testing, mammal capture by permit) within the aquatic preserves as they might relate to the well being of the animal life and be involved in planning the activity so as to cause the least amount of stress on the animal life.

f. Identification of Research Needs. The field personnel in the course of their duties shall identify research needs required to improve the management of animal life in the aquatic preserves. This identification process is more fully described in Chapter XII (Identified Program Need), Data/Information Needs.

3. Geologic Features

The management of geologic features will include the field personnel being aware of the natural geologic features and the changes, both human and natural, which affect these features within the aquatic preserves to better enable a review of applications for state-owned land uses that might affect these features. These geologic features will include islands, beaches, passes, shoals, shorelines, inlets, bays, and channels. The overall objective of the management of these features is to allow the naturally dynamic system to operate without man's influence or interference. Active management in this area shall include the review of proposed uses that might affect the geologic features within the aquatic preserve. The majority of this work will probably be on bulkheads as they might affect state-owned lands. The objective in the placement of bulkheads on lands upland of the aquatic preserve shall be that the natural contour and drainage be altered to the least amount practicable. Bulkheads are not allowed within the preserve, except as stated in Sections 258.42(2), and 258.44 F.S. and in accordance with the management objectives of these preserves.

The field personnel shall also be involved in the review of project proposals under other agencies, such as the U.S. Army Corps of Engineers or navigational district, and shall formally comment and review any permit application that impacts the aquatic preserves. These projects shall be reviewed jointly with those agencies' personnel whenever possible. Channel maintenance, jetty placement, and the opening of passes would be examples of such projects. The field personnel will review these projects on behalf of the aquatic preserve and its resources.

4. Archaeological and Historical Sites

Archaeological and Historical Sites have several characteristics which must be recognized in a resource management program.

i. They are a finite and non-renewable resource.

ii. Each site is unique because individually it represents the tangible remains of events which occurred at a specific time and place.

iii. While these sites uniquely reflect localized events, these events and the origin of particular sites are related to conditions and events in other times and places. They preserve traces of past biotic communities, climate, and other elements of the environment that may be of interest to other scientific disciplines.

iv. These sites, particularly archaeological sites, are very fragile because their significance derives not only from the individual artifacts within them, but equally from the spatial arrangement of those artifacts in both horizontal and vertical planes.

a. Administering agency. The management of the archaeological and historical sites is authorized and administered by the Division of Archives, History and Records Management (DAHRM) in the Florida Department of State. The management authority for this area of management is presented in Chapter II (Management Authority).

b. Management Policy. The management policy presented here is one of conservation, recommended by the Division of Archives, History and Records Management, and subject to that agency's changes. Their policy is as follows:

1. The field personnel and all other agencies planning activities within the aquatic preserves shall coordinate closely with DAHRM in order to prevent any unauthorized disturbance of archaeological and historical sites that may exist on the affected tract. DAHRM is vested with the title to archaeological and historical resources abandoned on state lands and is responsible for administration and protection of such resources (Section 267.061(1)(b), F.S.). It is illegal to destroy or otherwise alter sites on state lands without a permit from DAHRM (Section 267.13, F.S.). Therefore, agencies planning activities should coordinate their plans with DAHRM at a sufficiently early stage to preclude inadvertent damage or destruction to these resources.

2. The nature of these sites fragility and vulnerability to looting and other destruction requires that the location of these sites not be widely known, if the location is known at all. In most instances DAHRM will have knowlege of the known and expected site distribution in an area. Special field surveys for unkown areas may be required by DAHRM to identify potential endangerment of a proposed activity to these archaeological and historical sites. This will be especially necessary in the case of activities contemplating ground disturbance over large areas.

3. In the case of known sites, activities that are expected to alter or damage these sites shall alter their management or development plans as necessary, or make special provisions so as not to disturb or damage such sites prior to professionally acceptable and authorized mitigation.

4. If in the course of a management activity, or as a result of development or the permitting of dredge activities, it is determined that valuable historic or archaeological sites will be damaged or destroyed, DAHRM reserves the right to require salvage measures to mitigate the destructive impact of such activities on such sites (Section 267.061(1)(b), F.S.). Such salvage measures shall be accomplished before DAHRM would grant permission for site destruction.

5. Excavation of archaeological sites in the near future is discouraged. Archaeological sites within the aquatic preserves should be left undisturbed for the present, with particular attention devoted to preventing site looting by "treasure hunters".

6. Field personnel will note suspected sites for future surveys by DAHRM. Cooperation with other agencies in this activity is also encouraged by DAHRM. The DAHRM will help inform the field personnel about the characteristics and appearance of these sites.

7. Any discovery of instances of looting or unauthorized destruction of these sites will be reported to the DAHRM so that appropriate action may be initiated. The Florida Marine Patrol and other enforcement personnel of DNR shall provide enforcement assistance to DAHRM and make arrests or investigate cases of looting or other unauthorized destruction of archaeological sites.

The field personnel will follow the above management policy and become familiar with the personnel involved with this task in DAHRM and their procedures for identifying suspected sites.

5. Water Resources

Responsible management of water resources for the protection of human health and recreational enjoyment of these aquatic preserve waters as well as for the protection of the preserves' plant and animal communities, is without a doubt the most critical aspect of aquatic preserve management. Research to understand how human activity can alter or detrimentally affect the dynamic characteristics of an estuarine habitat can be approached confidently after monitoring data has been used to model the effects of naturally occurring variations on the same estuarine habitat. Only a single toxin may be necessary to initiate irreparable ecologically damaging changes in the water resources of all four of these aquatic preserves since they function as subsections of one hydrologic system supporting one biologically interdependent estuarine ecosystem.

Management Policy

The successful management of the water resources of the four aquatic preserves depends heavily on other government agencies (Department of Environmental Regulation and the Water Management Districts) charged with regulating water quality and quantity. The objective of this water resources management shall be to maintain the naturally high water quality and to ensure the natural seasonal fluctuations of fresh water into the estuary. Sources of data on water resources, other than from government agencies, are dependent or may be found among colleges, universities, scientific foundations and private

consultants working in the Charlotte Harbor area. These various entities have interests at many different levels and in different areas within the estuary. The aquatic preserves management program will manage the water resources through the coordination with these various entities. The field personnel will not have the ability to do water sampling, but through the analysis of the data from these other entities and their own field observations they will be able to identify water resource problems in the four aquatic preserves.

a. Familiarization with the Jurisdiction, Personnel, and Monitoring Programs of Government Agencies and Other Entities. Aquatic preserve field personnel will become thoroughly familiar with the jurisdiction, personnel and monitoring programs of other agencies, institutions and corporations involved in studying, monitoring, regulating and managing water resources within the four aquatic preserves and the basins which provide fresh water to these preserves. The basins in this case are those of the Peace, Myakka and Caloosahatchee Rivers, plus the basins of smaller streams which flow directly into aquatic preserve waters. Those agencies known to be working in the Charlotte Harbor aquatic preserves are listed below; and others may be added as they are identified.

1. Florida Department of Environmental Regulation
2. Southwest Florida Water Management District
3. South Florida Water Management District
4. U. S. Geological Survey
5. Florida Department of Natural Resources Marine Research Laboratory
6. Mote Marine Laboratory
7. Environmental Studies Program at New College of the University of South Florida at Sarasota

8. General Development Corporation, Environmental Quality Laboratory
9. U.S. Environmental Protection Agency
10. Florida Power and Light Company
11. Southwest Florida Regional Planning Council

b. Monitoring of Water Resources by Cooperative Data Collection and Reveiw. Field personnel will: 1. lend cooperative assistance to other agencies monitoring water resources within the four aquatic preserves and their basins; 2. promote coordination among involved agencies in planning monitoring program and in evaluating monitoring data; and 3. themselves monitor water resources within the preserves by reviewing the monitoring data collected and compiled by those agencies as it applies to the aquatic preserves and their resources.

c. Review of Permit and Lease Application for Aquatic Preserve Uses and Watershed Activities that would affect the Preserve Water Resources. Field personnel will review sovereign land lease applications, development of regional impact reviews, and DER/COE permit applications in cooperation with other agencies as necessary, and as outlined in Chapter V(C) for these proposed uses impact on the water resources of the four aquatic preserves.

d. Familiarization with and Monitoring of Activities and Users which Regularly Contribute Pollutants to Preserve Waters. Field personnel will become familiar with the activities and users which regularly or potentially contribute pollutants to the waters of these aquatic preserves. This monitoring will be both directly by field observations and indirectly by review of other entities' water resources data. Field personnel will encourage and

coordinate with other agencies involved with water resources monitoring to consider more detailed field monitoring in areas of the preserves where the incidents of polluting activities are found to be high.

These activities will also be applicable to Chapter X (Scientific Research), and the coordination through Chapter VI (Management Implementation Network). The field personnel's presence in the field will be complemented by their reliance on other agencies and entities for data and regulation. The field personnel will have the ability to visually monitor water resource crises and phenomena as they affect other resources.

6. Resource Mapping and Resource Protection Areas.

The resource description of such a large area requires the use of mapping and remote sensing. The Department of Natural Resources (DNR) has contracted with the Department of Transportation (DOT) to produce digitized vegetation and land use maps for the entire area of the four aquatic preserves. This work was done in conjunction with DNR's Marine Research Laboratory's Assessment of Fishery Habitat Loss Study in the Charlotte Harbor area.

The vegetation and land use mapping done in this study will become the basis for developing a Resource Protection Area management system in each of the four aquatic preserves. This mapping system will identify and classify various resources within each of the four aquatic preserves that require protection by the management program. This mapping system will also give acreage totals for each land use and vegetation classifcation in each preserve. The vegetation portion of the DOT mapping will be augmented over time by wildlife

and fisheries information (endangered species, bird rookeries, etc.), archaeological and historical site information and other resource factors deemed crucial to the continued health and viability of the aquatic preserves.

The DOT vegetation and land use mapping will be available in April, 1983. The onsite managers will supplement this mapping with the above information to develop a Resource Protection Area (RPA) mapping program. The RPA mapping system is anticipated to be based on three levels of resource classification. The class one level will contain resources of the highest quality. Uses proposed for these areas will receive the most rigorous review. The class one level will include the following: marine grassbeds (DOT codes, medium to dense (903) coverage); mangrove swamp (612); saltwater marsh (642); oyster bars; archaeological and historical sites (upland and submerged); endangered species habitat; colonial waterbird nesting sites; and other factors necessary to support this classification.

The class two level classification will be identified as those areas containing the resources of class one, but in a transitional condition compared to class one. These resources will either be building toward class one status or declining to class three status. Class two areas will require careful field review as to the specific area's sensitivity to each proposed use. In some respects, these areas may be as sensitive or more so to disturbances as class one areas. The resources of class two will include: marine grassbeds, sparse (901) or patchy (904) in coverage); mangroves in scrub condition or colonizing new lands (612); saltwater marsh (642) colonizing new lands; and other resources of class one type that fit in the class two condition.

The class three level classification will be characterized by the absence of the attributes of the above two classes. Class three areas may have small localized class one or two areas within them. Class three will generally have deep water areas or areas with no significant vegetation (541) or wildlife attributes. These areas will generally be more suitable to traditional aquatic preserve uses.

These RPA maps will require periodic revisions as the onsite managers learn more about the resource's reactions to man's uses. Scientifc research and other data additions may also require modification of this system. Natural changes will also require modification of this classification system. Periodic checking by Landsat satellite imagery will become useful for this remote sensing monitoring as the use of Landsat is more fully developed.

The RPA maps will become a planning tool for both onsite and central office staff. More detailed field review will still be required to supplement this information on a case by case basis, as necessary.

The initial development, as well as periodic review, will require the support and assistance of the many other resource regulating and management agencies, as well as local and regional government entities. Support will also be required of the colleges, universities, foundations and other interest groups and individuals.

The RPA mapping will use the same format as that of the DOT vegetation and land use mapping (USGS 7.5 minute quadrangle maps). These maps will be attached to the aquatic preserve management plan in Appendices D.

7. Cumulative Impact Anaylsis

Cumulative impacts are the sum total of major and minor changes or effects upon a natural system. Taken singularly these effects may not constitute a notable change in the condition of the natural system, but as these single changes or uses accumulate, their combined impact equals a substantive environmental disturbance or degradation of the natural system.

The review of proposed uses in the aquatic preserves by cumulative impact analysis requires a thorough knowledge of the natural system and the various interactions and dynamics within that system. This aquatic preserve management program will immediately initiate development of a cumulative impact analysis.

The availability of onsite preserve staff who are familiar with the distinctive characteristics of this estuarine system, coupled with their ability to access Landsat imagery, DOT land use mapping and other data sources, are the key to development of a successful cumulative impact analysis program. As cumulative impacts are identified for specific areas and/or resources, they will become an integral part of the project analysis and decision-making process.

8. Management of Encroachments

The management of encroachments in this section will apply to the unauthorized placement of structures or other illegal uses in the aquatic preserves. These encroachments might also include illegal extensions or uses in addition to an approved use (e.g., extension of a dock, construction of boat houses, extending an approved channel).

The management policy for the field personnel after the identification of a suspected illegal encroachment, will involve a reporting procedure, and the monitoring of the remedial action. After a field identification of suspected encroachments, field personnel will notify the central office to verify the title of property and research the possibility of the use being an approved activity. Due to the extensive areas involved in the four aquatic preserves, this will be a progressive activity depending on the field personnel's eventual familiarization with the preserves and the approved uses. The potential for these activities in such an extensive area may possibly require some type of mapping and recording system to assist the field personnel in monitoring these activities.

The management action for a verified illegal encroachment will be developed by the agencies specifically involved (i.e., Department of Natural Resources, Department of Environmental Regulation, etc.) The field personnel will assist in this process, as necessary, with the field evaluation or other support activities. The final action will be monitored by the field personnel, at the direction of the Trustees to the

central office. The procedures followed in these applications will be decided on a case by case basis.

C. Administrative Management Objectives

This chapter of the plan addresses the role of the Division of Recreation and Parks, Bureau of Environmental Land Management's central office, in the aquatic preserve management planning and implementation process. This central office role is generally interpreted within the context of coordinating activities with the preserve's field personnel. This coordination linkage is important to many program aspects, including project review and evaluation, local contact initiation, administrative rule development, contractual services and conflict resolution, not to mention the routine support (payroll, operating expenses, etc.) usually extended by the central office to the onsite managers. All program activities identified within this context are designed to protect and enhance the environmental, educational, scientific, and aesthetic qualities of the natural systems of the aquatic preserve.

1. Objectives

Specifically, the following administrative objectives are an essential part of the aquatic preserve management program.

a. To ensure a comprehensive, coordinated review and evaluation of proposed activities potentially affecting the environmental integrity of the aquatic preserves.

b. To serve as the link between aquatic preserve field personnel and state agencies and programs which originate in Tallahassee.

c. To serve as the primary staff in the development of administrative rule additions, deletions, and revisions.

d. To serve as the administrative staff for contractual agreements and services.

f. To establish and maintain a conflict resolution process.

2. Project Review and Evaluation

A major element in the administration of an aquatic preserve management system, is the establishment of a thorough project review process. It is the program intent that the central office staff review all proposed activities requiring the use of state-owned lands within the preserves.

Sections 258.42 through 258.44, F.S., establish the legal context within which all proposed uses of the aquatic preserves must be evaluated. Essentially, these sections require that projects be basically water-dependent or water-enhanced, not be contrary to the lawful and traditional uses of the preserve, and not infringe upon the traditional riparian rights of the upland property owner.

The primary mechanism through which project review of the proposed uses is realized is accomplished by participation in the state lands management process as established by Chapter 253, F.S., and modified by Chapter 258, F.S. The central office has been administratively designated, on October 4, 1982, as an agent of the Governor and Cabinet, sitting as the Board of

Trustees of the Internal Improvement Trust Fund, for the purposes of evaluating the environmental consequences of all proposed uses of state-owned lands within aquatic preserves. These proposed uses range from private single-family docks and navigation buoys to large commercial marinas.

In conducting the environmental evaluations, the central office staff will rely heavily upon the most current, readily available data such as Department of Transportation Landsat imagery, Department of Environmental Regulation biological reports, and other data resources (see Appendices). If a proposed activity is legally consistent with the maintenance criteria outlined in Section 258.42 F.S. and Chapter 16Q-20, F.A.C., and is generally of negligible environmental concern, then the project review will likely be conducted in it's entirety by the central office staff, utilizing the generalized environmental data.

The field personnel will be requested to conduct a more detailed environmental assessment of the project if the central office staff, during the course of the preliminary application review, determines that the requested use of state-owned lands may have a significant effect upon the environmental integrity of the preserve. Copies of all applications received will be provided to the field personnel for project monitoring and assessment of the possible cumulative impacts of these projects. Field personnel will be encouraged to establish direct communication links with the various regulatory and management agencies for purposes of

obtaining advance notification of projects potentially affecting the preserve. All environmental reviews and assessments, however, will be channeled through the central office unless other arrangements have been previously cleared with the central office.

While the state lands management program authorized by Chapters 253 and 258, F.S. and Chapters 16Q-20 and 16Q-21, F.A.C. is expected to be the primary management implementation vehicle for aquatic preserves, it is by no means the only vehicle. Section 253.77, F.S. and the December, 1982 Memorandum of Understanding betweeen the U.S. Army Corps of Engineers, Department of Environmental Regulation and Department of Natural Resources provides direct access from the Department of Natural Resources to the permitting process of the Department of Environmental Regulation. The D.R.I. and other regional or state level review processes represent other implementation mechanisms. The basic review approach and the evaluation relationship between the field personnel and the central office staff will be the same as the case involving the State Lands Management program.

One aspect of the aquatic preserve review and evaluation program is the identification of proposed activities that are either generally or specifically prohibited. Immediately upon review of such project applications, the central office staff will notify the Division of State Lands (or other program managers) that the proposed activity is unapprovable for the stated reasons. For those proposals which are subject to denial due to their adverse environmental impacts, even though the activity is permissible, Chapter 258, F.S., specifically provides that:

"(1) No further sale, lease or transfer of sovereignty submerged lands shall be approved or consummated by the Trustees except when such sale, lease, or transfer is in the public interest.

(2) The trustees shall not approve the waterward relocation or setting of bulkhead lines waterward of the line of mean high water within the preserve except when public road and bridge construction projects have no reasonable alternative and it is shown to be not contrary to the public interest.

(3)(a) No further dredging or filling of submerged lands shall be approved by the Trustees except the following activities may be authorized pursuant to a permit:

1. Such minimum dredging and spoiling as may be authorized for public navigation projects.

2. Such minimum dredging and spoiling as may be authorized for the creation and maintenance of marinas, piers, and docks and their attendant navigation channels.

3. Such other alteration of physical conditions as may, in the opinion of the trustees, be necessary to enhance the quality or utility of the preserve or the public health generally.

4. Such other maintenance dredging as may be required for existing navigational channels.

5. Such restoration of land as authorized by S. 253.124(8).

6. Such reasonable improvements as may be necessary for public utility installation or expansion.

7. Installation and maintenance of oil and gas transportation facilities, provided such facilities are properly marked with marine aids to navigation as prescribed by federal law.

(b) There shall, in no case, be any dredging seaward of a bulkhead line for the sole or primary purpose of providing fill for any area landward of a bulkhead line.

(c) There shall be no drilling of gas or oil wells. However, this will not prohibit the state from leasing the oil and gas rights and permitting drilling from outside the preserve to explore for oil and gas if approved by the board.

(d) There shall be no excavation of minerals, except the dredging of dead oyster shells as approved by the Department of Natural Resources.

(e) There shall be no erection of structures within the preserve except:

1. Private docks for reasonable ingress or egress of riparian owners;
2. Commercial docking facilities shown to be consistent with the use or management criteria of the preserve; and
3. Structures for shore protection, approved navigational aids, or public utility crossings authorized under subsection (3)(a).

(f) No wastes or effluents shall be discharged into the preserve which substantially inhibit the accomplishment of the purposes of this act.

(g) No nonpermitted wastes or effluents shall be directly discharged into the preserve which substantially inhibit the accomplishment of the purposes of this act."

Generally, applicants desirous of appealing staff recommendations will have to follow those appellate procedures outlined in the appropriate authorizing statutes. In the case of applications requesting the use of state-owned lands, three appellate procedures are available to the applicant.

Depending upon the type of application submitted, an applicant may: a. Ask the Governor and Cabinet to overturn an application decision rendered by the Executive Director of Department of Natural Resources (or his designee) under a delegation of authority; b. Request an Administrative Hearing under the procedures outlined in Chapter 120, F.S.; or c. Appeal the action of the Board of Trustees of the Internal Improvement Trust Fund to the District Court of Appeals.

3. Liaison Between Field Personnel and Other Interested Parties.

One of the most important aspects of the field personnel's job is to establish a mutually beneficial communication linkage with pertinent interest groups. The central office staff will assist the onsite personnel in initially identifying and contacting governmental bodies, special interest groups and interested individuals requiring aquatic preserve program coordination.

When requested by the on-site managers, the central office staff will assist in arranging for specialized management expertise not generally

available locally. This may include, for example, such things as arranging for Archives, History and Records Management to conduct a detailed cultural resource assessment for certain areas of the preserve.

4. Administrative Rule Responsibilities:

The central office will provide the staff for any required administrative rule additions, deletions or revisions arising from the aquatic preserve program. In all likelihood, the adoption of the individual aquatic preserve management plans will require amendments to Chapter 16Q-20, F.A.C. to reflect the preserve management as presented in this plan. Rule revisions will also be required if the Governor and Cabinet issue changes or additions to existing Cabinet policy concerning aquatic preserve management, or if the Legislature authorizes substantive amendments to the existing statutory authorities. All rule development will follow the procedures outlined in Chapter 120, F.S.

Chapter VI

MANAGEMENT IMPLEMENTATION NETWORK

This chapter of the management plan will address the various relationships of aquatic preserve management to the different government agencies and programs, and non-government entities, interest groups, and individuals within the aquatic preserve's area. The activities of both field personnel and central office staff as they relate to these other organizations will be presented.

A. Federal

Many federal agencies have property interests, land and wildlife management programs, research activities, construction activities, and regulation programs existing or potentially existing within the aquatic preserves. The objective of the aquatic preserve management program will be to complement these various activities wherever possible. The field personnel will assist these federal agencies in areas where they have common goals. The field personnel and central office staff (Bureau of Environmental Land Management in Tallahasee), will also review the federal activities as to their effect on the objectives of the aquatic preserve management. This review shall be coordinated through the Department of Environmental Regulation, Office of Coastal Management for the purposes of enforcing the provisions of the Federal Coastal Zone Management Act of 1972, as amended.

1. United States Fish and Wildlife Service. The U. S. Fish and Wildlife Service under the U.S. Department of the Interior operates four separate national wildflife refuges within the four aquatic preserves in the

Charlotte Harbor area (See Figure 2 and Appendix D). The Island Bay National Wildlife Refuge is in the Cape Haze Aquatic Preserve and very close to the Gasparilla Sound-Charlotte Harbor Aquatic Preserve. The Pine Island and J.N. "Ding" Darling National Wildlife Refuges are in the Pine Island Sound Aquatic Preserve. The Matlacha Pass National Wildlife Refuge is in the Matlacha Pass Aquatic Preserve. These refuges have important resources within them and their protection is of great importance to the surrounding aquatic preserve. The field personnel will become familiar with each refuge's management program and work with the federal personnel involved in this management. The field personnel will be able to notify the federal people of any irregular or illegal activities with the refuges, and hopefully, they can reciprocate in the aquatic preserves.

The aquatic preserve program will also be involved in the review of proposed preserve uses in conjunction with the Fish and Wildlife's, Division of Ecological Services. This division reviews dredge and fill requests and other federal level permitting under the Fish and Wildlife Coordination Act.

Another management program in which the field personnel could possibly interact with the Fish and Wildlife Service is the protection and recovery of endangered species and bird rookeries within the aquatic preserves. Field personnel will become involved in using available recovery techniques for this purpose.

2. Bureau of Land Management. The Bureau of Land Management under the Department of the Interior has several property holdings within various aquatic preserves. Both the field personnel and central office staff will

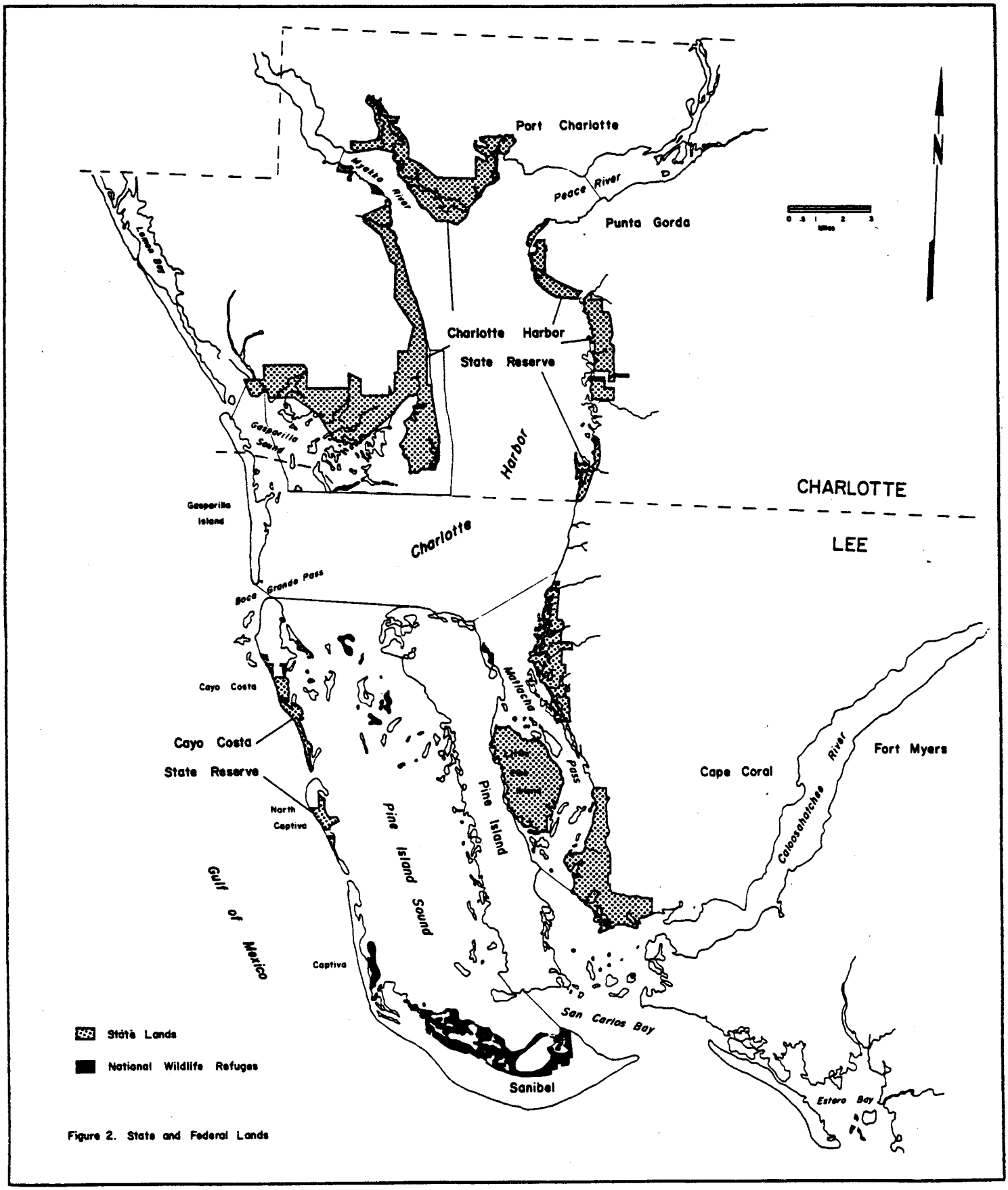

Figure 2. State and Federal Lands

become familiar with the Bureau of Land Management's management activities and will work with them whenever necessary.

3. U.S. Army Corps of Engineers. The U.S. Corps of Engineers (COE) is charged with providing technical guidance and planning assistance for the Nation's water resources development. The COE also provides supervision and direction to many engineering works such as harbors, waterways and many other types of structures. Their major responsibility, as it applies to the aquatic preserve, is the protection of navigable waters, pollution abatement and water quality, and the enhancement of fish and wildlife.

The COE activities in the Charlotte Harbor Aquatic Preserves include their involvement with the Florida Department of Environmental Regulation in the dredge and fill permitting process, technical oversight of channel and pass maintenance, and evaluating requests for new channels, passes, and other such public works projects. The field personnel will become familiar with the various programs, policies and procedures as they apply to the aquatic preserves. The field personnel and central office staff will also review proposed activities by the COE for conformance to the objectives of aquatic preserves management plan. This involvement should begin in the early stages of project planning in order to facilitate the best protection of the aquatic preserves possible.

4. U.S. Geological Survey. The U.S. Geological Survey (USGS) under the Department of the Interior has the reponsibility to perform surveys, investigations, and research pertaining to topography, geology, and the mineral and water resources of the United States. USGS also publishes

and disseminates data relative to those preceding activities. The USGS in the past has conducted many studies on various resources in the Charlotte Harbor region. They are currently involved in a study which concerns the four aquatic preserves of the Charlotte Harbor area entitled, "The Environmental Assessment of the Peace, Myakka and Caloosahatchee River Basins and Charlotte Harbor Estuarine System, Southwest Florida". Over the life of the project, this study is expected to supply much needed data on the existing conditions and evaluate the potential impact of future development on the water resources of the Charlotte Harbor area.

The study will include the chemical, biological, and water quality characteristics of the resources of this area, plus flow and circulation descriptions for the Charlotte Harbor area. The field personnel and central office staff will become familiar with this study and become familiar with the data results as they become available and integrate this information into their management activities.

5. U. S. Environmental Protection Agency. The U.S. Environmental Protection Agency (EPA), in cooperation with state and local governments is the federal agency responsible for the control and abatement of environmental pollution. The six areas of pollution within which the EPA is involved concerned are air, water, solid waste, noise, radiation and toxic substances. The Florida Department of Environmental Regulation (DER) is the state agency responsible for handling most of these programs on a state level in lieu of a federal program. Within the aquatic preserves, the field personnel will assist the EPA in planning field activities in which they may be involved and where there are common goals.

6. U.S. Coast Guard The U.S. Coast Guard is the federal agency involved in boating safety, including search and rescue when necessary. The Coast Guard is also charged with the permitting of structures which affect navigation and boating safety. These structures include bridges, causeways, aerial utilities and other structures which may be in conflict with navigational uses. The field personnel, in conjunction with the central office staff, will also review projects which the Coast Guard may be evaluating for permits.

7. National Marine Fisheries Service. The National Marine Fisheries Service (NMFS) under the U. S. Department of Commerce is active in the Charlotte Harbor area in recording commercial fish landings. The NMFS also has enforcement officers in the Charlotte Harbor area checking for illegal fishery activities. The field personnel will work with these personnel whenever they have common goals within the aquatic preserves.

B. State.

Many state agencies have programs which affect the resources or regulate activities within the aquatic preserves. There are also other programs within the Department of Natural Resources (DNR) that are within or affect the Charlotte Harbor area aquatic preserves. This section will describe the interactions and relationships of these various agency programs and how they relate to aquatic preserve management.

1. Department of Environmental Regulation. The Department of Environmental Regulation (DER) is responsible for regulating air and water quality and, in some cases, water quantity (through the water management districts) within the

Charlotte Harbor area. The DER is also the local contact for the initiation of dredge and fill applications in conjunction with the COE and DNR. With respects to water quality and dredge and fill regulation, the DER is possibly one of the most important agencies to the management of the aquatic preserves. The water quality of the preserves is the most important factor to the health of the estuarine complex and dredge and fill activities are one of the most potentially destructive activities within the preserves. The DER also regulates other forms of pollution, such as air, noise, and hazardous waste, which may be important in the future to the preserves.

The field personnel will become familiar with the water quality, dredge and fill, and other regulatory programs that are important to the aquatic preserves. The field personnel should develop a close working relationship with DER staff and become familiar with DER field activities and programs that are in common with the objectives of the aquatic preserve management program. The field personnel should open the most efficient line of communication with the local offices to receive the permit applications from DER as soon as possible to improve the response time within the review process.

The DER, office of Coastal Management is charged with coordinating activities related to Coastal Management in the state and and reviewing federal actions for consistency with the State Coastal Management Program, Section 380.20, F.S. The central office staff will maintain a close relationship with the Office of Coastal Management for assistance in the review of federal actions, data and research needs, and other program support.

2. Department of Community Affairs. The Department of Community Affairs is responsible for reviewing Developments of Regional Impact (DRI) and for Areas of Critical State Concern (ACSC). DRI's are major developments that have impacts on a scale which is greater than a county level and requires a regional review from neighboring local governments and state agencies. Both the central office staff and field personnel of the aquatic preserve program will be involved in reviewing DRI's. The field personnel should receive notice of a DRI through the central office staff and will proceed with the field review. The central office staff will coordinate the field review findings and work with the other state agencies in Tallahassee in the review of the DRI.

The ACSC staff of DCA has just completed the Charlotte Harbor Resource Planning and Management Program for the Charlotte Harbor Region. This region was identified as a possible area of critical state concern and the resource planning and management program was the preliminary review in this designation.

The ACSC program is intended to protect the areas of the state where unsuitable land development would endanger resources of regional or state-wide significance. When an area is identified as a possible ACSC, a Resource Planning and Management Program (RPMP) is established. The RPMP evaluates the resources, and the local government's land development practices. After this evaluation is complete, the RPMP committee makes recommendations to the local governments on how their land development practices could be improved to ensure an orderly and well-planned growth that would protect the critical resources. The local governments in Charlotte and Lee Counties are now in

the process of making these land development modifications, based on the RPMP recommendations. If these modifications are not made to the RPMP Committee's approval, those areas of local government that are not in conformance could be designated an ACSC or the entire area may be designated an ACSC by the Legislature. Under an ACSC designation, the local governments are required to notify DCA of any application for a development permit. The entire land development process will require the state's oversight until that local government modifies its land development practices to conform to the ACSC requirements. The Charlotte Harbor is still under review in this process. The recommendations of the Charlotte Harbor Committee as they apply to the aquatic preserves have been included in this plan.

3. Department of Natural Resources. The aquatic preserve management program is associated with several land management and other programs in the Department of Natural Resources (DNR) in the Charlotte Harbor area. These programs include the Charlotte Harbor State Reserve, Cayo Costa State Reserve, and the Cape Coral Wilderness Area. The present staff of the Charlotte Harbor aquatic preserves was assigned from the Charlotte Harbor State Reserve and Cayo Costa State Reserve staff to manage the preserves in conjunction with those programs. The Charlotte Harbor State Reserves forms a ring of mangroves around the shoreline of Charlotte Harbor proper and into the Cape Haze Aquatic Preserve mangrove areas (Figure 2). The Cape Coral Wilderness Area extends along the eastern shoreline of Matlacha Pass, but is broken in the middle by a two mile long out parcel just below State Road 78. Both the state reserves and wilderness areas will be managed in conjunction with the aquatic preserves, where possible.

There are other state-owned lands in the Charlotte Harbor area (e.g., Little Pine Island), that are upland or within the aquatic preserves that are not presently under an active management program. These areas will be incorporated in the aquatic preserve management program if their addition is advantageous to the preserves.

DNR's St. Petersburg Marine Research Laboratory under the Division of Marine Resources has several programs and projects within the Charlotte Harbor area which will benefit the aquatic preserve program. The Marine Lab is presently studying fishery habitat losses in the Charlotte Harbor estuarine complex.

The DOT digitized mapping, which will be used in the management of these aquatic preserves, was created as a product of that fishery habitat loss study. The data from this project, when it is completed, will be incorporated into this management plan. The Marine Lab staff is also involved in many other marine resource research projects. The field personnel will become familiar with these studies and will consult the Marine Lab for their data needs within the Charlotte Harbor estuarine complex whenever possible.

The Marine Patrol, under DNR's Division of Law Enforcement, also operates in the Charlotte Harbor area. The field personnel will become familiar with their programs and operation, and will call on the Marine Patrol for law enforcement support as required.

The Division of Marine Resources operates a Shellfish Environmental Assessment (SEAS) Program, locally out of Punta Gorda. The SEAS team performs monthly monitoring sampling of coliform levels in the Charlotte Harbor area in order to monitor conditions for shellfish harvesting. The SEAS team

also performs sampling during red tide events. The field personnel will maintain contact with SEAS staff and use their data in finding the sources of the coliform pollution if possible.

The Division of Marine Resources also handles the permitting for the collection of certain marine species and use of certain chemicals. The field and central office staff will become familiar with this permitting process and request notification of these permits within the four aquatic preserves.

The aquatic preserve program will work closely with the Division of State Lands in the review of applications for the use of sovereignty lands and other related issues. This relationship is more fully described in Chapter V(C).

The Division of Resource Management, through the Bureaus of Geology and Aquatic Plant Research and Development, is responsible for various programs potentially affecting the aquatic preserves. Additionally, this Division is responsible for administering the marine mammals protection program. Staff will establish communication linkages with this Division to ensure that adequate consideration is given to potential impacts upon the preserves that may result from the conduct of their various programs, such as oil and gas exploration and development, mining and reclamation activities, aquatic weed control, and manatee protection.

4. Florida Game and Fresh Water Fish Commission. (GFWFC) the The GFWFC's Environmental Services office in Vero Beach sends biologists to the Charlotte Harbor area to review projects which may have potential impacts on local fish and wildlife habitat as necessary. The field personnel will use the

GFWFC's assistance in their review process, when possible, and in developing fish and wildlife management for the aquatic preserves.

The GFWFC has enforcement officers working in the Charlotte Harbor Estuary area. The field personnel will interact with these officers where there are common goals.

The GFWFC is also the state coordinator of the Endangered Species in Florida. The field personnel and central office staff will work with GFWFC personnel in developing program needs in this area.

5. Department of Transportation. (DOT) The DOT has an office in Lee County and the resident engineer, by agreement, will notify the field personnel of anticipated projects having possible impacts on the aquatic preserves and their major tributaries. The field personnel and administrative staff will review any major highway or bridge projects that may be proposed in the future.

6. Department of State. The Division of Archives, History and Records Management (DAHRM) in the Department of State will have a close working relationship with the field personnel and central office staff in the protection of archaeological and historical sites. The field personnel will be directed by DAHRM in any activities or management policy needs for these sites.

7. Health and Rehabilitative Services. (HRS) Both the central office staff and field personnel will establish communication and coordination linkages with HRS and their locally conducted programs of septic tank regulation and mosquito control. Additionally, the central office staff will become involved in future meetings of the Governor's Working Group on mosquito control. Subsequent policy recommendations coming out of this group will be evaluated for applicability to the ongoing aquatic preserve management program.

C. Regional.

The regional level of the management implementation network as it applies to the aquatic preserves in Charlotte Harbor will include the two water management districts (South Florida, Southwest Florida), Southwest Florida Regional Planning Council, and the West Coast Inland Navigational District. These organizations have activities that are broader than the local government, but are on a smaller scale than the state level.

1. Water Management Districts. The district boundaries of the South Florida Water Management Distict (SFWMD) contain the lower southwest portion of Charlotte County and all of Lee County. Southwest Florida Water Management District (SWFWMD) boundaries include the remainder of Charlotte County and the Myakka River Basin in Sarasota County. SFWMD follows the Caloosahatchee River Basin and SWFWMD the Peace River and other basins to the North. The water management districts administer permitting programs for the local consumptive use of water, stormwater discharges, and dredge and fill type activities. This includes the withdrawal and use of water from rivers, streams, and wells. The types of water uses they permit in the

Charlotte Harbor region include irrigation, mining, and public water supply. The field personnel will become familiar with the review and permitting procedures as they might apply to the water supply of the the Charlotte Harbor estuarine complex. The water management districts are also involved in various studies on water supply and other related research that may be of use to aquatic preserve management.

2. Regional Planning Council. The Southwest Florida Regional Planning Council (SWFRPC) serves the local governments of Charlotte and Lee Counties, as well as four other southwest Florida counties, as a regional planning body. Among its duties, the SWFRPC: a. aids local governments with planning expertise; b. is the regional representative for the Development of Regional Impact (DRI) review process; c. serves as a regional clearinghouse for state and federal projects and programs; and d. conveys information from the local governments to the state and federal levels. The field personnel will become familiar with the various projects, programs, and data sources that the SWFRPC has within its administration that may effect or prove useful to the aquatic preserve program.

The DRI review of projects which affect the aquatic preserves will be reviewed by the central office staff, with the field personnel's field review, when necessary. DRIs for large marinas, large subdivisions on the uplands above the preserves, and commercial or industrial developments, will require a field review by the field personnel as to their effect on the aquatic preserves.

3. West Coast Inland Navigational District. (WCIND) The WCIND is a multi-county district on the west coast of Florida which acts as the local sponsor of navigation projects, public works and any related research projects that are necessary to carry out these tasks. This research capability includes the study of the environmental effects of navigational activities and restoration of damages from construction of the projects. The field personnel as directed by the central office will review any proposed project which will affect the aquatic preserves of Charlotte Harbor.

D. Local Governments and Special Districts.

This section will address the relationship of the aquatic preserve management program to the various local government agencies, special districts and their programs. The local governments are the incorporated cities and counties that surround the aquatic preserves. The counties involved are Charlotte and Lee. The incorporated cities include Cape Coral, Punta Gorda, Sanibel and indirectly Fort Myers, on the Caloosahatchee River. The special districts include mosquito control in Charlotte and Lee Counties, drainage districts, and any other special districts that might affect the aquatic preserve. The field personnel will be the local liaison for the aquatic preserves to these local government entities. The field personnel will be available to these local entities to assist them in modifying their policies and practices to conform to the objectives of the aquatic preserve's management plan.

1. Relationship to local management plans. The local governments are required by the Local Government Comprehensive Planning Act of 1975

(LGCPA), (Section 163.3161, F.S.) to have a comprehensive management plan with elements relating to the different governmental functions (i.e. housing, physical facilities, conservation, land use, and coastal zone protection). These plans, in effect, are long-range plans for the orderly and balanced development of the city or county. The comprehensive plans guide local zoning policies and practices toward a future as set out in the plan. No development was to be permitted that did not conform to the local government's comprehensive plan.

The aim of the aquatic preserve, with respect to these local government comprehensive plans, is to have their plans be consistent with the aquatic preserve management plans. The field personnel will become familiar with each of the above plans and how they support or are in conflict with the objectives of aquatic preserve management. The field personnel will assist local planning officials in having their plans meet these objectives. The field personnel and central office staff will assist these officials in the preparation of their Marina Elements, as required in Chapter IX. It is hoped that local governments will join in the spirit of aquatic preserve management and be willing to work for these changes.

The special districts may not have an official comprehensive management plan equivalent to the LGCPA plans, but, they do have management policies and program statements that may be similar to such a plan. The field personnel will become familiar with these policies and program statements and activities of these districts, and monitor their effect on the aquatic preserves. For example, the field personnel might recommend indentifying

areas that should not receive mosquito spraying or other alternative management because of remoteness to inhabited areas and possible, but unnecessary damage to the resources of the aquatic preserve, or drainage districts might be asked to not use certain types of herbicides or use them only at certain times of the year.

2. Relation to local development codes. The local zoning and development codes (e.g., building codes) provide the major local regulation as to what an owner can do on a particular parcel of property. The zoning prescribes the allowable uses and the intensity of those uses. These uses along an aquatic preserve can potentially have a profound effect on a preserve.

This section will operate in conjunction with the preceeding section on local management plans. The field personnel will become familiar with the local zoning and its potential effects on nearby aquatic preserves. The field personnel will assist local planning and zoning officials in identifying areas where changes in zoning would better conform to the objectives of the aquatic preserve management. The field personnel might also offer to assist local planning and zoning officials in the review of proposed subdivisions upland of the preserves.

3. Suggested policies and practices in support of Aquatic Preserve Management. This section will address any other policy or practice not covered in the two preceeding sections. These policies and practices might include local government mangrove ordinances, recreation problems where a park is in or near an aquatic preserve, or any other problem as it might apply to local governments to offer assistance or information to local officials or in coordinating

with other agencies to help solve these problems as they occur. The field personnel will also comment, through the central office, on any local practice that is identified as endangering the well being of the aquatic preserves.

E. Other Entities.

This section will apply to the numerous entities that have an interest in the aquatic preserve but are non governmental agencies. This will include, but not be limited to, the environmental interest groups (i.e., Audubon Society, Sierra Club, ECOSWF, Sanibel-Captiva Conservation Foundation), the scientific organizations (i.e., Environmental Quality Laboratory, Mote Marine Lab), the fishing and sports interest groups (i.e., Florida League of Anglers Organized Fishermen of Florida), the universities that may have research activities in the preserves (i.e., University of South Florida-New College, University of Miami, University of Florida), and any other interest groups or individuals. The relationship of these entities to aquatic preserve management might include the coordination of activities, such as scientific research, environmental education, management of rookeries or other natural areas, or numerous other possible activities. A worthwhile aquatic preserve management process will depend on the continued support and help of these interest groups in all of the aquatic preserves. The field personnel will be active in communicating the aquatic preserve management process and activities to the various groups and consulting with them for their help in their areas of expertise.

Chapter VII

PUBLIC USES

This chapter addresses the public use of the aquatic preserves. The public in this case shall refer to the general public or those persons without riparian rights. The "Florida Aquatic Preserve Act of 1975" (Section 258.35, F.S.) allows for the lawful and traditional public uses of the aquatic preserve, such as sport fishing, boating and swimming (as adapted from Section 258.43[1], F.S.). These and other traditional uses that do not involve a commercial intent or the use of a riparian right to place a structure in the preserve, and do not degrade or otherwise destroy the preserves will be considered public uses. This section will be further divided into consumptive and non-consumptive uses as applicable to each resource.

A. Consumptive Uses.

Consumptive uses involve the removal of resources from the preserves. These uses include fishing, hunting, shellfishing, shell collecting, and any other related uses. The management of these uses (see Chapter V. Resource Management, Section B: Onsite Management Objectives) will include the observation and monitoring of the effects of these uses on the resources. The field personnel will periodically assess the impacts through comparison to the Marine Research Laboratory's Fishery Habitat Loss Studies in the Charlotte Harbor area plus any other

studies or data sources that might become available. This management will also include the protection of the resources from unlawful or excess practices of these uses. The legality of these uses will be controlled by existing applicable state laws and local ordinances. These uses will also be monitored for their effect on other resources (e.g., bird rookeries, marine grassbeds, oyster bars, archaeological and historical sites). The field personnel will also be sensitive to additional enforcement needs (i.e., the need for additional enforcement staff during nesting seasons).

B. Non-consumptive Uses.

These uses are those which do not generally remove resources from the preserves. Examples of these uses include swimming, diving, boating, bird-watching, other related activities. The management practices involved with these uses will be the same as those previously described under Section A., except that these uses are not generally controlled by law. The guiding principle in these cases will be whether or not the activity causes a disruption of the preserve resources (e.g., destruction of marine grassbeds, disturbs rookeries). Only in the event of these disruptions will the field personnel become involved. Some of these uses may possibly be involved in environmental educational (Chapter XI) programs.

Chapter VIII

PRIVATE NON-COMMERCIAL Uses

This section will apply to those private, non-commercial, uses which are derived from riparian rights (e.g., docks, piers). The management of aquatic preserves must recognize the rightful and traditional uses of those near-shore sovereignty lands lying adjacent to upland property. This right of ingress, egress, boating, swimming, fishing, and other incidental uses of sovereignty lands normally allows for the placement of certain structures, such as docks, within the preserve. This right, however, can only be exercised with the prior consent of the Board, and does not include approval of activities that destroy or damage areas of environmental significance. The review of these will require the interaction of the Resource Protection Area mapping with the administrative and possible field review with later monitoring by field personnel as projected by Chapter V, Section B.

Private non-commercial uses shall be designed to avoid Critical Resource Protection Areas and shall be designed to reduce the use's impact to the preserve in general. Individuals planning to apply for the private non-commercial uses shall refer to the applicable Resource Protection Area Map in Appendix D.

Bulkheads should be placed, when allowed, in such a way as to be the least destructive and disruptive to the vegetation and other resource factors in

each area. Uses which do disrupt or destroy resources on state-owned lands will require mitigation. This mitigation will include restoration by the applicant or other remedy which will compensate for the loss of the affected resource to the aquatic preserve.

Dredging within the aquatic preserve shall be held to a minimum. Dredging proposals shall be reviewed according to the procedures in Chapter V depending on the proposed activities location within the RPA. Proposals within class one areas (Chapter V (B)[6]) will be scrutinized to the maximum extent in order to find the best practicable method of development and location if that use is acceptable in that particular area of the preserve. The mitigation of lost or disturbed resources shall be required. There shall be no dredging allowed in critical habitat areas or in nearby areas if it will adversely impact critical habitat areas.

The location of proposed multiple docking facilities, such as for condominium developments, shall be based on the marina siting criteria described in Chapter IX, because their impact is generally the same as marinas. No multiple docking facilities shall be located in Class 1 or 2 resource protection areas; provision for reasonable riparian ingress and egress shall be specifically allowable. The multiple docking facility designation will include any multiple docking facility for multiple unit developments, subdivision facilities or other non-profit operation. Docks and piers need to be located so that they cause the least amount of destruction or displacement of resources within the preserves. These resources should include all the factors used in the designation of RPA's (mangroves, marine grassbeds, etc.). Docks should be sited and designed so that they require minimum, if any, dredging.

Chapter IX

COMMERCIAL USES

This section addresses the variety of traditional and non-traditional (i.e., new uses to this area) commercial uses which might occur within the aquatic preserve. Among the traditional uses in the Charlotte Harbor area are utility crossings, marinas, fish packing houses, oil storage and other port facilities, commercial fishing, collection of marine animals for marine shows, and other types of fishing or boating for hire. Non-traditional uses in the Charlotte Harbor area which have also occurred in other areas of this or other states, include power plants, oil and gas transportation facilities, aquaculture, seaplane facilities, ferry services in or over the water, and other such commercial uses.

A. Traditional Commercial Uses.

1. Utility Crossings. There are at the present time both aerial and underwater utility crossings in the aquatic preserve. Future proposals should be designed so the preserves are crossed by the least destructive method in the least vulnerable areas according to the RPA maps (see Chapter V[B]). Increased or additional use of existing utility crossings is preferable, if their condition at the time of the proposal is acceptable. The field personnel should eventually develop a utility crossing plan for all areas with anticipated utility crossing needs to allow for clear and advance planning of these crossings in the best environmental location possible. The utility crossing plans, when completed, will become a part of this plan. Crossings should be

limited to open water areas to minimize disturbance to marine grass-beds, mangroves or or saltwater marsh grasses.

2. Commercial Fishing. The management of aquatic preserves shall not include the direct management of commercial fishing activities. Field personnel will monitor these activities and assess their affects on the preserve only in conjunction with the Division of Marine Resources and as part of a cooperative effort with that division. The field personnel will also notify the requisite authority in the event of illegal activities (Chapter 370 F.S. or by special act). For example, Charlotte County has special acts against certain types of fishing in its waters, and the field personnel will notify the appropriate officials in the event these acts are broken. The field personnel, along with other agencies and the division's programs and studies, will monitor fishing activities within the aquatic preserve with respect to the need to manage access of boats in certain areas, prevention of marine grassbed destruction and other needs of the aquatic preserve as they are associated with commercial fishing activities.

3. Marinas. The locating of marinas and their related uses will be a major concern of the Charlotte Harbor Aquatic Preserves management. Marinas represent a use with many potential impacts on the preserve's resources. The siting policy of the Blue Ribbon Marina Committee (Final Report-January 1983), as adopted by the Governor and Cabinet, is modified and shall be used for siting marinas in the aquatic preserves. This policy will be that:

a. marinas shall only be located in or near well flushed, deep water areas,

b. the design of the marina should not rely on dredge or fill activities,

c. the marina shall not be located in Class 1 and 2 resource protection areas,

d. the site location shall also take into account the access of the boat traffic to avoid marine grassbeds in the surrounding areas,

e. the location of new facilities shall be secondary to the expansion of existing facilities,

f. new facilities shall be discouraged in any location and shall be allowed only in Class 3 resource areas, and then only where the local governments have a marina element and after careful review and approval by the Board,

g. marinas should be specifically sited away from critical manatee habitat,

h. field personnel will also work with local governments (see Chapter VI) on location of marinas close to demand and in areas with sufficient uplands to support activity needs, and

i. field personnel will also work with those agencies in finding marina sites that meet the above policies and are protected from hurricanes.

4. Deep Water Port Facilities. The nature of these uses will require the same type of review as required in the above Marinas section. New port facilities shall be prohibited, and expansion of existing port facilities will be strongly discouraged and such approval will be carefully evaluated as to potential environmental damage. Special precautions will also be required to avoid the possibility of toxic materials and other pollutants being released into the preserves. Other impacts, such as air quality problems, high noise levels and high intensity lighting will require careful selection of a port location in areas that will not adversely affect

wildlife or other resources.

5. Ferry Services. Ferry services to the barrier islands were once the major means of travel. Proposed ferry services to the barrier islands will require careful planning of the route and operating schedule that will not disturb wildlife or other resources within the preserves.

6. Other Docking. Any other type of commercial docking, not mentioned in the preceding sections, will follow the marina siting policy as stated in Section A(3) of this Chapter.

B. Non-traditional Commercial Uses

1. Aquaculture. The Charlotte Harbor area could potentially have proposals for aquacultural development in the future. These uses may include floating structures or other new techniques now being used in aquaculture. The location and type of impacts to the resources will require careful examination. If there is not sufficient data available for a valid evaluation, a small scale test of the use might be possible in a selected area.

2. Power Plants. Power plants have the potential for causing major changes in the air quality, water quality, plant and animal life of the aquatic preserves. For these reasons they are potentially incompatible with the purposes of aquatic preserve management. The location of proposed power plants upstream of a preserve should also be evaluated as to the effects on the downstream preserves.

3. Seaplane Areas. Uses of this sort, which cause high noise levels, high speed disturbances or constant activity over a standard route or landing area, will require careful placement in areas that will not disturb wildlife, affect marine grassbeds, or otherwise degrade the natural condition of the aquatic preserve. The field personnel should be involved in the planning, time of operation scheduling and the later monitoring of this type of activity in conjunction with the central office staff.

4. Other Uses. Any other use that qualifies as a commercial use of state-owned submerged lands not mentioned above will require a review for its anticipated impact on the aquatic preserve and the best location for the activity compatible to the resource protection areas within each preserve.

Chapter X

SCIENTIFIC RESEARCH

The field personnel attached to the Charlotte Harbor aquatic preserves should serve as the area coordinator of scientific research in the preserves. Scientific research, and any other type of research or testing within the aquatic preserves, should require the clearance of both the field personnel and the central office staff before these activities can proceed. Certain activities could be detrimental to the resources of the preserve and should be carefully reviewed before allowing them to occur. Factors, including location, type, and time of year, should be carefully reviewed for the possible disturbance or affect of the research, on the other resources of the aquatic preserves. The field personnel, will be aware of the possibility of working with other government agencies, colleges, universities, research foundations and government programs to fill the data needs of the aquatic preserves (see Chapter V and XII). The field personnel will assist in the selection of possible test sites and other research needs within the preserves.

Chapter XI

ENVIRONMENTAL EDUCATION

The aquatic preserve should be used to enhance environmental educational programs at every opportunity. The goal of maintaining the aquatic preserves for the benefit of future generations can begin to be realized through the use of the aquatic preserve for environmental education. The education of the youth in Charlotte and Lee Counties is a very good way of enhancing the knowledge of the natural systems and future support of the aquatic preserve program. Knowledge of the resources in the preserves and their values are a major factor in the continued protection of the aquatic preserves in the future.

The field personnel will, through their normal activities in the aquatic preserves, select good examples of habitats and resources, within these aquatic environments for use during educational group tours. This might possibly include the development of an environmental educational boat tour through the preserves. These activities should also include the eventual development of a brochure outlining the major points of management in the four aquatic preserves. These brochures could then be circulated to the various user groups.

The field personnel should also prepare programs on the aquatic preserves for presentation to interested groups of all ages on the values of management activities. These types of presentations are also useful in explaining the management of the aquatic preserves to government units and private interest groups. The education of the public on aquatic preserve management is the key to the success and future of the preserves.

Chapter XII

IDENTIFIED PROGRAM NEEDS

This chapter of the management plan will address the various internal program needs that are expected to be identified during management activities. Meeting these needs will correct or generally relieve some stress on the preserves or the personnel involved in the management of the aquatic preserves. These needs may, in some cases, require legislative or administrative rule changes or acquisition of critical areas by the state.

The need to identify problem areas and adjust the management plan in a manner that will positively address these problems and management needs is an essential element of any good management program. Both field personnel and central office staff will continually monitor the management plan implementation process and specifically identify observed program needs and problems. The areas to be monitored include, but are not limited to:

A. Aquisition of additional property,

B. Boundary problems,

C. Legislative needs,

D. Administrative rule changes,

E. Data needs,

F. Resource protection capabilities, and

G. Funding and staffing needs.

Staff will annually develop an implementation status report that will contain a summary of identified management needs and suggested measures to be taken in meeting these needs.

A. Acquisition of Additional Property

There are areas both within and upland of the four aquatic preserves that are in public ownership under the jurisdiction of various local, state and federal agencies. Many of these lands contain important resources, such as bird rookeries, archaeological or historical sites, and endangered species habitat. Formal management agreements, memorandums of understanding, etc., that will ensure the compatible management of these areas shall be developed.

Other areas within or adjacent to the preserves that are in private ownership should be closely examined to determine the advisability of bringing them into public ownership. The acquisition of these lands might act as a buffer to critical resources, prevent development of sensitive areas, allow the restoration of areas adversely affected by previous development or allow removal of disrupting uses within a preserve. The field personnel, during normal management activities, should be aware of significant upland areas and sovereign land conveyances, which if developed, would compromise the integrity of the aquatic preserves. The field personnel will keep a running record of these areas and will prioritize these areas for possible public acquisition.

B. Boundary Problems and Systems Insufficiences

The boundaries of the aquatic preserves are often artificial delineations of the natural systems within and surrounding the preserves. A variety of scientific studies are presently being conducted both within and outside of

the preserves boundaries, and their results could conceivably require a change in these boundaries. These changes may include the extension of the present boundaries in some areas or exclude other areas. The field personnel, in their normal management activities, will be sensitive to the possible need for boundary modifications. Potential boundary changes and acquisition projects might include areas in the Gulf of Mexico, areas upstream of the present boundary in the streams flowing into the preserves, previously conveyed sovereign lands or other areas not presently within the preserves. Any boundary change will require legislative approval.

C. Legislative Needs

Management needs could conceivably involve changes in the legislation pertaining to aquatic preserves or the other statutes upon which aquatic preserve management is based. These changes may include boundary realignments or the strengthening of certain management authorities.

D. Administrative Rule Changes

Administrative rules are statements addressing the organization, procedures and practices used in the implementation of aquatic preserve management plans and policies. This process includes identifying problems within the Department of Natural Resources, as well as other agencies, that affect the management of the preserves. It is anticipated that the present general administrative rule on Florida Aquatic Preserves (Chapter 16Q-20, F.A.C.) will be amended to reflect this management plan's specific management concept.

E. Data (Information) Needs

The field personnel and central office staff will note data needs and promote research or other means to fulfill them. Data needs in the near future could possibly be supplied by such ongoing projects as the USGS Charlotte Harbor study. The field personnel will be aware of data needs as they interact with the various levels of government and other entities. These data needs might include additional mapping, ownership information, water quality data or any other data. The major supplier of data will probably be other public agencies conducting programs in and around the preserves. Other potential sources of data are the colleges and universities that have, in the past, conducted research projects in the Charlotte Harbor area.

F. Resource Protection and Enforcement Capabilities

There are some indications that the present level of enforcement is not fully protecting the resource, either as the result of a lack of manpower or authority. These needs might require additional enforcement support from local government or other state agencies, including tactical and logistical support. These needs may also involve additional equipment or vehicles.

The field personnel will become familiar with the capabilities of both Department of Natural Resource's staff and the other agencies with enforcement responsibilities in the preserves. Annually staff should fully assess the effectiveness of the protective and enforcement capabilities of these combined agencies.

G. Funding and Staffing Needs

The present aquatic preserve management program has been minimally implemented with funds from a variety of sources. The writing of this management plan was funded through a grant from the U.S. Office of Coastal Zone Management, National Oceanic and Atmospheric Administration, and the Office of Coastal Management in the Department of Environmental Regulation through "the Coastal Zone Management Act of 1972", as amended. This grant will end in early 1983.

The Bureau of Environmental Land Management, also responsible for management of the state reserve system, has provided assistance to the aquatic preserve program by involving the Bureau Central Office staff, as well as Cayo Costa and Charlotte Harbor State Reserves personnel. As the aquatic preserve program lacks specific appropriations for staff and equipment at this time, increasing the workload of existing personnel is the only option available to initiate an aquatic preserve program.

However, in order for the management program proposed in this plan to function and succeed, the program must have its own funding and staffing. The workload required by this program is too much for an existing staff to handle in addition to their obligations to the state reserves. Funding and staffing needs are critically important to the success of the aquatic preserve program.

A proposed budget of the funding and staffing needs for this Charlotte Harbor Aquatic Preserve Management Program has been estimated at $480,000

for staff, office/lab facility, equipment and expenses for the first year of operation. The proposed staff would include an environmental specialist, two biologists, two rangers and a secretary. An annual operating budget after the first year is estimated at approximately $150,000. This budget is anticipated to fulfill the funding and staffing needs of the program as identified in this plan.

LITERATURE CITED

Ballantine, D., and H.J. Humm. "Benthic Algae of the Anclote Estuary 1. Epiphytes of Seagrass Leaves." Florida Scientist, Vol. 38, No. 3, 1975.

Barnett, Brian, S., Raymond T. Fernald, Andreas Goetzfried and Stephen R. Lau. The Fish and Wildlife Resources of the Charlotte Harbor Area. Office of Environmental Services, Florida Game and Fresh Water Fish Commission, Vero Beach, FL, 1980.

Charlotte Harbor Resource Planning and Management Committee, Technical Advisory Committee. Technical Appendices. circa 1980.

Covington, James W. "Trade Relations Between Southwestern Florida and Cuba 1600-1840." Florida Historical Quarterly. Vol. 38, 1959.

Estevez, Ernest Dr. A Review of Scientific Information: Charlotte Harbor Estuarine Complex. Final Report to Southwest Florida Regional Planning Council. Mote Marine Laboratory, Review Series No. 3, Fort Myers, FL, 1981.

Florida Game and Fresh Water Fish Commission. Official Lists of Endangered and Potentially Endangered Fauna in Florida. February, 1983.

Goggin, John M. "Cultural Traditions in Florida Prehistory." The Florida Indian and His Neighbors. Griffin, John W. ed. Inter-American Center, Rollins College, Winter Park, Florida, 1949.

Heald, E.J., and William E. Odum. "The Contributions of Mangrove Swamps to Florida Fisheries." Proceedings of the Gulf Caribbean Fish Institute, Vol. 22, 1970.

Herwitz, Stanley. The Natural History of Cayo-Costa Island. New College Environmental Studies Program publication, No. 14, Sarasota, FL, 1977.

Odum, Howard T. "Tropical Marine Meadows." Coastal Ecological Systems of the United States. Vol 1 Odum H.T., D.J. Copeland, and E.A. McMahan, eds. Conservation Foundation, Washington D.C., 1974.

Odum, William E., Carole C. McIvor and Thomas J, Smith, III. The Ecology of the Mangroves of South Florida: A Community Profile. U.S. Department of the Interior, Fish and Wildlife Service, FWS/OBS - 81/24, January, 1982.

Savage, Thomas. Florida Mangroves as Shoreline Stabilizers. Florida Department of Natural Resources. Professional Paper No. 19, 1972.

Literature Cited (Continued)

Taylor, John L. "The Charlotte Habor Estuarine System." The Florida Scientist, Vol. 37, No.4, Fall, 1974.

Wang, Johnson C.S. and Edward C. Raney. Distribution and Fluctuation in the Fish and Fauna of the Charlotte Harbor Estuary, Florida. Mote Marine Laboratory, June, 1971.

Ward, Daniel B. ed. Rare and Endangered, Biota of Florida; Plants, Volume Five, Pritchard, Peter C.H., series editor. University Presses of Florida, Gainesville, 1978.

Wood, E. J. Ferguson, William E. Odum, and Joseph C. Zieman. Influence of Seagrasses on the Productivity of Coastal Lagoons. Mem. Simp. Intern, Lagunas Consteras, UNAM-UNESCO, 1969.

Zieman, Joseph C. "The Ecological Effects of Physical Damage From Motorboats on Turtle Grass Beds in Southern Florida." Aquatic Botany, Vol. 2, 1976.

Zieman, Joseph C. The Ecology of the Seagrasses of South Florida: A Community Profile. U.S. Department of the Interior, Fish and Wildlife Service, FWS/OBS-82/25, September, 1982.

***

CONTENTS OF APPENDICES

Appendices Contents (Continued)

Appendix D: Maps (Con't)

***

This page intentionally
left blank

This page intentionally
left blank