



FRAMEWORK FOR ACTION

Quantifiable Objectives and Proposed Action Plans for the Greater Charlotte Harbor Watershed

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for the

Charlotte Harbor National Estuary Program

- *Peace River & Watershed • Myakka River & Watershed*
- *Coastal Venice/Lemon Bay/Gasparilla Sound/Cape Haze*
- *Charlotte Harbor Proper • Pine Island Sound/Matlacha Pass*
- *Estero Bay & Watershed • Tidal Caloosahatchee River & Watershed*

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LIST OF ACRONYMS

ABM	Estero Bay Agency for Bay Management	FDOT or DOT	Florida Department of Transportation
ACOE or Corps	Army Corps of Engineers	FEMA	Federal Emergency Management Agency
CARL	Conservation and Recreational Lands Program	FLAWAC	Florida Land and Water Adjudicatory Commission
CBIA	Coastal Barrier Improvement Act	FMRI	Florida Marine Research Institute
CCMP	Comprehensive Conservation and Management Plan	FS	Florida Statutes
CDBG	Community Development Block Grant	GFC	Florida Game and Fresh Water Fish Commission
CFRPC	Central Florida Regional Planning Council	GICIA	Gasparilla Island Conservation and Improvement Association
CHEC	Charlotte Harbor Environmental Center	LDRs	Land Development Regulations
CHNEP	Charlotte Harbor National Estuary Program	LPA	Local Planning Agency
CNPC	Coastal Nonpoint Pollution Control	MOA	Memorandum of Agreement
CREW	Corkscrew Regional Ecosystem Watershed Trust	MPRSA	Marine Protection, Research, and Sanctuaries Act
CWA	Clean Water Act	MSSW	Management and Storage of Surface Water Permitting
CZMA	Coastal Zone Management Act	NEP	National Estuary Program
DCA	Department of Community Affairs	NADP/	
DEP	Department of Environmental Protection	NTN	National Atmospheric Deposition Program/National Trends Network
DRI	Development of Regional Impact	NAWQA	National Water Quality Assessment Program
DWMP	District Water Management Plan	NBS	National Biological Service
ECARP	Environmental Service Conservation Acreage Reserve Program	NEPA	National Environmental Policy Act
EM	Ecosystem Management	NOAA	National Oceanic and Atmospheric Administration
EMA	Ecosystem Management Area	NPDES	National Pollutant Discharge Elimination System
EMAP	Environmental Monitoring and Assessment Program	NPS	Nonpoint Source
EPA	Environmental Protection Agency	NRCS	Natural Resources Conservation Service
ERP	Environmental Resource Permitting	OGT	Office of Greenways and Trails
FAC	Florida Administrative Code	P-2000	Preservation 2000
		POTWS	Publicly Owned Treatment Works
		PPT	Parts per Thousand

PR/
MRWSA Peace River/Manasota Regional
Water Supply Authority
RPC Regional Planning Council
SCCF Sanibel-Captiva Conservation
Foundation
SFWMD South Florida Water
Management District
SOR Save Our Rivers
SRPP Strategic Regional Policy Plan
STP Sewage Treatment Plants
SWAMP Surface Water Assessment and
Monitoring Program
SWFRPC Southwest Florida Regional
Planning Council

SFWWMD Southwest Florida Water
Management District
SWIM Surface Water Improvement and
Management
USCG United States Coast Guard
USDA
or DOA Department of Agriculture
USFWS United States Fish and Wildlife
Service
USGS United States Geologic Survey
USTs Underground Storage Tanks
WCIND West Coast Inland Navigation
District
WMDs Water Management Districts
WRM Wetlands Resource Management
WRP Wetland Reserve Program

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1.0 Introduction

This document summarizes the joint work of the Technical Advisory Committee (TAC) and the Citizens' Advisory Committee (CAC) that was conducted during an extensive series of workshops in 1997 and 1998 to develop both *Quantifiable Objectives* as well as an initial list of *Priority Action Plans* for preservation, restoration, and enhancement of the natural resources within the Charlotte Harbor NEP study area. These efforts form the basis for this *Framework for Action* document upon which local, regional, state, and federal organizations will subsequently be asked to work with the Charlotte Harbor NEP in developing a finalized series of *Priority Action Plans*. The importance of this effort in the development of the Charlotte Harbor Comprehensive Conservation and Management Plan (CCMP) cannot be overstated as these *Priority Action Plans* and the preceding background information gathered during development of the Charlotte Harbor NEP's *Quantifiable Objectives* will form the technical foundation of the CCMP as well as establish the direction of future management actions for its participants. In developing the CCMP the staff of the Charlotte Harbor NEP and the members of the Management Conference will be: identifying key problems; summarize findings; and determining environmental goals and objectives, within each of the *Priority Action Plans*. It is through these mechanisms that the CCMP will serve as guide for the development of sound alternatives for the management and restoration of natural resources to ensure that both existing and future compatible uses of the watershed are protected.

1.1 The Charlotte Harbor NEP Study Area

The Charlotte Harbor NEP study area encompasses approximately 4,400 square miles of the southern Gulf Coast of Florida. The study area is divided into eight geographic subdivisions based on hydrologic, ecologic, and management characteristics. The subdivisions (basins) used in the NEP's previous *Synthesis of Existing Information* and are listed below and depicted in Figure 1.1.

Table 1.1 Charlotte Harbor NEP Watersheds

● Myakka River	● Coastal Venice
● Peace River	● Estero Bay
● Tidal Caloosahatchee River	● Pine Island Sound / Matlacha Pass
● Charlotte Harbor Proper	● Lemon Bay

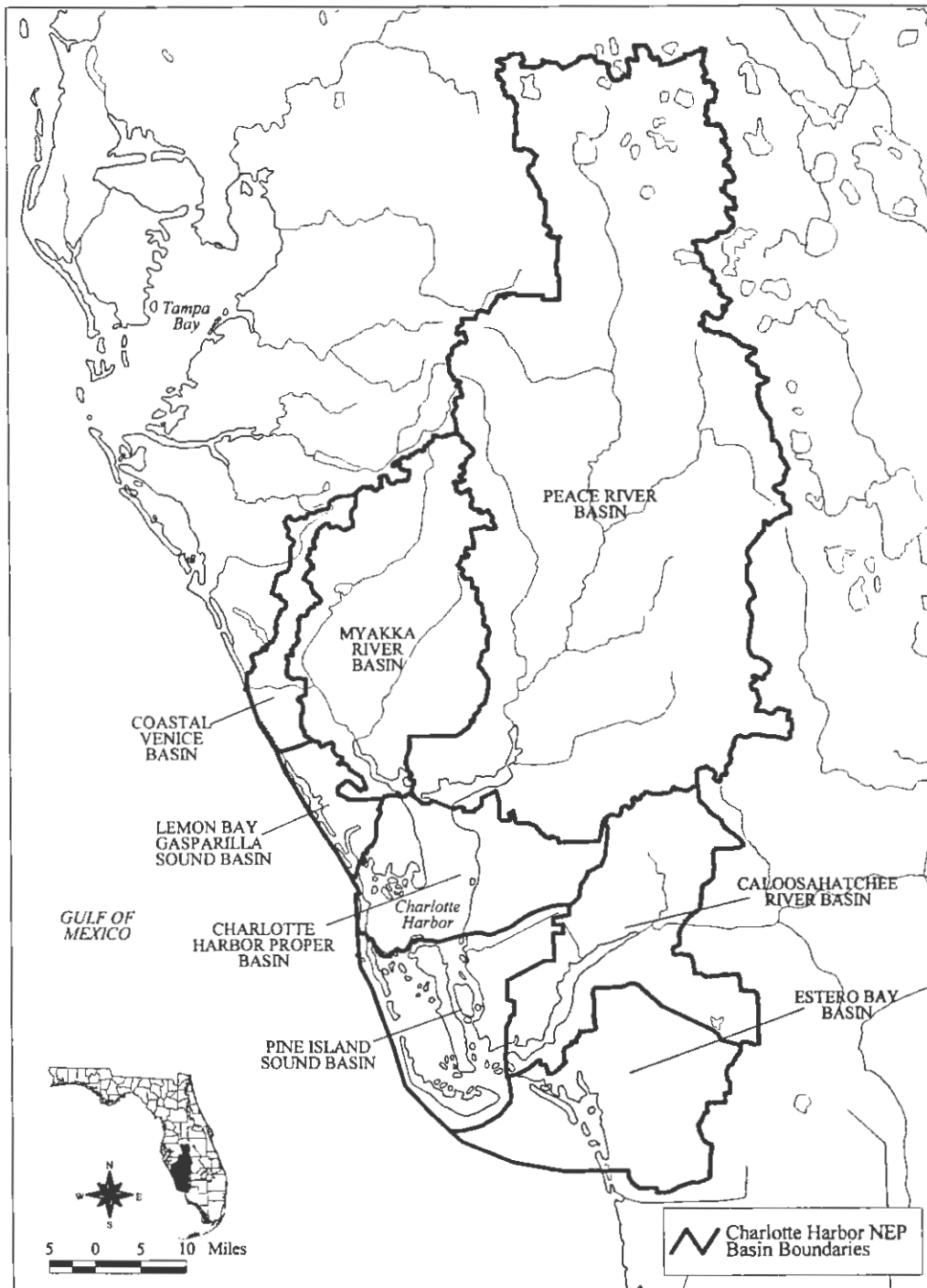


Figure 1.1 Charlotte Harbor NEP Watersheds

The diversity of the physical, ecological, and management challenges within the Charlotte Harbor NEP study area poses a distinct challenge to natural resource managers responsible for its stewardship. The Charlotte Harbor NEP study area includes habitats ranging from riverine to estuarine and coastal lagoon. Unique habitats range in extent from small tidal marsh areas, to the second largest open water estuary in the state. These areas range in character from nearly pristine wild areas, to regions undergoing dynamic and rapid growth into both cities and expansive metropolitan areas.

1.2 The Resources of Concern

The resources of concern within the Charlotte Harbor NEP study area include both living resources, as well as critical habitats such as seagrass beds, coastal wetlands (e.g. sloughs, salt marshes, mangrove forests), barrier beaches, and functionally related uplands. These habitats support a wide range of floral and faunal populations, including: recreationally and commercially important fish populations; wetland, riverine and estuarine dependent bird species; marine mammals; etc. The amounts and quality of the water resources within the study area in part define its character, and are extremely important with respect to recreational and commercial uses, tourism, and the quality of residential life in coastal and adjoining inland areas.

1.2.1 NEP Priority Problems and Goals

In consideration of the valuable resources at risk, the Charlotte Harbor NEP has formally established seven goals on which to base the various aspects of the overall program. These are:

Charlotte Harbor National Estuary Program Specific Goals

1. *Improve the environmental integrity of the Charlotte Harbor study area.*
2. *Preserve, restore, and enhance seagrass beds, coastal wetlands, barrier beaches, and functionally related uplands.*
3. *Reduce point and non-point sources of pollution to attain desired uses of the estuary.*
4. *Provide the proper freshwater inflow to the estuary to ensure a balanced and productive ecosystem.*
5. *Develop and implement a strategy for public participation and education.*

6. *Develop and implement a formal Charlotte Harbor management plan with a specified structure and process for achieving goals for the estuary.*
7. *Develop an accessible information management system that integrates data on the Charlotte Harbor study area pertinent to Harbor and watershed management.*

In order to provide a focus for the *Quantifiable Objectives* and *Priority Actions* to be implemented in the CCMP, the Charlotte Harbor NEP formally adopted three *Priority Problems*. These problems are defined below:

Charlotte Harbor National Estuary Program Priority Problems

The issues or problems described below can also be viewed as symptoms or consequences of more basis, causal processes. Land uses and land use management, for examples, affect hydroperiods (the time it takes rainwater to travel to a water body like a river), nutrient concentrations (and thereby, loading rates), and habitat availability. Given the rate and scale of land use decisions in the study area, a continuing Program effort will be needed in the general subject area of land use management. Also, the Program must address the problem of incomplete information on particular topics. Certain topics in certain geographic areas may be important but lack definitive data.

- | | |
|--|---|
| <i>Hydrologic Alterations</i> | - <i>Adverse changes to amounts, locations, timing of freshwater flows, the hydrologic function of flood plain systems, and natural river flows.</i> |
| <i>Water Quality Degradation</i> | - <i>Including but not limited to pollution from agricultural and urban runoff, point source discharges, septic tank system loadings, atmospheric deposition, and groundwater.</i> |
| <i>Fish and Wildlife Habitat Loss</i> | - <i>Degradation and elimination of headwater streams and other habitats caused by development, conversion of natural shorelines, cumulative impacts of docks and boats, invasion of exotic species, and cumulative and future impacts.</i> |

1.3 The NEP Process

The standard NEP process involves the completion of four major elements over a five-year period. These four elements include:

- Establishment of the Management Conference
- Characterization of the estuary
- Development of the Comprehensive Conservation and Management Plan
- Implementation of the Comprehensive Conservation and Management Plan

The Charlotte Harbor NEP is on an accelerated time table and is scheduled complete the first three elements within just three years.

1.3.1 Management Conference

The Management Conference is the decision-making framework for carrying out the overall NEP process. It is composed of the Policy, Management, Technical Advisory, and Citizen Advisory Committees. Through committee structure and public outreach efforts, the Conference provides a forum for collaborative decision-making and consensus building around often conflicting issues. It is the function of the NEP staff to facilitate the members of the Management Conference working together in partnership to develop, through consensus, an overall master plan called the Comprehensive Conservation and Management Plan (CCMP). Through workshops and public forums, the Management Conference identifies major problems, decides where to focus corrective actions, and agrees to specific political, financial, and institutional commitments. After the CCMP has been developed and adopted, its elements are then coordinated and implemented under state and local auspices.

- **The Policy Committee** - is composed of key officials (mayors, county commissioners, agency chiefs, etc.) or their designees, who help provide the resources to support the Management Conference. This committee makes the final decisions after considering the ecosystem needs, the cost and benefits of proposed restoration and protection strategies.
- **The Management Committee** - is typically comprised by local, regional, state, and federal agency managers having environmental resource management responsibilities. Through this committee, the Conference builds a support base from key government agencies responsible for NEP related activities, including: agricultural management; land use planning; fish and wildlife management; and sewage and stormwater treatment. Agencies represented on this committee also have potential CCMP implementation responsibilities. Thus, their input is crucial during the early development of the CCMP.
- **The Technical Advisory Committee** - is composed of interested technical experts working in, and with responsibility of, estuarine and watershed-related scientific issues and projects in the NEP study area. Membership typically includes local scientists from both private and public sector organizations. This committee provides a forum

to identify and discuss technical and *Priority Problems* associated with the NEP study area and develop the most feasible and cost-effective management actions appropriate for implementation of the CCMP.

- **The Citizen Advisory Committee** - ideally includes a representative cross-section of the general public living in the NEP study area. Members may include representatives of: the major businesses and industry; environmental and civic groups; farmer and fishing groups; educators and other affected and/or interested citizens. This committee serves to inform the Conference of the concerns of the people living in the NEP watersheds.

A major responsibility of these committees comprising the Management Conference, therefore, is to build public support and political cooperation needed to complete the series of tasks leading to the development and implementation of the Charlotte Harbor CCMP.

1.4 Background Information

Prior to the development of the *Quantifiable Objectives* and *Priority Action Plans* which are presented in this report, the Charlotte Harbor NEP staff, advisory committees and the NEP's consultants completed a series of studies and compilations which in total formed the foundations of information upon which the *Quantifiable Objectives* and preliminary *Priority Actions* were based. These documents contain additional background information beyond that presented in this *Framework for Action*.

- **State of the Harbor Report** - summarizes much of the history and causes for concerns regarding the potential for: hydrologic alterations; water quality degradation; and fish and wildlife habitat loss, caused by past and predicted future rapid urban development through many of the Charlotte Harbor NEP watersheds.
- **Compendium of Existing Monitoring Programs** - summarizes both past and current major environmental monitoring studies conducted in the Charlotte Harbor NEP study area.
- **Base Programs Analysis** - describes the laws, policies, and resource management structure which exist within the Charlotte Harbor NEP watersheds.
- **Synthesis of Existing Information** - summarizes existing information for each of the Charlotte Harbor NEP watersheds regarding: land use; soils; hydrography; water quality; potential pollutant loadings; key natural communities and habitats; etc.

1.5 Quantifiable Objectives

Prior to the development of the preliminary *Priority Actions*, a series of practical and defensible *Quantifiable Objectives* were developed to address each of the three previously identified Charlotte Harbor NEP *Priority Problems*. The goal of this phase of the NEP process was the development of appropriate *Quantifiable Objectives* to ensure the preservation, restoration, and enhancement of the natural resources of the Charlotte Harbor NEP study area. The *Quantifiable Objectives* present in this document evolved through an extended series of workshops during which issues and priority problems were discussed. Ballots and rankings by committee members led to the formation and refinement of each of the proposed *Quantifiable Objectives*.

The identification of *Quantifiable Objectives* is a critical step to the NEP process. Since without specific *Quantifiable Objectives* it will be difficult, if not impossible, to gauge the future success or failure of subsequent management activities initiated throughout the Charlotte Harbor NEP study area. Each *Quantifiable Objective* must be technically sound, defensible, objective, and should be able to be assessed utilizing either existing and planned future monitoring programs. In addition, the *Quantifiable Objectives* should address the specific major resource issue(s) which have been identified within the Charlotte Harbor NEP study area.

Previously, the importance of identifying an initial set of *Quantifiable Objectives* has been recognized by other NEP programs, during which they were adopted as an initial step prior to the identification and development of specific *Priority Actions*. As such, each *Quantifiable Objective* can be used as a measurable benchmark to determine and assess the most effective action(s) necessary for addressing specific *Priority Problems*. The development of *Quantifiable Objectives* adds to both the technical foundation of the CCMP, as well as establishes the direction of future management actions for participants within the CCMP.

The following series of tables summarize the relations between the *Quantifiable Objectives*, which are presented in detail in the following sections of this *Framework for Action* document, and issues and areas identified during the Charlotte Harbor NEP process.

- **Table 1.2** - One of the first elements conducted by the Charlotte Harbor NEP staff was to hold an extensive series of workshops throughout the study area to assess public perceptions as to key issues within each of the watersheds. This table summarizes the relations between each of the primary issues identified during these workshops and the subsequently developed *Quantifiable Objectives*, dealing with:

- 1) Hydrologic Alterations (HA-1 through HA-4)
- 2) Water Quality Degradation (WQ-1 through WQ-7)
- 3) Fish and Wildlife Habitat Loss (FW-1 through FW-4)

- **Table 1.3** - As an initial step in developing *Quantifiable Objectives* for the Charlotte Harbor NEP, the members of the TAC/CAC and Management Committee Members were also asked to identify what they perceived to be the key issues both for the overall study area, as well as within each of the eight NEP watershed basins. This table summarizes the relations between the identified key issues and the final *Quantifiable Objectives*.
- **Table 1.4** - The Charlotte Harbor NEP study area is comprised of eight interrelated watershed basins. This table shows where the final *Quantifiable Objectives* are applicable in relation to these basins.

Table 1.2 Issues Identified During the Citizens Workshops (September 1996)	
Issue	Quantifiable Objective
Anthropogenic Effects	WQ1, WQ2, WQ3, WQ4, WQ5, WQ6, HA1, HA2, HA3, HA4, FW1, FW2, FW3, FW4
Aesthetics	
Protection for tourism/living	WQ1, WQ2, WQ3, WQ4, WQ5, WQ6, FW1, FW2, FW3, FW4
Vanishing coastline	FW1, FW2, FW4
Waterfront Development	WQ1, WQ2, WQ3, WQ4, WQ5, WQ6, WQ7 FW1, FW2, FW3
Lack of public access	FW1, FW2
Multi-story construction on coast	FW1, FW2
Removal of coastline vegetation	FW1, FW2
Boating Pollution	
Pollution in marinas	WQ1, WQ2, WQ 3, WQ4, WQ6, WQ7
Dredging of deep channels	FW2, FW3

Table 1.2 Issues Identified During the Citizens Workshops (September 1996)	
Sewage discharges from live aboards	WQ1, WQ2, WQ 3, WQ4, WQ6, WQ7
Heavy metal contamination	WQ1, WQ2, WQ 3, WQ4, WQ6
Ecosystem Management	
Overuse of exotic weed control	WQ1, WQ6, FW4
Decline of natural habitat and nursery areas	WQ1, WQ2, WQ 3, WQ4, WQ6, WQ7, HA1, HA2, HA4, FW1, FW2, FW3
Competing uses of the waterfront	FW1, FW2
Insufficient detainage of storm water	WQ1, WQ2, WQ 3, WQ4, WQ5, WQ6, WQ7, HA1, HA2, HA3, HA4, FW1, FW2
Channelization	FW2, HA3, HA4
Exotic species control	WQ1, FW2, FW4
Conservation and Preservation	
Public access to recreational areas	FW1, FW2, FW3
Encourage preservation of historic structures	
Development and Land Use	
Need for Growth Management	FW1, FW2, WQ1, WQ6, HA3
Limit Growth	
Development in the Peace River EMA Area	FW1
Urban and Suburban Sprawl	
Education	
Education rather than regulation	
Economics	
Maintain commercial fishing (Lake Hancock)	

Table 1.2 Issues Identified During the Citizens Workshops (September 1996)	
Habitat Restoration and Protection	
Establish greenway and wildlife corridors	FW1, FW2
Restore wetlands adjacent to rivers	FW1, FW2
Purchase land along rivers and harbor	FW1, FW2
Increase bird nesting areas	FW1, FW2
Protecting bird nesting/breeding areas	FW1, FW2, FW4
Loss of wetlands contiguous to the rivers and harbor	FW1, FW2, FW4
Habitat fragmentation	FW1, FW2
Establishment of greenways/wildlife corridors	FW1, FW2
Over cutting of mangroves	FW1, FW2
Manatee awareness areas	FW2
Purchase remaining mangroves and wetlands	FW1, FW2
Limit use of boat motors in seagrass beds	FW3
Mark navigation channels in seagrass areas	FW3
Hydrology	
Restore natural flow from Tenoroc area	HA1, HA2, HA3
Re-establish historical floodplains	HA1, HA2, HA3
Limit freshwater diversion	HA1, HA2, HA3
Reduce over-pumping of fresh water	HA1, HA2, HA3
Effects of deep well injection	
Establish minimum lake levels and stream flows	HA1, HA2, HA3, HA4
Managing timing of inflows to estuary	HA1, HA2, HA3, HA4
Long Term Issues	
Evaluate effects of global warming	

Table 1.2 Issues Identified During the Citizens Workshops (September 1996)	
Management and Implementation	
Expedite enforcement	
Regulation, enforcement, and property rights	
Need for basin-wide approach	WQ1, WQ2, WQ 3, WQ4, WQ6, WQ7, HA1, HA2, HA3, HA4, FW1, FW2, FW3, FW4
Monitoring and Research	
Coordinate basin-wide baseline environmental research	WQ1, WQ3, WQ4, HA1, HA2, FW2, FW3, FW4

**Table 1.3 *Quantifiable Objectives* in Relation to Key Issues Identified
by TAC/CAC and Management Committee Members**

Issue from Ballots in Ranked Order (#1 Designating the most Important Issue)	Hydrologic Alteration				Water Quality							Fish & Wildlife Habitat			
	#1	#2	#3	#4	#1	#2	#3	#4	#5	#6	#7	#1	#2	#3	#4
1) Uplands to urban land use	X	X	X	X	X	X		X	X	X	X	X	X		
2) Urban stormwater runoff			X	X	X	X	X	X	X	X	X	X			
3) Wetlands to urban land use	X	X	X	X	X	X	X		X	X	X	X			
4) Uplands to agricultural land use	X	X	X	X	X	X		X	X	X	X	X	X		
5) Wetlands to agricultural land use	X	X	X	X	X	X	X	X	X	X	X	X	X		
6) Lower density land use to high density	X	X	X	X	X	X			X	X	X				
7) Shoreline alteration				X			X		X	X	X	X	X	X	X
8) Agricultural stormwater runoff		X	X	X	X	X	X	X	X	X	X	X			
9) On-site disposal system effluent					X	X	X	X	X	X	X	X			

**Table 1.3 *Quantifiable Objectives* in Relation to Key Issues Identified
by TAC/CAC and Management Committee Members**

Issue from Ballots (#1 Designating the most Important Issue)	Hydrologic Alteration				Water Quality							Fish & Wildlife Habitat			
	#1	#2	#3	#4	#1	#2	#3	#4	#5	#6	#7	#1	#2	#3	#4
10) Agricultural land use to urban	X	X	X	X	X	X	X		X	X	X	X	X		
11) Mining land use - phosphate	X	X	X	X	X	X	X		X	X	X	X	X		
12) Urban infrastructure		X	X	X						X	X	X	X		
13) Point source discharges to surface waters					X	X	X	X	X	X	X	X			
14) Inter-basin transfers of water	X	X		X											
15) Water supply agricultural	X	X	X	X							X				
16) Channelization			X	X										X	
17) Boating								X		X	X			X	

Table 1.4 Relationship Between *Quantifiable Objectives* and NEP Basins

Basin	Hydrologic Alteration				Water Quality							Fish and Wildlife Habitat			
	#1	#2	#3	#4	#1	#2	#3	#4	#5	#6	#7	#1	#2	#3	#4
Peace River	X	X	X	X	X	X	X	X	X	X	X	X	X		X
Myakka River	X	X		X	X	X	X	X		X	X	X	X		X
Coastal Venice			X		X	X	X	X		X	X	X	X	X	X
Lemon Bay					X	X	X	X		X	X	X	X	X	X
Gasparilla Sound				X	X	X	X	X		X	X	X	X	X	X
Pine Island Sound				X	X	X	X	X		X	X	X	X	X	X
Caloosahatchee River		X			X	X	X	X		X	X	X	X		X
Estero Bay			X		X	X	X	X		X		X	X	X	X

1.6 Priority Actions

The development of a final set of *Priority Actions* will serve as the foundation for the recommendations ultimately contained within the CCMP, and will facilitate the Management Conference members in the actual creation and consensus building process in determining programs and policies.

The draft *Priority Actions* presented within this document were developed to meet the *Quantifiable Objectives* established by the Charlotte Harbor NEP Management Conference. When finalized, these proposed actions:

- will form the foundation of the recommendations contained within the final CCMP document, and
- facilitate the Management Conference members consensus building process through their actual creation/refinement of these actions.

A *Priority Action* is an important environmental management activity which is intended to meet one or more *Quantifiable Objectives* developed by the Management Conference. Sets of *Priority Actions* will eventually be combined with estimated costs and identifications of responsible parties to form the management plans that will be the basis of the Charlotte Harbor CCMP. As such, the draft *Priority Actions* contained within this document are a key step to the CCMP development process, since they provide a strategy for how the *Quantifiable Objectives* will be met. To this end, each of the final *Priority Actions* should contain a series of key, essential elements including:

- **A statement of the *Priority Action* and its goal** - The *Priority Action* should begin with a brief statement of what the action is, what *Priority Problem* it addresses, and how it will help achieve the associated *Quantifiable Objective*.
- **Brief background of the *Priority Action* and its rationale** - This should be a summary of background information about the *Priority Action*, how it will satisfy its *Quantifiable Objective*, and the rationale for its implementation. The background may include a history of the *Priority Problem*, a description of how the *Priority Action* will mesh with past or ongoing management activities, and how this *Priority Action* will achieve the objectives. This background information should also describe where and how similar *Priority Actions* have been successfully implemented as part of other NEP programs.
- **Where the *Priority Action* will be implemented** - This section will describe where the *Priority Action* will be implemented. Identification of the locations (major basins

and/or water bodies) within the Charlotte Harbor NEP study area where the *Priority Action* will be most effective or applicable will help identify the most appropriate responsible parties and will ensure an efficient use of funds and resources for its implementation.

- **Strategy for implementing the *Priority Action*** - A strategy for implementing the *Priority Action* should be presented in a detailed step-wise approach.
- **Responsible agencies** - A discussion of responsible parties for implementing each *Priority Action* should be included. These groups could include government agencies (local, regional, state, or federal), not-for profit groups, private organizations, industry, or other private interests.
- **Resources required** - The staff and financial requirements for each of these management activities should be established after the Management Conference determines its priorities and the level of effort to be expended on implementing the specific action.
- **Expected benefits derived from the *Priority Action*, and any drawbacks** - It is essential that the expected benefits derived from a *Priority Action* be explicitly stated. Management Conference participants cannot be expected to endorse complicated and costly management strategies if there is not a clear understanding of the benefits that may be expected for these actions, as well as the degree that the *Priority Action* will satisfy the *Quantifiable Objectives*. In addition, an acknowledgment of potential drawbacks needs to also be included. All possible outcomes and the implications of each *Priority Action* need to be understood by those who may become responsible for their implementation. Identifying potential drawbacks up front will minimize both future conflicts and failures.
- **Monitoring the success of the *Priority Action*** - A means of monitoring the success of each *Priority Action* is required to gauge the effectiveness of the activity and how well it is satisfying its expected benefits during implementation.
- **Regulatory needs** - Each *Priority Action* should include a brief description of any of the regulatory needs for its implementation. A *Priority Action* may need only increased enforcement of existing regulations, or new rules or policies may need to be invoked. Regulatory aspects of completing *Priority Actions* may come from local governments, the state, or federal sources.
- **Related *Priority Action*** - Each *Priority Problem*, and some objectives, will be affected by more than one *Priority Action*. By showing the relationship of associated

Priority Actions, a clear understanding of the overall management program and its major focuses can be seen. This will also provide assistance in prioritizing *Priority Actions*, in that related *Priority Actions* may be compared for cost-effectiveness and timeliness.

1.7 CCMP Development

As the characterization phase of the Charlotte Harbor NEP process is completed, specific elements of the CCMP will begin to take shape. Two of the major elements of this process are:

- The development of recommended *Priority Actions* and specific implementation schedules necessary to maintain and/or restore key watershed elements identified at risk during the process; and
- Develop plans for the coordinated implementation of *Priority Actions* among participating agencies of the Management Conference. During the joint Technical and Citizens Advisory Committee *Priority Action* workshops there was a strong consensus that a mechanism be established to promote interagency cooperation with the Charlotte Harbor NEP study area. This was based on a realization that in many instances implementation of the proposed draft actions would necessitate agencies to work together where rules and procedures may conflict.

Additional mandatory initiatives of the NEP at this stage include the development of a formalized data management strategy, and the establishment of a coordinated monitoring program (these efforts are currently under development).

1.8 CCMP Implementation

Two major elements must also be accomplished to ensure that the CCMP is implemented appropriately. They are:

- Development of a plan to monitor the effectiveness of each of the actions undertaken in conjunction with implementation of the CCMP; and
- Review federal assistance and development programs to determine whether they are consistent with the goals of the CCMP.

2.0 Quantifiable Objectives & Priority Action Plans for Hydrologic Alterations

2.1 Hydrologic Alterations *Quantifiable Objectives*

The following four *Quantifiable Objectives* were established to address specific problems of associated with hydrologic alterations which have occurred within the Charlotte Harbor NEP study area.

HA1: Establish values for minimum seasonal flows beginning with the Myakka River at State Road 72 and for Big Slough; the Peace River at Bartow, Zolfo Springs, and Arcadia; and for the tributaries Horse Creek, Joshua Creek, Shell Creek, and the lower Peace River/upper estuary by the year 2005. Achieve these minimum seasonal flows by the year 2020.

HA2: Identify, establish, and maintain a more natural seasonal variation (annual hydrograph) in freshwater flows by the year 2010 for:

- a. Caloosahatchee River;
- b. Upper Peace River and its tributaries from Tenoroc to Zolfo Springs; and
- c. the Upper Myakka River (with special attention to Flatford Swamp).

HA3: Restore, enhance, and improve where practical historic subbasin boundaries and natural hydrology for basins within the Charlotte Harbor NEP study area, with special attention to Outstanding Florida Waters, Class I waterbodies, and tributaries to Estero Bay by the year 2020.

HA4: Enhance and improve by the year 2020 to more natural hydrologic conditions waterbodies affected by artificially created structures throughout the Charlotte Harbor NEP study area beginning with:

- a. the Sanibel Causeway;
- b. Myakka River;
 - 1) the weir below Upper Myakka Lake;
 - 2) the crossing below Lower Myakka Lake;
 - 3) Down's Dam;
- c. the causeway between Lover's Key State Recreation Area and Bonita Beach;
- d. the water control structure on the south end of Lake Hancock;
- e. the structure on Coral Creek; and
- f. the Gator Slough canal collector system (Lee and Charlotte Counties).

The sections that follow discuss each of these *Quantifiable Objectives* individually, as well as the preliminary *Priority Actions* which were developed by the joint Technical Advisory Committee / Citizens' Advisory Committee working groups.

2.2 Hydrologic Alteration: HA-1

A. Statement of Quantifiable Objective

HAI. Establish values for minimum seasonal flows beginning with the Myakka River at State Road 72 and for Big Slough; the Peace River at Bartow, Zolfo Springs, and Arcadia; and for the tributaries Horse Creek, Joshua Creek, Shell Creek, and the lower Peace River/upper estuary by the year 2005. Achieve these minimum seasonal flows by the year 2020.

B. Charlotte Harbor NEP Goals and Priority Problem Addressed by the Quantifiable Objective

- Goal # 1: Improve the environmental integrity of the Charlotte Harbor study area.
Goal # 4: Provide the proper freshwater inflow to the estuary to ensure a balanced and productive ecosystem.

Priority Problem # 1: Hydrologic Alterations -- adverse changes to amounts, locations, and timing of freshwater flows, the hydrologic function of flood plain systems, and natural river flows.

C. Background Information

The Myakka and Peace river basins constitute more than 60 percent of the total inflow area and contribute more than half the total tributary inflow to the Charlotte Harbor estuarine system (Levesque and Hammett, 1997; Hammett, 1990). The total Charlotte Harbor inflow area (watershed) is approximately 12,100 km² (Hammett, 1990) and consists of the Peace, Myakka, and Caloosahatchee river basins and the coastal area and islands that encompass the harbor. The Peace and Myakka river basins drain approximately 6,090 km² and 1,560 km², respectively, while the coastal areas and islands drain only about 920 km².

Flow in the Myakka River is sluggish, often with no net flow during the dry season (Hand et al., 1996). The upper reaches of the Big Slough portion of the Myakka River have been channeled to enhance drainage and the lower reaches receive some drainage from residential canals. The Myakka River may be threatened by encroaching development to the east.

There are two dams on the Myakka River (Stoker, 1986). At the south end of Lake Myakka, water normally flows over a concrete structure and through a bypass (notch) in the structure itself. The second is an in-stream structure (Down's Dam) located about one mile south of Lower Myakka Lake. These dams control river stages only during low discharges. Flows from approximately 62 percent of the Myakka River Basin and 11 percent of the Peace River Basin currently are not

monitored by recording stream flow gauges because of the complications associated with computing continuous stream flow in tidally affected reaches of the rivers (Levesque and Hammett, 1997).

The Peace River contributes an average flow of 2,010 ft³/sec of the total 6,000 ft³/sec of the total freshwater inflow to Charlotte Harbor (Hammett, 1990). Except for a dam on Shell Creek, a tributary to the lower Peace River, flows through the Peace River are largely uncontrolled (Stoker, 1986). Horse Creek is a major tributary of the Peace River and drains the western part of the Peace River basin (Lewelling, 1997).

Much of the Peace River subbasin in Polk County has been strip mined for phosphate, which has two impacts on river flow (Hammett, 1988). First, mining alters the natural drainage patterns in the basin. Rainwater that ran off under natural conditions may be internally drained to settling ponds as a result of mining. Second, processing phosphate ore requires large amounts of water, most of which is either rainfall retained in non-contributing basins and recycled, or groundwater pumped from the Floridan aquifer system. Because of a projected depletion of phosphate reserves in Polk and Hillsborough counties, a southern migration by the phosphate industry into the Horse Creek subbasin of the Peace River basin is planned (Lewelling, 1997).

Many areas within the Myakka and Peace Rivers' subbasins have historically been drained or diverted to facilitate range and pasture land for cattle ranching, row and field crops, and citrus groves. Increasing urbanization along the west bank of the Myakka River, and particularly in the North Port and Port Charlotte areas, is gradually forcing agricultural uses into previously undeveloped or pasture lands in these basins.

Trends in Flows

The Charlotte Harbor NEP Nomination Package (State of Florida, 1995) states that:

"...the combined effects of mining, farming, municipal supply, and other activities has caused the flows of freshwater in the upper Peace River to decline significantly through time."

Although specific quantifiable cause/effect relationships between specific activities and observed changes in river flows have yet to be established, activities (mining, farming, etc.), along with long-term natural variations in rainfall, are the most likely significant potential causes of hydrologic alterations. Further research is needed to better identify which activities and processes have historically contributed, and currently contribute, most significantly to river flow characteristics. However, numerous researchers have come to similar conclusions regarding potential causes of changing flows and historical declines in water quality in the Peace River, including:

Hammett (1988) - This U.S. Geological Survey study included extensive analyses of land use, water use, stream flow and water quality data for the watersheds of the Charlotte Harbor

estuarine system. The data analyzed include the historic record through the early 1980s. Trends were tested using the non-parametric Seasonal Kendall Tau statistical procedure.

Environmental Quality Laboratory (1995b) - Analyses were conducted at the request of the Southwest Florida Water Management District as part of the most recent summary of the results from the Peace River/Manasota Regional Water Supply Authority Hydrobiological Monitoring Program. This document summarized trends in flows for the Peace River at Arcadia; and two major tributaries, Horse and Joshua Creeks, which enter the Peace River upstream of the water treatment facility. Trends were tested using the non-parametric Seasonal Kendall Tau procedure for three time periods: 1951 to 1994; 1966 to 1994; and 1976 to 1994. Potential trends in flow were also tested for Shell Creek which enters the Peace River further downstream just before the point where it enters Charlotte Harbor. Historic flow data for this basin only extends back to 1966. In addition, trends in flows were partitioned into three seasonal components: 1) the cool/damp season (November through February); 2) the warm/dry period (March through June); and 3) the hot/wet season (July through October).

Coastal Environmental (1996) - This study was conducted for the Southwest Florida Water Management District Charlotte Harbor SWIM program. The purpose of the project was to develop empirical (least squares regression-based) models to be used to identify potential resource-based freshwater inflow and salinity targets for the tidal Peace River and Upper Charlotte Harbor. In order to develop predictive salinity models, relationships between rainfall and flows for the Peace River watershed were developed for both the historic (1933-1960) and modern (1970-1989) periods. These two periods were selected since preceding work (Hammett, 1990; Coastal, 1995) had suggested that a fundamental change had occurred in the relationships between gauged flows and rainfall within the Peace River basins somewhere between 1961 and 1965.

Flannery and Barcelo (1998) - This paper, presented at the Charlotte Harbor National Estuary Program Symposium, extended trend analysis (using Seasonal Kendall Tau) for the major freshwater inflows into the Upper Charlotte Harbor Estuary for each gauge from the period of record through 1996. Additional trend tests were conducted for shorter periods, including the last 21 years. Long-term changes in groundwater levels and rainfall patterns were also summarized for different basin regions.

At times the findings of these investigations may seem somewhat confusing or contradictory. However, when comparing the results most differences are simply reflections of the different time periods analyzed, or minor discrepancies caused by using monthly or annual means versus moving averages. When these studies are reviewed in the context of their approach and specific emphasis, the conclusions of each support a specific set of findings.

- Since the 1930s when U.S. Geological Survey flow gauges were installed in Peace River

basin until present, there has been a significant long-term decline in flows at each of the gauge sites.

- The magnitude (slope of the trend) of the declines in flows progressively increases upstream toward the headwaters of the Peace Basin such that the declines are greatest at Bartow, slightly less for the Peace at Zolfo Springs, less at the furthest downstream gauge at Arcadia.
- Statistical analysis (Coastal, 1996) has shown that in the upper Peace River Basin much of the decline in flow cannot be attributed to regional long-term changes in climatic rainfall patterns but may be associated with anthropogenic influences including alterations of surface hydrological features, and reductions in aquifer elevations. On the other hand, the major component of long-term declines in flows further downstream in the basin at Arcadia can be shown to be associated with corresponding historic changes in rainfall.

Table 2.1 Comparison Among Peace River Gauging Locations of Percent Decline Accounted for by Long-Term Declines in Rainfall

Location of Gauge	Annual Percent Decline Due to Rainfall	Annual Percent Decline <u>Not</u> Due to Rainfall	Total Annual Percent Decline
Peace River at Bartow	0.72	1.40	2.12
Peace River at Zolfo Springs	0.92	0.55	1.47
Peace River at Arcadia	0.98	0.25	1.23

The results of stream flow trend analysis indicate that changes in streamflow were generally largest in the Upper Peace River Basin, and became progressively smaller at sites further to the south. This spatial trend suggests that all factors affecting streamflow (potentially reduced rainfall, lower groundwater levels, reduced surface runoff) were most marked to the north, and declined in significance in the southern reaches of the watershed.

Whether declining flows were more marked for high flows or low flows was also examined through the use of cumulative distribution functions. The results indicated that declines in high flows may be attributable to both a rainfall deficit during the past decades, as well as from removing some portions of the watershed by mining and reclaiming the land in such a manner so as to not contribute surface flows to the river. By comparison, declines during low flows

may be attributable to changes caused by alterations associated with mining, or even the removing point source discharges from the river flow.

- While the overall historic flow pattern since the 1930s has shown a sharp decline, this trend has been neither uniform or consistent. During the initial 26 year period of record (1933-1958) Peace River flows at the Arcadia gauge significantly increased. This was followed by a dramatic decline over a relatively short period 1961 to 1965 when the relationships between basin rainfall and flow seemed to change. This was followed by an extended period of 12 -15 years, until the late 1970s, during which Peace River flows at Arcadia continued to decline systematically. However, for at least the last two decades, there has been no significant trend in river flows at the Arcadia gauge.

Table 2.2 Comparison of Long-Term Trends in Gauged Flows for the Peace River and the Major Tributaries Contributing to Total Freshwater Inputs at the Mouth of the Peace River				
USGS Gauging Station	Seasonal Kendall Tau Trend Test for the Time Period Ending in 1996 and Starting in:			
	1932	1951	1965	1975
Peace at Arcadia	-0.4 (.11)	-1.1 (.01)	-0.4 (.43)	+0.9 (.34)
Horse Creek		-0.3 (.39)	+0.1 (.81)	+1.7 (.12)
Joshua Creek		+0.8 (.05)	+1.6 (.01)	+3.6 (.002)
Shell Creek			-0.2 (.73)	+1.3 (.20)

* Slopes expressed as percent of median flow for period tested. Significance levels are enclosed in parentheses.

- Although Peace River flows at Arcadia have not shown any significant change over the past twenty years, significant increases in flows have been measured in downstream basins, such as Joshua Creek. Further analysis has shown that most of this increase has occurred during the spring dry-season. This and corresponding significant increases in chloride concentrations in these freshwater systems, strongly suggest that groundwater from agricultural runoff has resulted in the observed increases in flows in such tributaries. The

magnitude of any such increases, however, has been relatively small and statistically non-significant when compared to the total seasonal freshwater Peace River flows to the Charlotte Harbor Estuary.

Public Supply

In the early 1970s General Development Utilities began to actively search for a major regional water source for the projected population growth in a number of large communities in Southwest Florida under construction or planned by its parent company, General Development Corporation. These developments included the *City of North Port* in Sarasota County, *Port Charlotte* in Charlotte County, *South Gulf Cove* in Charlotte County, and two developments for which Developments of Regional Impact (DRIs) were later abandoned: *Myakka Estates* in Sarasota County and *Villages of DeSoto* in DeSoto County. Population projections for the year 2020 exceeded a quarter million new residents in these planned communities. General Development Utilities' goal was to establish a reliable and expandable source of potable water to supply this projected rapid population growth. After reviewing a number of potential alternative sources, and seeking the advice of numerous consultants including staff from the University of Miami, it was determined that the site of the current water treatment facility on the Peace River in DeSoto County provided the greatest opportunity for a sustainable water supply for development within the three county area.

Charlotte County took control of General Development Utilities facilities within Charlotte County, and ownership of the Peace River Water Treatment Plant was transferred to the public Peace River/Manasota Regional Water Supply Authority. The authority was formed and functions through agreements made among Manatee, Sarasota, DeSoto, and Charlotte counties. With the Authority's ownership of the Peace River Water Treatment Facility, the Authority soon began plans to expand the plant and make it more of the regional supply originally envisioned by General Development Utilities. A further goal of the Authority has been to develop a series of interconnections among the member county's' water supplies to reduce potential effects of natural disasters and other interruptions in supply. The Authority's plan to expand the Peace River Facility in DeSoto County and interconnect it with Carlton Reserve Water Treatment Plant in Sarasota County is generally referred to as the "Peace River Option."

Prior to the constructing a regional water supply system on the Peace River near State Road No. 761 to provide potable water to Port Charlotte and adjacent areas, General Development Corporation contracted with staff of the Rosenstiel School of Marine and Atmospheric Science (Michel *et al.*, 1975) to conduct a general feasibility study. The purpose of this effort was to:

- collect baseline biological and physical data
- develop relationships between fresh water flows, tides and salinity for the area of the Peace River downstream of the facility
- investigate interactions between salinity and biological communities

- develop predictive models to assess potential effects of proposed freshwater withdrawals on salinity in the lower Peace River
- provide initial data to establish a basis for future long-term monitoring studies.

Information on biological communities and salinity/flow relationships were based on field investigations conducted by the University of Miami staff between 1973 and 1974. During this period Peace River flows (measured at Arcadia) ranged from a low of 62 cfs to more than 10,000 cfs. Fortuitously, the relationships between salinity and flow developed during this relatively short study, and subsequently used in calibrating their numerical models, were characteristic of the normal range of variation in flows which have subsequently occurred during extended wet and dry periods.

The resulting numerical model was used to predict changes in salinity at a series of points extending from the mouth of the river upstream to the water treatment facility. Changes in salinities were modeled under worst case conditions assuming freshwater withdrawals during naturally occurring periods of low river flow. Low Arcadia Peace River flows (50 to 100 cfs) were modeled since they represented the greatest potential for changes due to freshwater withdrawals. The following table summarizes the predicted model results of 12 mgd (18.6 cfs) and 30 mgd (46.4 cfs) withdrawals under conditions of 100 cfs Peace River flows at Arcadia.

Table 2.3 Results of Michel <i>et al.</i>				
Location on Peace River	Median Salinity Over Tidal Cycle No Withdrawal	Range in Salinity Over Tidal Cycle No Withdrawal	Maximum Increase in Salinity	
			12 mgd	30 mgd
US 41 Bridge	29.2	1.4	.02	.04
I-75 Bridge	22.6	2.6	.4	1.1
Harbour Heights	18.0	3.6	.7	1.8
Downstream of Lettuce Lake Area	8.2	3.0	1.1	3.0
Just Downstream of Water Facility	1.2	1.9	.8	3.2

The report concluded that "under these conditions of flow and withdrawal, biological data indicated that such slight salinity increases, above the naturally occurring values of low flow periods, should add little additional stress on the plants and animals of the study area. This conclusion was based on what was found to be the highly dynamic natural seasonal changes in salinity within portions of the lower Peace River due to difference in flows during wet and dry periods.

The permitted withdrawals by the Peace River Water Treatment Facility have always been more conservative and below the proposed “safe” levels proposed by the University of Miami Study. During the permit renewal process in 1988, consulting scientists for General Development and those of the Southwest Florida Water Management District agreed that the existing withdrawal schedule caused the plant to rely too heavily on periods of low to moderate flows. As a result the withdrawal schedule was modified. A minimum criterion was established of no withdrawals when flows at Arcadia were below 100 cfs during the dry season and 130 cfs during periods of higher flow. Beyond that withdrawals could equal up to 10% of flow, with a maximum not to exceed 22.0 mgd. The decision to modify the previous withdrawal schedule was based on analysis by the District staff and EQL (1987b, 1988a,b) of the monitoring data collected for the Hydrobiological Monitoring Program between 1976 and 1987. Over this twelve year period, monthly physical water profile data were collected at eleven samples from the US 41 upstream to where Horse Creek joins the Peace River above the Water Treatment Facility. Based on these data, statistical salinity models of the relationships between flows and salinity were developed for various segments of the river downstream of the point of withdrawal. These models indicated that natural changes in river salinity, immediately downstream of the facility, increased rapidly during seasonal periods when sustained flows progressively declined below 100 cfs (Arcadia). These conclusions supported previous findings and formed the basis for establishing the minimum flow of 100 cfs.

Further modifications to the withdrawal schedule were implemented in the most recent permit revision. The year-round limit to any withdrawals was raised to Arcadia flow above 130 cfs, and continued limits of 10% above that level. This schedule requires withdrawals to more closely follow the natural variability of the freshwater river flows. This increase in the minimum flows prior to any withdrawals was in part due to the recognition of the importance initial spring increases in flows have on stimulating phytoplankton production. The basis of which was developed as part of the Hydrobiological Monitoring Program (EQL, 1995).

Since publication of the Michel et al. (1975) report, updated information and methods have been used to assess the potential impacts of water withdrawals. As discussed, data from the environmental monitoring plan has been used to better evaluate the ecology of the river and justify a major revision of the withdrawal schedule to make it more compatible with the freshwater inflow requirements of the estuary. To assess the potential impacts of withdrawals on freshwater inflows, maximum possible withdrawals at the water treatment plant have been calculated using over twenty years of daily streamflow records. Using numerous (> 130) observations of salinity in the river, regressions have been developed to predict salinity at different locations in the estuary under no-withdrawal and maximum possible withdrawal conditions. These results are presented in SWFWMD (1995). The use of regression analyses for salinity evaluations has been a key element in other Gulf Coast estuaries (Texas Water Resources Development Board, 1995). Also, since 1983, the locations of four salinity concentrations have been regularly monitored in the estuary and the effects of withdrawals on these isohalines has been simulated (EQL, 1995). Assessing the location of key isohalines has been proven be one of the most valuable management tools emanating from

extensive studies of the Sacramento/San Joaquin Delta estuarine system (San Francisco Bay Estuary Project, 1993). Recent studies of the Manatee River funded by the Tampa Bay National Estuary Program have also employed this approach (Dames and Moore, 1995).

Minimum Flows

Annual minimum average flows and the percent of time the individual flow rates are exceeded appear in Figure 2.1 for the Myakka River near Big Slough, the Peace River at Bartow, Joshua Creek, and Zolfo Springs, and the tributaries Horse Creek and Shell Creek. Minimum flows might be established using percent exceedances based on historic flows and might be set at any percentile.

D. Relationship of this *Quantifiable Objective* to Objectives of Other Management Programs

The Southwest Florida Water Management District (SWFWMD) is mandated to set minimum flows for many of the major rivers in Southwest Florida, including the Peace River. This is consistent with the Surface Water Improvement and Management (SWIM) Plan for Charlotte Harbor, but much of the motivation for setting minimum flows is in response to Water Use Permitting issues. However, setting minimum flows in the upstream reaches of the river system as well provides a broader protection. By setting guidelines for flows in individual tributaries, those separate systems can be afforded the same protection as downstream reaches.

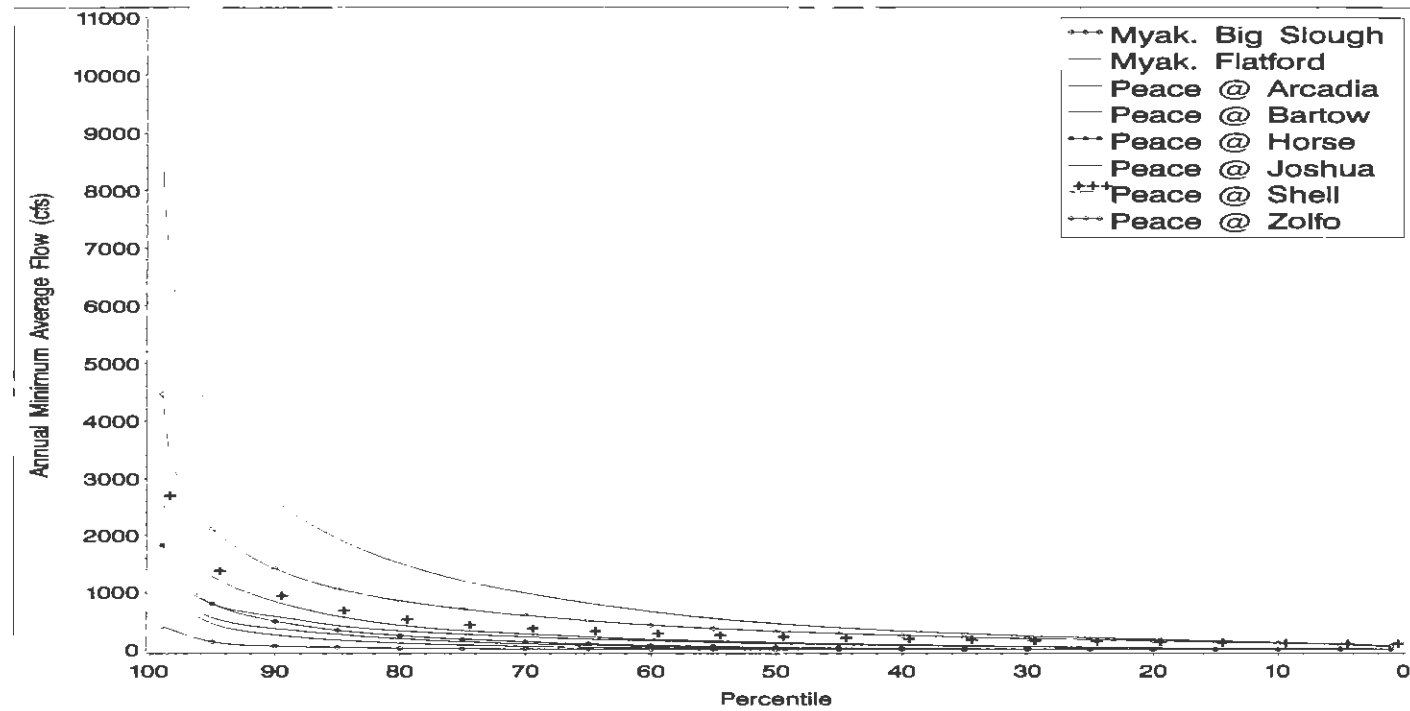


Figure 2.1 Annual minimum average flows and the percent of time the individual flow rates are exceeded for the Myakka River near Big Slough, the Peace River at Bartow, Joshua Creek, and Zolfo Springs, and the tributaries Horse Creek and Shell Creek.

2.3 Hydrologic Alteration: HA-2

A. Statement of Quantifiable Objective

HA2: Identify, establish, and maintain a more natural seasonal variation (annual hydrograph) in freshwater flows by the year 2010 for:

- a. Caloosahatchee River;*
- b. Upper Peace River and its tributaries from Tenoroc to Zolfo Springs; and*
- c. the Upper Myakka River (with special attention to Flatford Swamp).*

B. Charlotte Harbor NEP Goals and Priority Problem Addressed by the Quantifiable Objective

- Goal # 1: Improve the environmental integrity of the Charlotte Harbor study area.
- Goal # 4: Provide the proper freshwater inflow to the estuary to ensure a balanced and productive ecosystem.

Priority Problem # 1: Hydrologic Alterations -- adverse changes to amounts, locations, and timing of freshwater flows, the hydrologic function of flood plain systems, and natural river flows.

C. Background Information (also see background information for HA-1)

Unlike the Peace River, no significant declining trends in river flow have been identified for the Myakka River or Caloosahatchee River (Coastal, 1995; Hammett, 1988). The Caloosahatchee River was originally a shallow, meandering stream with headwaters near Lake Hicpochee. In its natural state, the river could go dry during the dry season and the saltwater front could move as far upstream as the Ortona Lock (structure S-78) (Fan and Burgess, 1983). Dredging and straightening of the channel began in the 1880s at the upper end of the river. In the 1930s, the U.S. Army Corps of Engineers (USACE) continued to straighten, widen, and deepen the channel. Moore Haven Lock (structure S-77) and Ortona Lock (structure S-78) were completed by the USACE in 1937. In the 1960s the USACE conducted extensive dredging and installed Franklin Lock (structure S-79).

The Caloosahatchee River basin drains approximately 3,570 km² and the modern Caloosahatchee River is a channelized flood control and navigational waterway (SWFRPC *et al.*, 1994). The water levels and flows in the Caloosahatchee River upstream of the Franklin Lock and Dam serve to provide water level maintenance for Lake Okeechobee, as well as local drainage and flood control, irrigation and municipal water supply, navigation, and salinity control. The freshwater portion of the river upstream of the Franklin Lock and Dam has been channelized and is referred to as the C-43 Canal. Water levels and flows in the C-43 Canal are regulated by the Ortona Lock (S-78) and the Moore

Haven Lock and Dam (S-77) at Lake Okeechobee.

Tributaries south of the Caloosahatchee River have been extensively modified. Many of the tributary flows are regulated by pumping stations, gated spillways, or culverts with adjustable controls. Relatively large volumes of water may flow toward the river during the wet season, but the direction of the flow is frequently reversed during the dry season (Hammett, 1988). The base flows of some tributaries may be reduced by pumping from shallow irrigation wells and stream intakes; flows of other tributaries may be slightly augmented by irrigation return flow.

"Natural" hydrologic function in the Peace River basin has been altered by the effects of non-contributing basins in areas of mined lands. In these areas, mining has altered the historical hydrology and may restrict and / or contain the sheet flow in mined or previously mined areas (Lewelling and Wylie, 1993). Reclamation commonly involves backfilling mined areas with either clay, sand-tailings, or both, as well as with the overburden displaced during mining. Runoff responds more slowly to rainfall in reclaimed basins than in unmined basins because of undeveloped drainage systems in the reclaimed basins. In contrast, hydrologic problems associated with Flatford Swamp and the upper Myakka River basin are generally the over-pumping of groundwater during the dry season for irrigation purposes.

To identify the "natural" hydrologic variation for this objective, annual and monthly hydrographs can be plotted for the targeted stream or river channels as they were for identifying minimum flows. The difficulty in establishing a more "natural" hydrologic character to the Caloosahatchee River is the absence of historical data prior to control structures being placed along the river channel.

The hydrographs provide a measure of historic variation on which action plans to restore hydrologic variation can be based. Annual and monthly hydrographs of flow data from stations along the Caloosahatchee River near Olga, the upper Peace River at Zolfo Springs, and the upper Myakka River just south of Flatford Swamp are presented in Figures 2.2 through 2.4.

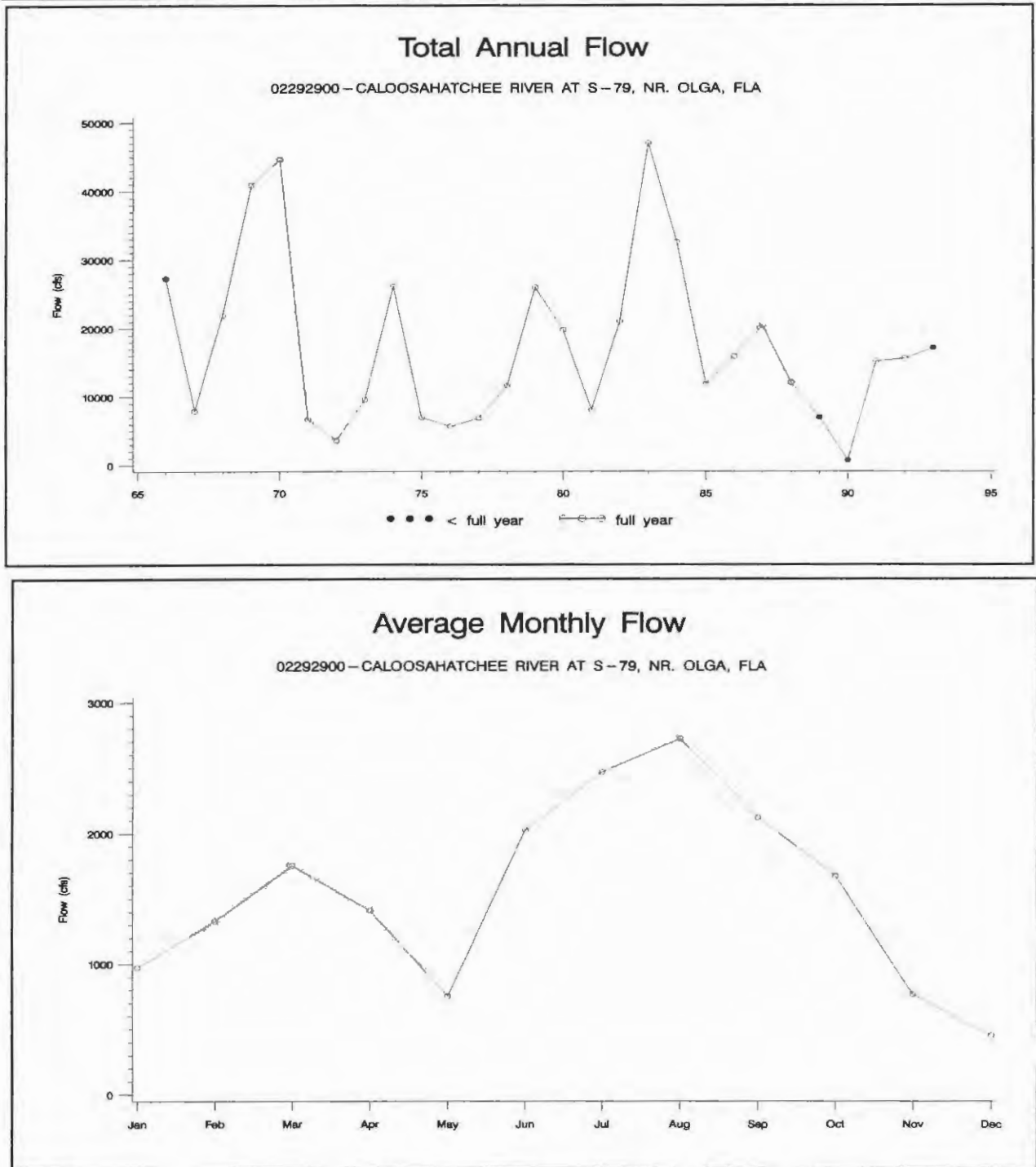


Figure 2.2 Annual and monthly hydrographs of flow data from stations along the Caloosahatchee River near Olga.

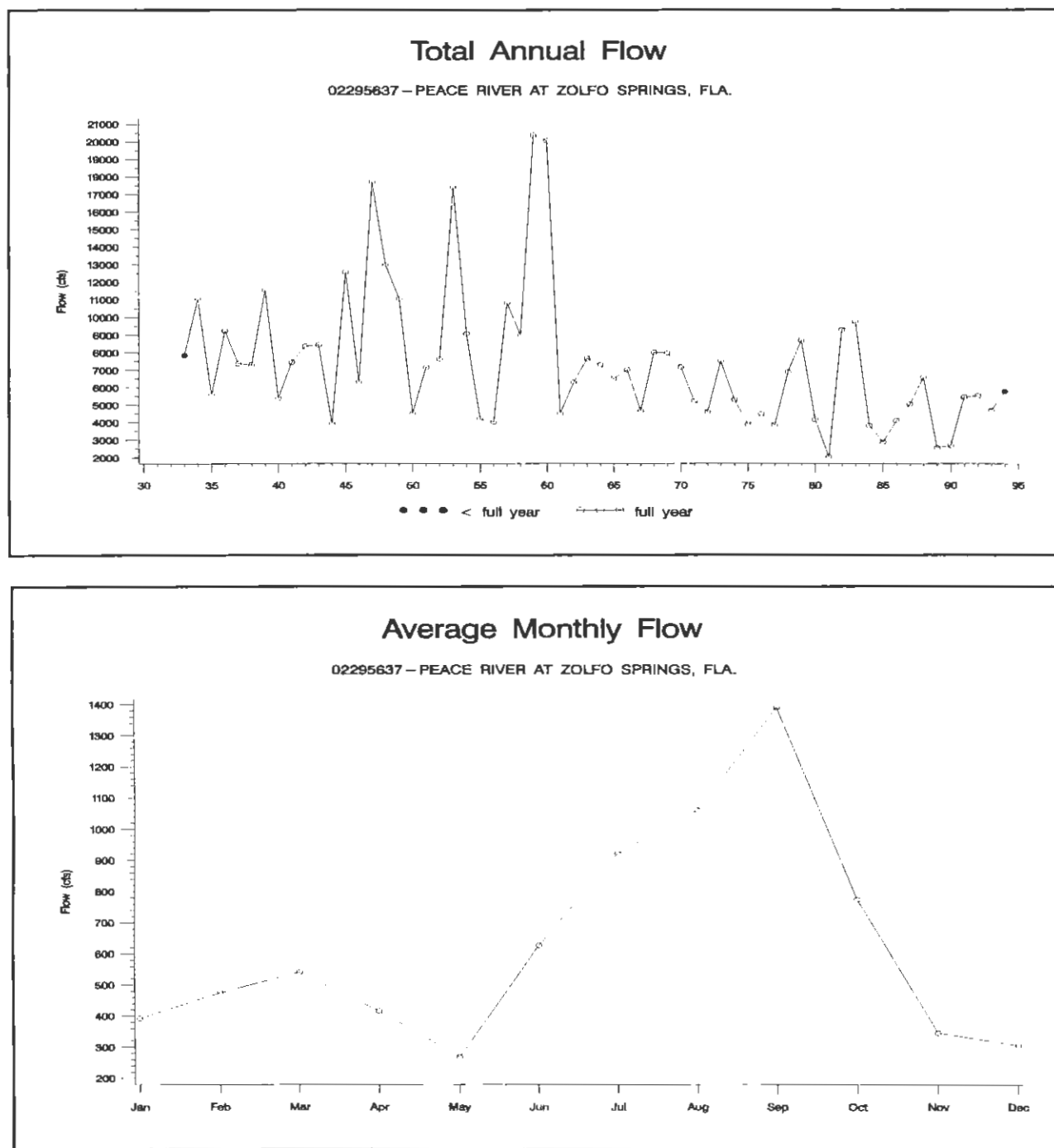


Figure 2.3 Annual and monthly hydrographs of flow data from stations for the upper Peace River at Zolfo Springs.

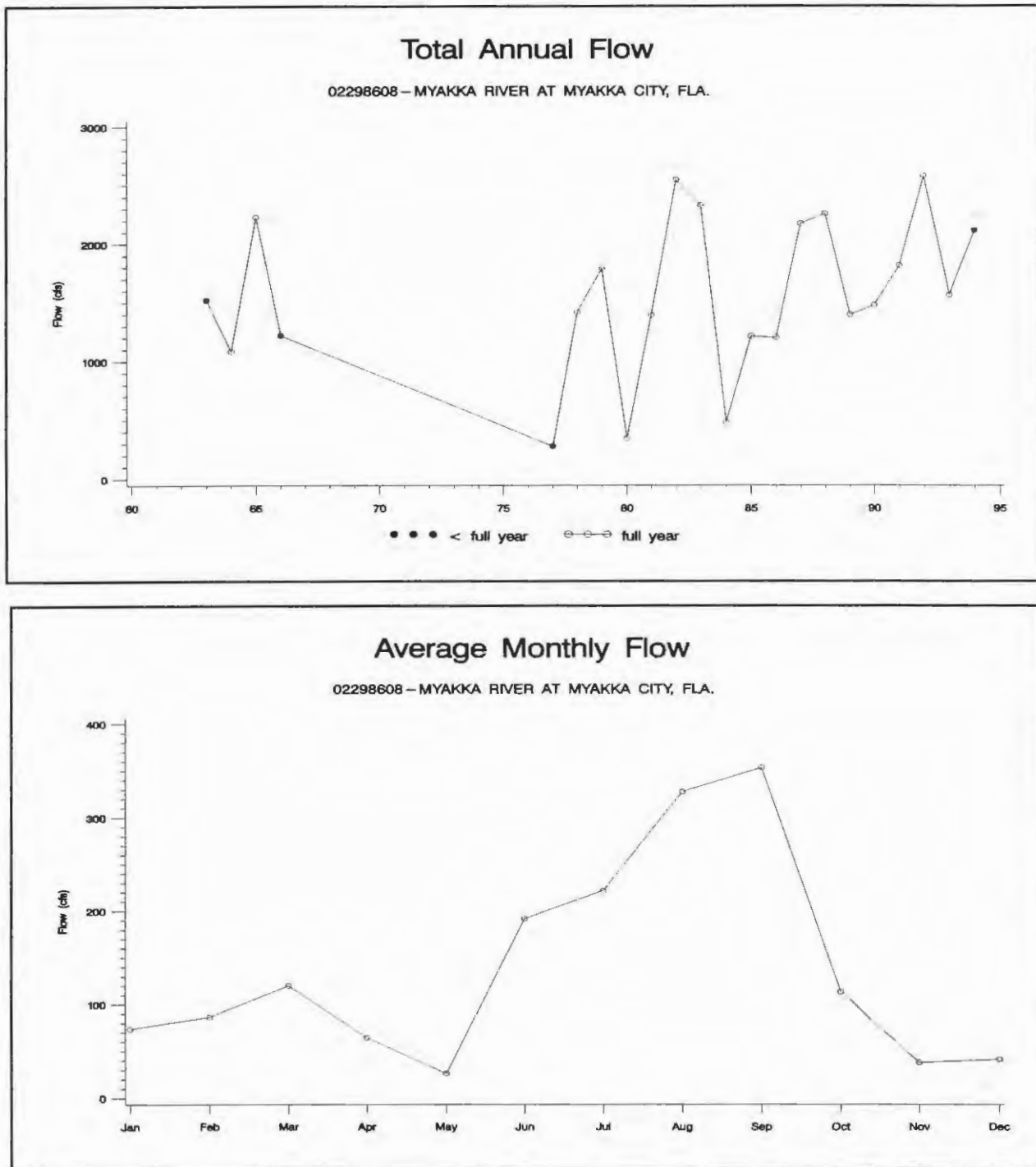


Figure 2.4 Annual and monthly hydrographs of flow data from stations for the upper Myakka River just south of Flatford Swamp.

D. Relationship of this *Quantifiable Objective* to Objectives of Other Management Programs

The Southwest Florida Water Management District (SWFWMD) is currently investigating options for restoring the hydrology of Flatford Swamp to a more natural state. Joint efforts to achieve this objective would improve habitat and water quality in the upper Myakka River and would benefit the entire Charlotte Harbor NEP area. SWFWMD Water Use Permitting efforts can also be incorporated to maximize benefits by encouraging water conservation and limiting ground water use. The National Resource Conservation Service (NRCS) also works with farmers to develop prudent water use strategies and to incorporate best management practices (BMPs) into their operations.

The South Florida Water Management District (SFWMD) and the U.S. Army Corps of Engineers' "Re-Study" of the Caloosahatchee River are currently investigating alternatives that would establish a permanent oligohaline habitat below the Franklin Lock (structure S-79) and would decrease the frequency and magnitude of channelized flows.

2.4 Hydrologic Alteration: HA-3

A. Statement of Quantifiable Objective

HA3: *Restore, enhance, and improve where practical historic subbasin boundaries and natural hydrology for basins within the Charlotte Harbor NEP study area, with special attention to Outstanding Florida Waters, Class I waterbodies, and tributaries to Estero Bay by the year 2020.*

B. Charlotte Harbor NEP Goals and Priority Problem Addressed by the Quantifiable Objective

Goal # 1: Improve the environmental integrity of the Charlotte Harbor study area.

Goal # 4: Provide the proper freshwater inflow to the estuary to ensure a balanced and productive ecosystem.

Priority Problem # 1: Hydrologic Alterations -- adverse changes to amounts, locations, and timing of freshwater flows, the hydrologic function of flood plain systems, and natural river flows.

C. Background Information

The Estero Bay basin includes the area in Lee County south of the Calooshatchee River and the small portion of Collier County that drains into Estero Bay. The basin includes all of Estero Bay, most of which lies within the Estero Bay Aquatic Preserve, and the adjacent barrier islands. Much of the northern part of the basin is in the City of Ft. Myers. Other population centers include Bonita Springs and the Town of Ft. Myers Beach.

Major surface water features in the Estero Bay basin include Hendry Creek, Mullock Creek, the Estero River, areas of Corkscrew Swamp, Spring Creek, Ten Mile Canal, and the Imperial River. These waterways, and the lower portion of Ten Mile Canal, are tidally influenced to some degree. The Estero River east of U.S. 41 has slow conveyance and is considered a groundwater recharge area along with the Imperial River east of I-75 (SWFRPC, 1995). In some areas, local drainage canals provide limited regional flood protection during wet periods, but also lead to over-drainage during dry periods.

Freshwater inflow into the Estero Bay estuary generally peaks in September (Drew and Schomer, 1984). Flows measured in the Imperial River from 1940 to 1952 indicate that flow in dry months (December to May) averages only about 7% of the total annual inflow. Tidally-induced flows in Estero Bay are far greater than freshwater inflow. The salinities of the upper reaches of the Estero

Bay tributaries seldom fall below 10 ppt in the wet season.

There are only minor creeks and rivers flowing into Estero Bay providing a source of fresh water, making Estero Bay extremely sensitive to changes in upland drainage, affecting the quantity, quality, and seasonality of freshwater influx. Much of the area is subject to flooding during periods of extensive rainfall (SFWMD, 1980). During low flow conditions, such as droughts, most of these coastal streams have negligible freshwater discharge. Along the mainland of Estero Bay, most stormwater either evaporates or empties into the streams and canals that discharge into the bay. Coastal streams are relatively short (less than 8 miles long) and sluggish due to low gradients, with flows ranging from 1 to 3 feet per mile (Lee County, 1997).

While historically these rivers and creeks had extensive marsh or mangrove fringes, some of these important habitat areas have been lost to development (Sutcliffe and Thompson, 1983). The increasing southerly development of greater Ft. Myers relies on drainage canals that eventually flow to the bay; urbanization of this area is creating surface water management problems (Lee County, 1997). Some shallow agricultural channels also transport surface water runoff. The fresh water discharges, combined with tides, influence circulation patterns, sedimentation, nutrients, and pollution levels.

Because of the level topography (slope = 0.035%; JEI, 1998), the surface drainage patterns to Estero Bay are poorly defined, with significant numbers of wetlands and relatively short, low gradient freshwater tributary streams; surface water hydrology is influenced by overland sheetflow. Surface water from the Six Mile Cypress Slough, which serves as the outfall channel for the Six Mile basin, intercepts Ten Mile Canal north of U.S. Highway 41. Surface water runoff from both the Ten and Six Mile basins is channeled down Ten Mile Canal to Mullock Creek and eventually into Estero Bay (SFWMD, 1980).

As sheet flows move southwest across the basin, it is collected by natural and artificially constructed channels and channeled into the Estero River, Halfway Creek, Spring Creek, the Imperial River, Cocohatchee River, Corkscrew Canal, and Camp Keais Strand. Much of the sheetflow of water from northeast to southwest has been obstructed by a series of elevated grades and dikes in the interstate area between Corkscrew Road on the north and County Road 846 on the south (JEI, 1998). The cumulative effects of these hydrologic alterations have led to lower dry season water tables, increased point source discharges of runoff rather than sheet flow, and decreased stage and timing of wetland inundation. For example, a mass balance calculation of rainfall versus outflow of the Imperial River during the 1995 flood even indicated that more water was discharged from the Imperial River than had actually fallen in the 86 mile watershed (JEI, 1998).

As a result, the existing capacities of the Estero River, Halfway Creek, Spring Creek and Imperial River cannot accommodate the runoff generated from upstream Corkscrew Swamp area. Also, low-lying areas in southwest Lee County are inundated by stormwater runoff generated miles away. To

restore historic subbasin boundaries to these waterbodies, information regarding the watershed boundary should be compiled from literature as well as historic and existing maps and photographs. Once the historic boundaries are identified, action plans can then be developed by which to accomplish the *Quantifiable Objective*.

Subbasin boundaries vary in the literature, depending on the data used. Average rainfall conditions do not result in the same sheet flow patterns as high rainfall conditions and development has also altered the boundaries by diverting flows. The differences in sheet flows in the basin are presented as historic and existing boundaries of the Estero Bay subbasins identified by Johnson Engineering (1998) and are mapped in Figures 2.5 and 2.6.

D. Relationship of this *Quantifiable Objective* to Objectives of Other Management Programs

South Florida Water Management District (SFWMD) manages freshwater flows from urban areas through surface water permitting. However, many alterations to coastal hydrologic systems were made prior to permit criteria establishment, or are completed through agricultural activities which are often exempt from permit requirements. Initiating a program to return coastal surface water flows to more natural patterns would complement on-going permitting and enforcement efforts, and is consistent with the District's SWIM Plan.

In 1966, the State of Florida Board of Trustees of the Internal Improvement Trust Fund designated the northern half of the bay above Black Island as the Estero Bay Aquatic preserve. The dedication of Estero Bay as the first aquatic preserve in December 1966 initiated the aquatic preserve system (Lee County, 1997). The Estero Bay Management Plan was adopted by the Florida Legislature under the Florida Aquatic Preserves Act of 1975. In 1983 the Estero Bay Aquatic Preserve was amended by the Legislature to include the southern half of Estero Bay. In addition, several large adjacent tracts of associated marsh/high marsh/uplands at the northern end of the bay have been acquired as part of the State Buffer Preserves program and additional areas are under consideration for purchase under the State's CARL program.

Waters of the preserve are also classified as Outstanding Florida Waters (OFWs) by the Florida Department of Environmental Protection (FDEP), and in 1990 the tributaries within the preserve were included in the designation. The regulatory significance of the OFW designation places limits on the kinds of discharges entering these waters, for which the FDEP has the authority to issue permits in these waters. Permits cannot be issued for either direct or indirect discharges that would degrade the water quality and permits for many activities such as dredging and filling must be clearly shown as in the public interest before they can be approved.

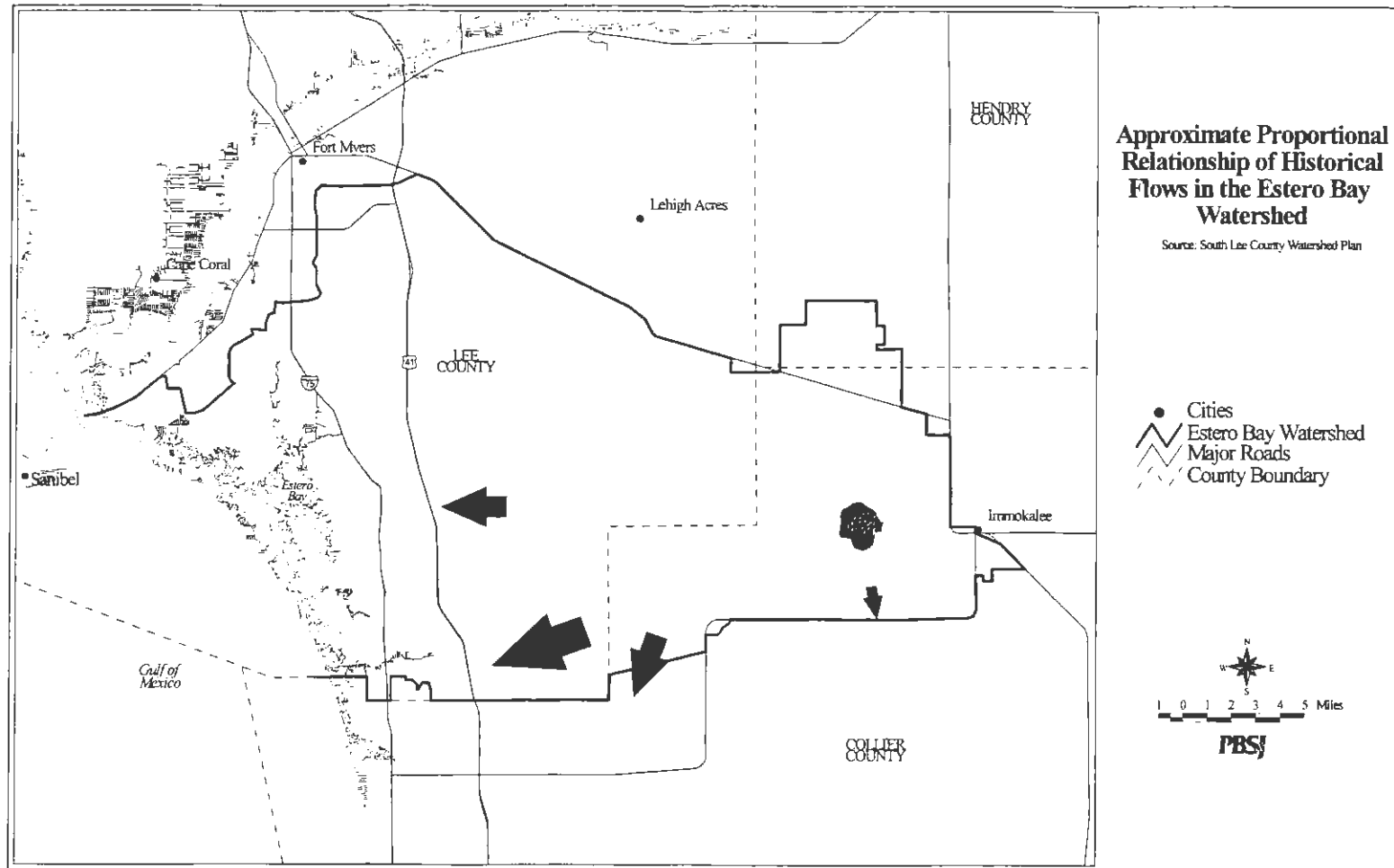


Figure 2.5 Historic (1961) pattern of surface flow within the Estero Bay subbasins (after Johnson Engineering, *et al.*, 1998).

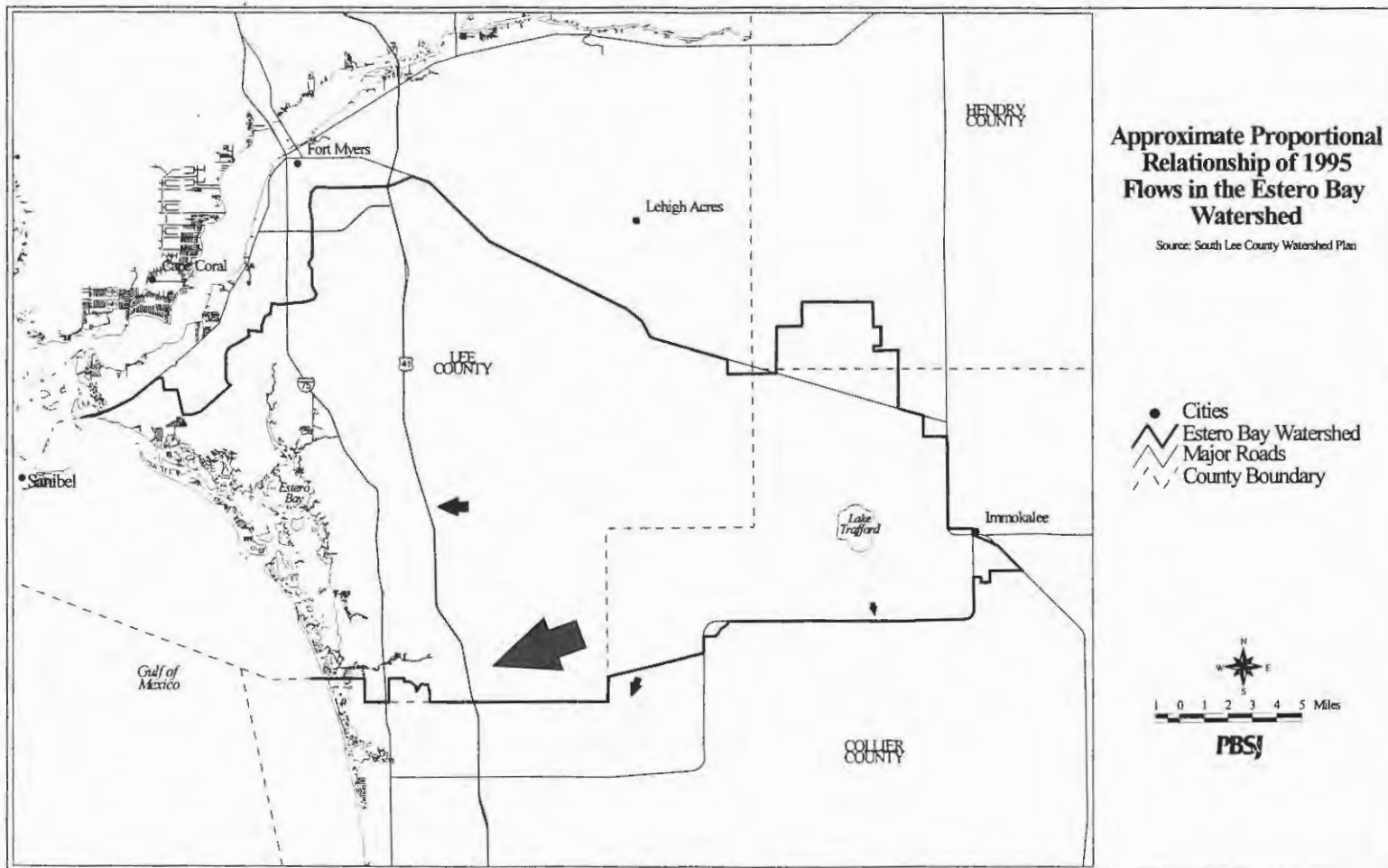


Figure 2.6 Existing (1995) patterns of surface flow within the Estero Bay subbasins (after Johnson Engineering, *et al.*, 1998).

2.5 Hydrologic Alteration: HA-4

A. Statement of Quantifiable Objective

HA-4: *Enhance and improve by the year 2020 to more natural hydrologic conditions waterbodies affected by artificially created structures throughout the Charlotte Harbor NEP study area beginning with:*

- a. *the Sanibel Causeway;*
- b. *Myakka River;*
 - 1) *the weir below Upper Myakka Lake;*
 - 2) *the crossing below Lower Myakka Lake;*
 - 3) *Down's Dam;*
- c. *the causeway between Lover's Key State Recreation Area and Bonita Beach;*
- d. *the water control structure on the south end of Lake Hancock;*
- e. *the structure on Coral Creek; and*
- f. *the Gator Slough canal collector system (Lee and Charlotte Counties).*

B. Charlotte Harbor NEP Goals and Priority Problem Addressed by the Quantifiable Objective

- Goal # 1: Improve the environmental integrity of the Charlotte Harbor study area.
- Goal #3: Reduce point and non-point sources of pollution to attain desired uses of the estuary.
- Goal # 4: Provide the proper freshwater inflow to the estuary to ensure a balanced and productive ecosystem.

Priority Problem # 1: Hydrologic Alterations -- adverse changes to amounts, locations, and timing of freshwater flows, the hydrologic function of flood plain systems, and natural river flows.

C. Background Information

Anthropogenic activities have caused hydrologic alterations of both surface and groundwater flows throughout all eight of the basin watersheds identified within the Charlotte Harbor NEP study area. Many of these alterations have either intentionally or unintentionally resulted from the construction of artificial structures. Such artificial structures fall into a number of broad categories:

- **Instream Structures Meant to Impound Water**

Both the weir structure below Upper Myakka Lake and the crossing below Lower

Myakka Lake, as well as the water control structure at the southern end of Lake Hancock serve to hold water at artificially high levels, which in turn results in downstream reaches of receiving less water than they would otherwise during extended dry periods. In addition, there are other instream structures within the Charlotte Harbor NEP study area which historically were constructed either to hold back water for potable supplies (Shell Creek Dam) or navigation (Franklin Lock (S-79) structure on the Caloosahatchee River).

- **Instream Structures Meant to Prevent the Movement of Saltwater Upstream**

There are a number of other instream structures within the Charlotte Harbor NEP study area whose primary purpose for construction was to prevent the movement of tidal saltwater upstream during the spring dry-season or extended periods of drought, thus reducing available freshwater supplies from the associated surface water. Both Down's Dam on the Myakka River and the structure on Coral Creek are examples of such barriers constructed to reduce saltwater movement.

- **Drainage Canals**

Historically, drainage canals were constructed throughout many areas within the Charlotte Harbor NEP study area to provide for both agricultural as well as residential development. Some of these interconnected systems, such as the Gator Slough Canal and collector system in Lee and Charlotte Counties drain extensive areas, causing uncharacteristically rapid influxes of freshwater into normally more marine areas of the estuary.

- **Canals Constructed to Provide Navigational Access**

There are a number of examples within the coastal areas of the Charlotte Harbor NEP where construction of navigation canals were started in conjunction with development plans some of which were abandoned during the 1970s with the implementation of new dredge and fill permit requirements.

- **Causeways Across Wetlands and Shallow Open Waters**

Both the Sanibel Causeway, as well as the Gasparilla Causeway between Lover's Key State Recreation Area and Bonita Beach are examples of transportation corridors that were constructed using fill to reduce costs prior to existing dredge and fill permit requirement. As such, such roadways provide opportunities for mitigation during subsequent upgrading.

- **Roadway and other Transportation Corridors which Dam or Divert Historic Sheet Flows**

In a somewhat analogous manner to the impacts of causeways described above, there are a number of major roadways and other transportation corridor within the Charlotte Harbor NEP study area where historic sheet flow patterns were altered. As these facilities age and need upgrading, were practical, opportunities exist to mitigate for past hydrologic alterations.

D. Relationship of this *Quantifiable Objective* to Objectives of Other Management Programs

The U.S. Army Corps of Engineers and the Florida Department of Environmental Protection regulate dredge and fill activities, with commenting authority by other federal and state agencies, within the freshwater, estuarine and coastal areas of the Charlotte Harbor NEP. In addition, both the South Florida Water Management District and the Southwest Florida Water Management District manages freshwater flows from urban areas through surface water permitting. However, many historic alterations to both freshwater and marine hydrologic systems were made prior to the establishment of current permitting criteria.

**2.4 Matrix of Relationships Between Hydrologic Alterations
Quantifiable Objectives and Action Plans**

Quantifiable Objective	Action Plan																
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
HA-1	X	X	X	X	X	X		X	X	X	X			X	X		
HA-2		X	X	X	X	X	X	X	X	X	X	X		X			X
HA-3		X	X			X		X	X	X	X	X	X	X			X
HA-4									X	X	X				X		

The *Priority Actions* (HA-A through HA-Q) that are detailed in the following pages describe the types of Actions that would help achieve these *Quantifiable Objectives*.

2.5 HA-A

Action

Establish and implement minimum flows for tributaries as detailed in the Quantifiable Objective. Determine maximum cumulative withdrawals.

Background

The State Legislature has required the Water Management Districts to establish minimum flows and levels for all surface waters. The joint Charlotte Harbor NEP Technical Advisory Committee/Citizens Advisory Committee strongly felt that the Southwest Florida Water Management District should make this a priority activity for several surface waters. These identified surface waters have either been shown to have undergone significant hydrologic alteration historically or potentially may be impacted by proposed projects.

- **Quantifiable Objective - HA-1**
- **Areas for Implementation -**
 - 1) the Myakka River and Big Slough at State Road. 72;
 - 2) the Peace River at: a) Bartow, b) Zolfo Springs, and c) Arcadia; and
 - 3) the Peace River tributaries: a) Horse Creek, b) Joshua Creek, and c) Shell Creek

Strategy

- 1) Develop a priority for the establishment of minimum flows based on:
 - existing documented impacts.
 - the potential for hydrologic impacts which might be associated with proposed projects.
- 2) Conduct the necessary research to establish minimum flows on a basin wide approach for the proceeding areas. Evaluate flows in conjunction with both environmental and water supply needs.

Potential Responsible Agencies & Organizations

Southwest Florida Water Management District

Expected benefits

Established protective criteria for surface waters to prevent future overuse and allow for long-term planning of regional needs and sources, as well as maintain and recharge surficial aquifers.

Monitoring Response

Accurate rainfall and flow data for major watersheds within the Charlotte Harbor NEP.

Related Actions

HA-F, HA-I, HA-J, HA-K

2.6 HA-B

Action

Identify gaps in flow data based on ecosystem needs and projected needs for water withdrawals due to population growth, development, agriculture and mining. Implement data collection to address these gaps.

Background

In order to document changes in surface water flows and patterns due to hydrologic alterations, it is important that accurate, long-term data bases be developed for all basins and watershed potentially at risk within the Charlotte Harbor NEP study area. While many areas within the NEP have extensive historical flow records, other areas have little if any data on major surface water features. Accurate data will also be needed to assess the effectiveness of many of the NEP's proposed Action Plans.

- **Quantifiable Objective** - HA-1, HA-2
- **Areas for Implementation** - Watersheds within the Charlotte Harbor NEP study area currently without sufficient accurate measurements of rainfall and gauged surface flows.

Strategy

- 1) Identify basins and sub-basins where there is insufficient watershed flow data to accurately assess seasonal and long-term changes in water resources.
- 2) Determine the minimum number and appropriate locations of needed gauges.
- 3) Install appropriate monitoring gauges.
- 4) Integrate with Stormwater Utility Programs.

Potential Responsible Agencies & Organizations

Water Management Districts
U.S. Geological Service
U.S. Army Corps of Engineers
Water Supply Authorities
County and Municipal Governments

Expected benefits

Will provide accurate, long-term information on amounts and variability of surface water resources and provide a basis for planning. Provide scientific basis for the establishment of minimum flows, and assess future changes related to projected development and consumptive uses.

Monitoring Response

As specified in "Action."

Related Actions

None.

2.7 HA-C

Action

Evaluate the interaction between groundwater and surface water and how they contribute to overall river flows.

Background

There is general agreement that in many areas of the Charlotte Harbor NEP long-term changes in surface water flows have resulted from hydrologic alterations in groundwater levels. The importance of these interactions and magnitude of such potential alterations need to be documented throughout the NEP study area.

- **Quantifiable Objective** - HA-1, HA-2, HA-3
- **Areas for Implementation** -Entire Charlotte Harbor NEP study area

Strategy

- 1) Determine the goals to be derived from scientific investigations of the interactions of groundwaters and surface waters in areas: a) currently thought to have significant anthropogenic impacts; b) areas though to have the highest potential for future impacts.
- 2) Design long-term studies to assess the relative magnitudes of human and natural variability.
- 3) Implement long-term monitoring programs.

Potential Responsible Agencies & Organizations

Water Management Districts
U.S. Geological Survey

Expected benefits

Accurate knowledge of the interactions and relationship between groundwater and surface water resources and the magnitude of changes caused by growth.

Monitoring Response

As designed by "Action Plan."

Related Actions

None.

2.8 HA-D

Action

Encourage efficient use and reuse of water.

Background

The Charlotte Harbor NEP TAC/CAC working groups strongly felt that freshwater supplies would continue to increase as an issue as a result of the development which is projected to occur in Southwest Florida over the next few decades. As a result, it was felt that the efficient use and reuse of water should be made a key planning element at the local, regional and state levels.

- **Quantifiable Objective** - HA-1, HA-2
- **Areas for Implementation** - Entire Charlotte Harbor NEP study area

Strategy

- 1) Encourage BMPs for use of surface and groundwaters by urban, agricultural, and industrial users.
- 2) Develop economic incentives to encourage water re-use programs wherever possible.
- 3) Encourage advanced wastewater treatment and re-use and/or return rather than deep well injection.
- 4) Encourage progressive rate structures to facilitate the efficient use of water.
- 5) Enhance existing education programs designed to inform and promote public awareness as to the importance of efficient water use.

Potential Responsible Agencies & Organizations

County governments
Water Management Districts
Florida Department of Environmental Regulation
Agricultural Extension Services
Public and private utilities

Expected benefits

Reduced demands on all surface and groundwater resources to provide for projected growth.

Monitoring Response

Development of accurate methods to track both consumption and re-use of water resources.

Related Actions

HA-E, HA-G, HA-H

2.9 HA-E

Action

Discourage deep-well injection of wastewater effluent in favor of Advanced Wastewater Treatment of surface water discharges which are compatible with the water quality of the receiving waters, and encourage appropriate reuse alternatives.

Background

The Charlotte Harbor NEP Technical Advisory Committee/Citizens Advisory Committee stressed that freshwater supplies would continue to increase as an issue as a result of the development which is projected to occur in Southwest Florida in the future. As a result, it was felt that the efficient use and reuse of water should be made a key planning element at the local, regional and state levels. Deep-well injection was seen as short-sighted and a last-resort alternative in comparison to Advanced Wastewater Treatment to appropriate standards compatible with the water quality requirements of the receiving waters and/or appropriate reuse alternatives.

- **Quantifiable Objective** - HA-1, HA-2
- **Areas for Implementation** - Entire Charlotte Harbor NEP study area

Strategy

- 1) Develop interagency task force (Water Management Districts, Florida Department of Environmental Protection, U.S. Environmental Protection Agency, etc.) to review conflicts in current permitting requirements.
- 2) Establish site-specific criteria for nutrient discharges to receiving waters based both on their characteristics and on TMDLs.
- 3) Provide economic incentives to utilities to re-use and/or return appropriately treated wastewater.

Potential Responsible Agencies & Organizations

County and Municipal Governments
Water Management Districts
Florida Department of Environmental Regulation
Agricultural Extension Services
Public and private utilities

Expected benefits

Reduced demands on all surface and groundwater resources to provide for projected growth.

Monitoring Response

Site specific monitoring programs to assess and correct any problems associated with changes in nutrient loadings.

Related Actions

HA-D, HA-G, HA-H

2.10 HA-F

Action

Re-establish, where practical, surface flows from sub-basins that do not currently contribute to their historic hydrologic connections.

Background

In a number of the areas within the Charlotte Harbor NEP there are regions, especially within the upper Peace River basin, where surface flows no longer contribute to the flows in their historic watersheds. In some areas, such hydrologic alterations have accounted for significant changes in both the amount and seasonal characteristics of flows of the major tributaries within these subbasins.

- **Quantifiable Objective** - HA-1, HA-2, HA-3, HA-4
- **Areas for Implementation** - The initial emphasis should center on the upper Peace River basin

Strategy

- 1) Assess and document changes in historic basins caused by past and current alterations, including: mining; ditching; channelizing, damming, and other structural changes.
- 2) Evaluate plans to establish more natural surface water flows from historic sub-basins.
- 3) Determine mechanisms to fund restoration projects.
- 4) Rank projects and implement as funds become available.

Potential Responsible Agencies & Organizations

Southwest Florida Water Management District
Department of Environmental Protection, Bureau of Mines
Mining Companies
County and Municipal Governments

Expected benefits

Restore more natural surface water flows in the upper Peace River basin.

Monitoring Response

Water quantity and quality changes.

Related Actions

HA-A, HA-I, HA-J, HA-K

2.11 HA-G

Action

Plug abandoned groundwater wells to improve groundwater quality, increase water levels, and promote water conservation.

Background

Within the Charlotte Harbor NEP there are a number of abandoned agriculture wells. Some of these wells, although once capped, are now free flowing, while the casings of others have failed providing direct connections to groundwater layers of significantly differing quality. The Water Management Districts have had programs to deal with this problem. However, the Charlotte Harbor NEP Technical Advisory Committee/Citizen Advisory Committee felt that a greater emphasis should be given to these programs and standards for future well abandonments strengthened.

- **Quantifiable Objective** - HA-1, HA-2, HA-3
- **Areas for Implementation** -Entire Charlotte Harbor NEP study area

Strategy

Develop and /or support programs to identify and plug abandoned groundwater wells.

Potential Responsible Agencies & Organizations

Water Management Districts

Expected benefits

Reduced loss of groundwater resources through direct loss and mixing of lower grade waters.

Monitoring Response

Within "Action Plan."

Related Actions

HA-D, HA-HD

2.12 HA-H

Action

Where possible (practical), restore groundwater levels to historic seasonal mean levels.

Background

There are areas within the Charlotte Harbor NEP where groundwater levels have severely declined due to the historic overuse of groundwater for mining, agricultural, and public supplies. In specific areas this has resulted in declines in both wetland habitats, as well as surface water flows which are seasonally dependent on groundwater contributions. The Charlotte Harbor NEP TAC/CAC committees felt that, where possible, efforts should be made to restore groundwater levels to the greatest extent practical to, in part, mitigate for these past hydrologic impacts.

- **Quantifiable Objective** - HA-1, HA-2, HA-3
- **Areas for Implementation** - Initial primary emphasis would be in the upper Peace River basin

Strategy

- 1) Identify and document areas of greatest long-term changes in groundwater levels.
- 2) Identify potential causes and relative contributions.
- 3) Determine potential for restoration of groundwater levels and the relative effectiveness of proposed actions.
- 4) Implement long-term restoration plan.

Potential Responsible Agencies & Organizations

Water Management Districts
Agricultural Community
Mining Companies
U.S. Army Corps of Engineers
County and Municipal Governments

Expected benefits

Restoration of wetlands and increased surface water flows in specific areas.

Monitoring Response

Groundwater levels and surface water flows.

Related Actions

HA-D, HA-G

2.13 HA-I

Action

Create and distribute both Public Service Announcements and videos that explain: the importance of maintaining minimum freshwater flows in tributaries and to the estuarine complex; water resource issues; and water conservation.

Background

The Charlotte Harbor NEP joint Technical Advisory Committee/Citizens Advisory Committee felt that it was an import function of the NEP to promote the development and distribution of Public Service Announcements. One element of this program should emphasize the importance of maintaining minimum freshwater flows, both with regards to riverine habitats as well as sustaining estuarine production. Additional water resource issues, and the need for water conservation and reuse need to be included as related topics.

- **Quantifiable Objective** - HA-1, HA-2, HA-3, HA-4
- **Areas for Implementation** - entire Charlotte Harbor NEP study area

Strategy

- 1) Identify public perceptions of freshwater flows.
- 2) Based on these results develop a Public Service Announcement and video highlighting the NEP's efforts to: establish, enhance, and maintain minimum seasonal flows in each of the major basins, and water resource issues.

Potential Responsible Agencies & Organizations

Water Management Districts
Game and Freshwater Fish Commission
U.S. Fish and Wildlife Service
Department of Environmental Protection
U.S. Environmental Protection Agency
Florida Gulf Coast University
Charlotte Harbor National Estuary Program
Florida Sea Grant

Expected benefits

Increased public awareness of issues and benefits to be derived from restoring and maintaining adequate surface water flows.

Monitoring Response

None.

Related Actions

HA-A, HA-F, HA-J, HA-K

2.14 HA-J

Action

Create portable displays that explain the importance of: maintaining minimum flows; local water resources; and water conservation.

Background

The Charlotte Harbor NEP joint Technical Advisory Committee/Citizens Advisory Committee proposed that as part of an overall effort to promote public awareness as to the importance of maintaining minimum freshwater flows, water conservation, and reuse within the NEP watersheds, portable displays should be created that could be placed in public areas, including: schools, churches, county administrative buildings, malls, etc.

- **Quantifiable Objective** - HA-1, HA-2, HA-3, HA-4
- **Areas for Implementation** - Entire Charlotte Harbor NEP study area

Strategy

- 1) Identify public perceptions of freshwater flows.
- 2) Based on these results develop a traveling display that highlights the NEP's efforts to: establish, enhance, and maintain minimum seasonal flows in each of the major basins.
- 3) The display should clearly indicate the benefits to the public which will result from such efforts and how they can help or participate.

Potential Responsible Agencies & Organizations

Water Management Districts
Game and Freshwater Fish Commission
US Fish and Wildlife Service
Department of Environmental Protection
U.S. Environmental Protection Agency
Charlotte Harbor National Estuary Program
Florida Sea Grant
Florida Coast Management Program

Expected benefits

Increased public awareness of issues and benefits to be derived from restoring and maintaining adequate surface water flows.

Monitoring Response

None.

Related Actions

HA-A, HA-F, HA-I, HA-K

2.15 HA-K

Action

Create an education plan and a coordinated overall effort to educate the public about water use and the importance of minimum flows.

Background

In addition to the creation of Public Service Announcements and portable displays, the Charlotte Harbor NEP TAC/CAC joint working groups suggested the development of an overall public education plan to coordinate and facilitate public awareness and education concerning water resource issues.

- **Quantifiable Objective** - HA-1, HA-2, HA-3, HA-4
- **Areas for Implementation** - entire Charlotte Harbor NEP study area

Strategy

- 1) Identify areas where the public is generally interested and those where specific knowledge is generally limited concerning the issues surrounding water use and the importance of maintaining adequate freshwater flows in riverine and estuarine systems.
- 2) Develop a coordinated program to better inform the public of the issues and increase the ready availability of unbiased information and level of current knowledge.
- 3) Identify a focal point within each of the NEP basins to be responsible for identifying target groups and carrying out the program.
- 4) Make sure that local and state governmental representatives are supplied information, and involved in the program.
- 5) Develop both a comprehensive video and a speakers presentation that can be presented to interested public groups and schools.

Potential Responsible Agencies & Organizations

County and Municipal Departments of Education
Water Management Districts & Basin Boards
Game and Freshwater Fish Commission
U.S. Fish and Wildlife Service
Florida Department of Environmental Protection
U.S. Environmental Protection Agency
Regional Water Supply Authorities

Expected benefits

Increased public awareness of issues and benefits to be derived from restoring and maintaining adequate surface water flows.

Monitoring Response

None.

Related Actions

HA-A, HA-F, HA-I, HA-J

2.16 HA-L**Action**

Implement the recommendations of the South Lee County Plan (SFWMD).

Background

The South Florida Water Management District has completed (1998) a thorough review of the hydrologic alterations of surface water flows which have occurred in the Estero Bay Watershed. This document contains a series of recommendations to both prevent future similar changes in surface flow patterns, as well as projects to mitigate some of the historic alterations and diversions which have occurred.

- **Quantifiable Objective** - HA-2, HA-3
- **Areas for Implementation** - Southern Lee County

Strategy

- 1) Prioritize recommendations within the South Lee County Plan based on both need, and degree to which substantial benefits can reasonably be expected for defensible costs.
- 2) Implement selected elements within the plan and assess resulting benefits.

Potential Responsible Agencies & Organizations

Lee County

South Florida Water Management District

US Army Corps of Engineers

Florida Department of Environmental Regulation

Florida Department of Transportation

Expected benefits

Improvement and mitigation of historic hydrologic alterations to the Estero Bay Watershed.

Monitoring Response

Establish network of gauging stations to determine patterns and movement of surface waters.

Related Actions

HA-N

2.17 HA-M

Action

Prevent and/or reduce, to the greatest extent possible, future hydrologic impacts of transportation projects within the Charlotte Harbor NEP and mitigate for past problems whenever possible.

Background

Historically, many transportation projects within the Charlotte Harbor NEP study area have either blocked and/or diverted the patterns of surface water flows. By comparison, the current design criteria used during planning and construction of local, state, and federal transportation projects generally account for and prevent these previous problems. The Charlotte Harbor NEP's joint TAC/CAC working group felt that as transportation needs increase in response to the rapid rate of growth in Southwest Florida, every effort should be made to mitigate for past hydrologic alterations as existing facilities are expanded and/or upgraded.

- **Quantifiable Objective** - HA-3
- **Areas for Implementation** - Entire Charlotte Harbor NEP study area

Strategy

- 1) Make mitigation of any potential hydrologic alterations a key criterion for evaluation during any new roadway construction projects.
- 2) Support to the greatest practical extent, mitigation of hydrologic alterations and impacts to water quality, as part of future roadway improvement projects.

Potential Responsible Agencies & Organizations

Florida Department of Transportation
County and Municipal Governments
Water Management Districts
Florida Department of Environmental Regulation
U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
Metropolitan Planning Organizations

Expected benefits

A re-evaluation of the methods used in assessing past and future hydrologic alterations which have or could result from roadways and other transportation projects within the Charlotte Harbor NEP.

Monitoring Response

Assess impacts due to transportation projects.

Related Actions

HA-O

2.18 HA-N**Action**

Ensure Charlotte Harbor NEP representation and involvement in the reconnaissance and feasibility phases of the U.S. Army Corps of Engineers comprehensive restudy of the Central and South Florida Flood Control Project.

Background

The U.S. Army Corps of Engineers is currently in the process of undertaking a major restudy of its works and related issues in South Florida. The Charlotte Harbor NEP's Technical Advisory Committee/Citizens Advisory Committee felt that it would be appropriate for the NEP staff to be represented on the advisory group for the planning study.

- **Quantifiable Objective** - HA-2, HA-3
- **Areas for Implementation** - Lee County

Strategy

Provide that members of the review committees for the U.S. Army Corps of Engineers Central and South Florida restudy are aware of the concerns and proposed Actions Plans for the CCMP.

Potential Responsible Agencies & Organizations

U.S. Army Corps of Engineers
U.S. Environmental Protection Agency
Charlotte Harbor NEP

Expected benefits

Provision for representatives of the Charlotte Harbor NEP to be part of this process.

Monitoring Response

None.

Related Actions

None.

2.19 HA-O

Action

Support implementation of 3-D model studies to determine potential hydrologic benefits of proposed alternative alterations of the Sanibel Causeway during any reconstruction program.

Background

It has been proposed that the bridges to Sanibel be replaced. As part of this replacement, there have been suggestions that the causeways which were constructed as part of the roadway when the current bridges were built either be removed or modified. The primary reason for removing the causeways would be to restore the patterns of circulation in San Carlos Bay and nearby waters to the conditions which existed before the causeways were constructed. The Charlotte Harbor NEP Technical Advisory Committee/Citizens Advisory Committee strongly support the use of a three dimensional (3-D) model to assess both the alterations caused by the existing causeways and any proposed modifications.

- **Quantifiable Objective - HA-4**
- **Areas for Implementation - Southern Pine Island Sound, San Carlos Bay, Estero Bay**

Strategy

Implement a 3-D model to determine the impacts of the Sanibel causeway on the circulation and ecology of San Carlos Bay and nearby waters. In the bridge re-design, the circulation effects and the model's analysis will be considered.

Potential Responsible Agencies & Organizations

City of Sanibel
South Florida Water Management District
Lee County
U.S. Army Corps of Engineers
U.S. Coast Guard
U.S. Environmental Protection Agency
Florida Department of Environmental Regulation
U.S. Marine Fisheries Service

Expected benefits

Improvement of previous hydrologic alterations which resulted from construction of the causeway.
Accurate assessment of the potential for new significant unexpected impacts caused by any proposed changes.

Monitoring Response

Monitor changes in flows during construction in order to verify model results.

Related Actions

HA-M

2.20 HA-P**Action**

Form a working group to evaluate potential alternatives to modification and/or removal of the structure at the southern end of Lake Hancock.

Background

As a result of the thick layers of unconsolidated "muck" on the bottom of Lake Hancock, nutrient levels within the surface waters of the lake are often extremely high and water quality (based on a Trophic State Index) is usually "Poor." The waters leaving Lake Hancock can result in degraded water quality and algal bloom in the upper Peace River. It has been suggested that construction of a "filtration marsh system" to reduce pollutant loads leaving Lake Hancock would help improve water quality in these areas of the Peace River. Another potential mechanism to increase the area of natural marsh in the lake system would be to drop lake levels by either removal or control of the structure at the southern end of the lake.

- **Quantifiable Objective** - HA-1
- **Areas for Implementation** - Upper Peace River basin

Strategy

If the muck is not cleaned up from the bottom of Lake Hancock, remove the dam (with considerations for flow and water quality).

Potential Responsible Agencies & Organizations

Southwest Florida Water Management District

Polk County

Florida Department of Environmental Protection

Florida Game and Freshwater Game Commission

U.S. Fish and Wildlife Service

Expected benefits

Reduction of large periodic discharges of highly polluted waters from the lake into the upper Peace River.

Monitoring Response

Monitor flows and water quality in the upper Peace River.

Related Actions

None.

2.21 HA-Q

Action

Restore hydrologic surface features of the Peace Creek flood plain.

Background

- **Quantifiable Objective** - HA-1, HA-2, HA-3
- **Areas for Implementation** - upper Peace River basin, between Bartow and Lake Wales

As it exists, Peace Creek is little more than a channelized system, with major hydrologic alterations of most of its historic flood plain. As one of the most altered areas within the upper Peace River basin, the Technical and Citizens Advisory Committees of the Charlotte Harbor NEP felt that it deserved special attention for restoration.

Strategy

- 1) Acquire flood plain property bordering Peace Creek either through fee simple, or less-than-fee acquisition process.
- 2) Restore sheet flow and some semblance of a natural marsh system in the flood plain by de-channelizing Peace Creek.

Potential Responsible Agencies & Organizations

Southwest Florida Water Management District
Florida Department of Environmental Protection

Expected benefits

Restoration of a more natural seasonal variation in freshwater flow to the upper Peace River. Flood attenuation and storage. Water quality improvement due to removal of cattle and subsequent nutrient filtration by recreated marsh system.

Monitoring Response

Seasonal flows and water quality

Related Actions

HA-A, HA-C, HA-F, HA-H

3.0 Quantifiable Objectives & Priority Action Plans for Water Quality Degradation

3.1 Water Quality Objectives

The following four *Quantifiable Objectives* were established to address specific problems associated with Water Quality Degradation.

WQ 1: Identify those waterbodies that do not meet their designated water quality standards, and develop a plan by the year 2000 to meet those standards.

WQ 2: Develop Total Maximum Daily Loads (TMDLs) for the basins in the Charlotte Harbor NEP study area by the year 2005.

WQ 3: Identify specific actions and develop timetables for achieving TMDLs by the year 2010.

WQ 4: Achieve water quality that will meet shellfish harvesting standards throughout the Class II waters of the Charlotte Harbor NEP study area by the year 2015.

WQ 5: Restore and maintain Lake Hancock to Class III water quality standards (or better) and improve the Trophic State Index (TSI) value for the water exiting the lake from *poor* to *good* by the year 2010.

WQ 6: Meet or exceed designated water quality standards throughout basins of the Charlotte Harbor NEP study area by the year 2015 with possible exceptions for natural and/or site-specific conditions.

WQ 7: Identify waterbodies in the Charlotte Harbor NEP study area that should be designated as Outstanding Florida Waters and support the establishment of that designation by the year 2000.

The sections that follow discuss each of these *Quantifiable Objectives* in detail and provide some background information on each objective.

3.2 Water Quality: WQ-1

A. Statement of Quantifiable Objective

- WQ 1:** *Identify those waterbodies that do not meet their designated water quality standards, and develop a plan by the year 2000 to meet those standards.*
- WQ 6:** *Meet or exceed designated water quality standards throughout basins of the Charlotte Harbor NEP study area by the year 2015 with possible exceptions for natural and/or site-specific conditions.*

B. Charlotte Harbor NEP Goals and Priority Problem Addressed by the Quantifiable Objective

- Goal # 1:** Improve the environmental integrity of the Charlotte Harbor study area.
- Goal # 2:** Preserve, restore, and enhance seagrass beds, coastal wetlands, barrier beaches, and functionally related uplands.
- Goal # 3:** Reduce point and non-point sources of pollution to attain desired uses of the estuary.

Priority Problem # 2. Water Quality Degradation -- including but not limited to pollution from agricultural and urban runoff, point source discharges, septic tank system loadings, atmospheric deposition, and groundwater.

C. Background Information (also see discussion WQ-2)

Federal and State Statutes

The federal Clean Water Act provides the statutory basis for the State of Florida's water quality standards programs. The federal regulatory requirements governing such programs (Water Quality Standards Regulation) are published in 40 CFR 131. Each state is responsible for reviewing, establishing, and revising its specific water quality standards. The Clean Water Act requires that the surface waters be classified according to their designated uses. To manage surface waters of the state, Florida has developed a surface water quality standards system. The components of this system include: classifications, criteria, an antidegradation policy, and criteria for the special protection of certain waters. Florida has five classes with associated designated uses, which are arranged in order of degree of protection required:

- **Class I - Potable Water Supplies** - currently there are over a dozen lakes, rivers and stream within the State which have been classified as "Potable Water Supplies."

- Class II - Shellfish Propagation or Harvesting - This classification generally coastal waters where commercial shellfish harvesting occurs, or could occur if adequate water quality standards are met.
- Class III - Recreation, Propagation and Maintenance of a Healthy, Well-Balanced Population of Fish and Wildlife - All surface waters within the state are by default Class III unless described in rule 62-302.400 of the Florida Administrative Code.
- Class IV - Agricultural Water Supplies - Generally located in agriculture areas around Lake Okeechobee.
- Class V - Navigation, Utility and Industrial Use - Currently, there are no class IV water bodies in the State of Florida (the Fenholloway River was reclassified as Class III in 1998).

Specific water quality criteria have been established for each of these classifications to protect the most beneficial current and future uses of the waters of the state. While some of these are intended to protect aquatic life, others are designed to protect human health, and are contained within rules 62-302.500 and 62-302.530 of the Florida Administrative Code. Water quality standards also include general provisions for pollutants which are not specifically listed. Another component of water quality standards is the antidegradation policy (found in 62-302.400) which allows for protection of water quality above the minimum required for a classification.

A complement to classes is the designation of Outstanding Florida Waters. An Outstanding Florida Water is a water worthy of special protection due to its natural attributes (403.061 Florida Statute). The intent of an Outstanding Florida Water designation is to maintain ambient water quality, even if these designations are more protective than those required by the water body's specific classification. Most OFWs are within the state or federal park system such as aquatic preserves, national seashores, or wildlife refuges. Other waters may also be designated as OFWs through "Special Waters" rulemaking. The designation process and a listing of all Outstanding Florida Waters are contained in rule 62-302.700 of the Florida Administrative Code.

Charlotte Harbor Study Area

The estuary of Charlotte Harbor Proper is one of the largest bays in Florida, covering 163 square miles of Charlotte Harbor proper as well as Pine Island Sound, San Carlos Bay, and Matlacha pass. The northern part of the harbor receives freshwater from the Peace and Myakka rivers and the Estero and Caloosahatchee rivers flow into the southern portion of the Charlotte Harbor NEP area. Urban development in the basin is heavily concentrated in the north at Port Charlotte and near the mouth of the Peace River at Punta Gorda. There is also localized urbanization at the mouth of the Caloosahatchee.

Water quality in this basin is generally good, although there are some problems (Hand *et al.*, 1996). The predominant pollution problems are associated with development: bacteria from accelerated urban runoff through canals and sediments from construction. Nutrient levels, particularly phosphorus, are elevated and originate primarily from the Peace River basin. Nutrient loading in San Carlos Bay may be the result of urban runoff in the Ft. Myers area and agricultural runoff in the Caloosahatchee River drainage. The timing and possible quality of fresh water inflows into the north end of Matlacha Pass are affected by an extensive canal system in the largely undeveloped northern portion of Cape Coral.

The Peace River is characterized by generally good to fair water quality (Hand *et al.*, 1996). Poor water quality occurs in the northern basin as a result of domestic and industrial point source discharges and urban stormwater runoff in the lower Peace River basin, while the worst water quality problems occur in the upper basin around Lake Parker, Banana Lake, Lake Hancock, and their tributaries. The Myakka River basin generally has very good water quality and supports productive freshwater and estuarine habitats.

Several locations in the headwaters of the Peace River have been significantly affected as result of receiving wastewater and phosphate effluent. By the year 2020, the population in the inflow area is expected to increase by more than 500,000 people and require an additional 76 million gallons per day water supply (Hammett, 1988). The increased population will produce an additional 3 tons per day of nitrogen and 0.65 ton per day of phosphorus. These increased nutrient loads can be expected to occur concurrently with decreased freshwater inflow.

Within Pine Island Sound some of the most serious water quality problem in the basin have historically occurred in the Sanibel River, located on Sanibel Island (Hand *et al.*, 1996). It has previously received domestic wastewater and runoff from the islands more developed areas. Leachate from local waste water treatment plants (WWTPs) has been controlled, but stormwater runoff remains a problem. A fish kill and die-off of clams occurred in 1990 and have been attributed to high temperature water discharge and low dissolved oxygen (DO).

A portion of the State of Florida's 1998 303(d) list of waters that do not meet applicable water quality standards are presented in Table 3.1 (under the next *Quantifiable Objective*). The Caloosahatchee River, Charlotte Harbor, Myakka River, and Peace River all have water segments which do not meet applicable water quality standards.

The list is based on water segment assessments from the 1996 305(b) report. As required by Section 303(d) of the Federal Water Pollution Control Act, the list identifies those waters for which Total Maximum Daily Loads (TMDLs) will be developed. For water segments which are a SWIM water body, TMDLs will be developed in cooperation with the appropriate water management district (WMD); for selected parameters, the TMDLs will be based on pollutant load reduction goals (PLRGs) the WMDs plan to develop. As such, the list includes a specific year for TMDL

development based on the WMD schedule for PLRG development (if available).

The schedule for non-SWIM waters will be based on a new watershed management approach that rotates through the state on a five year cycle. In a given basin, the plan is to develop TMDLs for high priority water bodies during the first rotation through the cycle and develop TMDLs for low priority water bodies during the second cycle. This new approach will be implemented over the next two years, during which TMDLs will be developed by FDEP for selected waters as part of pilot projects for basin management.

D. Relationship of this Quantifiable Objective to Objectives of Other Management Programs

This objective is consistent with the overall goals of the water management districts' SWIM programs and other state, local, and federal management initiatives that seek to promote seagrass growth. Seagrass has been identified as a critical component of estuarine ecosystems by the Tampa Bay, Sarasota Bay, and Indian River Lagoon NEPs.

3.3 Water Quality: WQ- 2 & 3

A. Statement of Quantifiable Objective

WQ 2: *Develop Total Maximum Daily Loads (TMDLs) for the basins in the Charlotte Harbor NEP study area by the year 2005.*

WQ 3: *Identify specific actions and develop timetables for achieving TMDLs by the year 2010.*

B. Charlotte Harbor NEP Goals and Priority Problem Addressed by the Quantifiable Objective

Goal # 1: Improve the environmental integrity of the Charlotte Harbor study area.

Goal # 2: Preserve, restore, and enhance seagrass beds, coastal wetlands, barrier beaches, and functionally related uplands.

Goal # 3: Reduce point and non-point sources of pollution to attain desired uses of the estuary.

Priority Problem # 2. Water Quality Degradation -- including but not limited to pollution from agricultural and urban runoff, point source discharges, septic tank system loadings, atmospheric deposition, and groundwater.

C. Background Information (also see background information for WQ-1)

Environmental Protection Agency

The Clean Water Act (CWA) establishes a national goal of "fishable, swimmable" waters. The Clean Water Act contains a number of provisions the goal of which are to restore and maintain the quality of the nation's water resources. States also establish water quality standards which describe the desirable conditions and minimal standards for the state's water bodies. At a minimum, the federal Clean Water Act requires major categories of industry to meet national standards for the quality of the effluent they discharge, and municipal sewage treatment plants to provide secondary treatment of sewage. The Clean Water Act's National Pollutant Discharge Elimination System (NPDES) program further requires EPA and/or the states to issue enforceable permits for point source discharges such as industrial process wastewater, municipal wastewater treatment plants, and/or stormwater discharges from urban areas. The EPA also assists states in developing and implementing programs to control nonpoint (diffuse) sources of pollution, such as agricultural runoff. However, despite the implementation of these Clean Water Act provisions, there are still waters that do not meet state water quality standards. Clean Water Act Section 303(d) addresses these remaining waters by requiring states to identify the waters and develop TMDLs for them, with oversight from EPA.

As such, the primary goal of a TMDL is to meet a state's water quality standards. A TMDL is a written, quantitative assessment of water quality problems and contributing pollutant sources. It specifies the amount of a pollutant or other stressor that needs to be reduced to meet existing water quality standards, allocates pollution control responsibilities among pollution sources in the watershed, and provides a basis for taking the specific actions needed to restore a water body. Section 303(d) requires states to develop lists of waters needing TMDLs and to develop TMDLs for those waters on the list. The law also requires states to establish a priority ranking for their lists of waters needing TMDLs, taking into account the severity of the pollution and the existing and future uses of each waterbody. EPA must approve or disapprove state lists of waters and TMDLs. If states do not submit lists or TMDLs, or if state submissions are inadequate, EPA will establish lists and TMDLs in lieu of the state.

The TMDL program is also linked to other programs and activities within the Clean Water Act. A TMDL can identify the need for point source dischargers to implement pollution controls that are based on the quality of the receiving water. These controls can then be implemented through the point source discharger's NPDES permit. A TMDL can also identify the need to control nonpoint sources of pollution like agricultural runoff. States receive funds under Clean Water Act section 319(h) to implement comprehensive state programs to reduce nonpoint source pollution. Other sections of the Clean Water Act, other Federal statutes and programs, state and local laws, and partnerships with citizens groups may also be used to implement portions of the TMDL program.

EPA has developed strategies, priorities and the steps for the Agency to take in helping states meet required TMDL program requirements. The EPA's Strategy for the implementation of the TMDL program is based on elements driven by a water quality-based approach. These elements include:

- helping states successfully assess, evaluate and identify waters needing TMDLs;
- working with and supporting states in establishing priority ranking and targeting process to develop schedules for the completion of TMDLs within a reasonable time periods;
- supporting state's development of appropriate TMDLs by: 1) defining the necessary elements for approvable TMDL's, and 2) providing for scientific research, technical tools and technology transfer and training;
- developing specific guidance for implementing TMDLs, and establishing criteria for measuring success;
- building broad partnerships with states, other federal agencies and key stakeholder groups for supporting the effective implementation of programs;
- creating general greater public access to the TMDL programs and water quality information;
- and, promoting innovative, low cost and equitable approaches to improving water quality;

As such, EPA envisions TMDL programs that identify remaining sources of pollution and allocates pollutant loadings in those places where water quality goals are still not being achieved. EPA further envisions working with states and other partners to meet the specific requirements within TMDL programs. These program elements include:

- Working on a watershed basis. Under the TMDL program, watershed approaches are the framework for identifying localized threats and making priorities and decisions based on both risks to the community and the environment.
- Under the program, lists of waterbodies requiring TMDLs provide a full public accounting of watersheds where current activities are not enough to either protect or restore impacted waterbodies. TMDLs are thus an important part of the water quality-based approach leading productive watersheds by effectively targeting pollution control and restoration activities.
- Though the process, EPA envisions significant improvements in the methods and tools used to both identify waters needing TMDLs as well as develop actual TMDLs. Under the program, development of these tools will be targeted by EPA to address the most widespread and difficult environmental problems; for example, pollution associated with wet weather events. EPA is committed to making these analytical methods and tools more widely available to all affected and interested parties.
- EPA envisions the States to be primary responsibility for implementing the program. As such, EPA will help States meet their responsibilities by issuing and revising guidance, policy and regulations, and by providing technical assistance.
- Further, EPA recognizes that local citizen, organization and government involvement to be the fundamental way of identifying waters needing TMDLs as well as developing and implementing TMDL programs. EPA is committed to improving public access to water quality information. EPA believes that access to information makes it easier for more people to become involved in improving local water quality.
- EPA is committed to promoting innovative ways for governments and communities to develop common-sense solutions for water quality problems in their watersheds. When stakeholders work together they can often find cheaper and more equitable ways to control pollution.

In April 1991, EPA published EPA 440/4-91-001, explaining the role of TMDLs in watershed protection. In June 1992, EPA amended its regulations to describe in greater detail State submission requirements for lists of waters needing TMDLs. The regulations require states to submit lists every two years and to target those waters for which TMDLs will be developed during the next two years.

EPA's 1991 guidance was developed jointly with states. Since publishing the guidance, EPA has worked cooperatively with states to develop state lists of waters needing TMDLs and to develop TMDLs for the states' priority waters. EPA's guidance on some listing issues provided states with flexibility in meeting Clean Water Act requirements. As a result, states have taken different approaches to dealing with two factors - the consideration of activities other than TMDLs that will restore water quality, and the consideration of data quality. Many states, including Florida, have

decided to identify all impaired waters on the 303(d) list regardless of whether activities other than TMDLs will be used. The waters where non-TMDL activities will be used to restore water quality have been assigned a low priority.

There is widespread recognition that more emphasis needs to be placed on developing TMDLs that address wet weather stormwater discharges and nonpoint source pollution problems, and on finding ways to involve local citizens, governments, and organizations. EPA's 1991 guidance encouraged states to develop TMDLs for these more difficult water quality problems, and outlined many of the existing Federal, state and local authorities that are needed to implement TMDLs. The guidance also recognized that TMDLs addressing multiple point and nonpoint source pollutant loads often require greater resource commitments and more complex water quality analysis, including models capable of simulating rainfall events, or water quality conditions that are not constant over time. The availability of tools to develop TMDLs varies. Water quality models for point source TMDLs predict the fate and transport of chemicals instream, and can be applied with greater confidence than models for TMDLs that address nonpoint sources. Model development is still needed to better predict the delivery of pollutants from nonpoint sources and to link these predicted pollutant loadings to the condition of a water body.

EPA is continuing to develop a multipurpose environmental analysis system called BASINS (Better Assessment Science Integrating Point and Nonpoint Sources). BASINS contains an assessment and planning component that allows users to organize and display geographic information for selected watersheds. It also contains a modeling component to examine impacts of pollutant loadings from point and nonpoint sources and to characterize the overall condition of specific watersheds.

State of Florida

State of Florida 1998 303(d) List provides background information required by Section 303(d) of the Clean Water Act. Since the 303(d) List includes a prioritization and notes waters scheduled for TMDL development within the next two years, a separate TMDL Priority List is not necessary.

The State's 303(d) List and accompanying maps identify those water quality-limited segments requiring Total Maximum Daily Loads (TMDLs) within the State's boundaries. Waters are identified for which technology based effluent limitations, and/or other pollution control requirements have not been stringent enough to meet the applicable water quality standards for these waterbodies.

The 303(d) List and subsequent priority schedule for TMDL development are based primarily on the state's 1996 305(b) Water Quality Assessment ("305(b) report"), which uses a watershed approach to evaluate state surface waters. All existing and readily available water quality related data and information were assembled and evaluated in the development of the 305(b) report, including but not limited to data in EPA's Storage and Retrieval (STORET) database, the 1994 319 Nonpoint Assessment, the Statewide Biological Database (biological assessments), and fish consumption advisory information. To obtain more recent data, staff in the Department of Environmental Protection's (Department) Division of Water Facilities met with staff from the state's five Water

Management Districts (WMDs), solicited information from Department district staff, and received input from the public (via public notice periods).

EPA guidelines specify waters need not be included if other federal, state or local requirements have or are expected to result in the attainment and maintenance of applicable water quality standards. While documentation has been provided to delist specific waters, delisting determinations will be an ongoing assessment. Some water segments on the list have been identified for potential delisting, pending further study. However, until additional information is collected and evaluated, these water segments will remain on the 303(d) List.

D. Relationship of this Quantifiable Objective to Objectives of Other Management Programs

This objective is consistent with the overall goals of the water management district's SWIM programs and other state, local, and federal management initiatives that seek to control excess nutrient loadings. Local monitoring and resource management activities will be enhanced by setting a quantifiable objective for primary pollutants throughout the Charlotte Harbor NEP.

Table 3.1 Potential TMDL Water Bodies Listed in Florida DEP 303(d) List

Name	Water Segment	MAP ID	Parameters of Concern	Comments	Priority
Caloosahatchee River	Tidal Caloosahatchee	2	Coliforms, Nutrients		Low
Caloosahatchee River	Manuel Branch	3	Dissolved Oxygen, Nutrients		Low
Caloosahatchee River	Billy Creek	4	Dissolved Oxygen , Nutrients	Problems due to urban landuse (some industrial) has caused aquatic weed proliferation.	High
Caloosahatchee River	Tidal Caloosahatchee	10	Nutrients		Low
Caloosahatchee River	Yellow Fever Creek	11	Dissolved Oxygen		Low
Caloosahatchee River	Tidal Caloosahatchee	15	Dissolved Oxygen , Nutrients , Biochemical Oxygen Demand		Low
Caloosahatchee River	Nine Mile Canal	19	Nutrients , Dissolved Oxygen , Biochemical Oxygen Demand , Coliforms	Low dissolved oxygen due to deep canals that intercept groundwater.	High

Table 3.1 Potential TMDL Water Bodies Listed in Florida DEP 303(d) List

Caloosahatchee River	Daughtrey Creek	21	Nutrients , Dissolved Oxygen	Potential problems due to package plants and septic tanks. Extensive development planned.	High
Caloosahatchee River	Trout Creek	24	Dissolved Oxygen, Coliforms , Biochemical Oxygen Demand		Low
Caloosahatchee River	Lake Hicpochee	26	Nutrients	Agricultural drainage from several areas including Lake Okeechobee.	High
Caloosahatchee River	East Caloosahatchee	28	Dissolved Oxygen , Nutrients , Biochemical Oxygen Demand		Low
Charlotte Harbor	Matlacha Pass	4	Nutrients, Mercury (Based on Fish Consumption Advisory)	Matlacha STP will be moved in 1998 to Pine Island. Poor WQ could be caused by poor flushing. Although Matlacha Pass is the only listed segment a TMDL will be determined for all of Charlotte Harbor.	High
Charlotte Harbor	No. Prong of Alligator Creek	30	Dissolved Oxygen, Coliforms , Turbidity		Low
Everglades-West	Cost Imperial River	35	Dissolved Oxygen, Nutrients		Low

Table 3.1 Potential TMDL Water Bodies Listed in Florida DEP 303(d) List					
Everglades-West	Coast Estero River	36	Nutrients		Low
Everglades-West	Coast Estero Bay	37	Nutrients	Upcoming Army Corps of Engineers project may provide additional data. Site of Gulf Coast University.	Low
Everglades-West	Coast Hendry Creek	38	Dissolved Oxygen , Nutrients		Low
Everglades-West	Coast Spring Creek	41	Dissolved Oxygen, Nutrients		Low
Myakka River	Myakka River	8	Nutrients, Mercury (Based on Fish Consumption Advisory)	Low intensity land use. Rangeland/pasture areas addressed by conservation plans. Septic systems present.	High
Myakka River	Unnamed Creek	11	Nutrients	Area made up of native range citrus and small urban development. Septic systems present.	High
Myakka River	Deer Prairie Slough	24	Dissolved Oxygen, Nutrients , Biochemical Oxygen Demand		Low
Myakka River	Big Slough Canal	39	Dissolved Oxygen, Coliforms, Nutrients		Low

Table 3.1 Potential TMDL Water Bodies Listed in Florida DEP 303(d) List

Myakka River	Myakka River	44	Dissolved Oxygen, Coliforms, Nutrients, Total Suspended Solids		Low
Myakka River	Mud Lake Slough	46	Dissolved Oxygen, Coliforms , Nutrients, Turbidity , Total Suspended Solids		High
Myakka River	Upper Lake Myakka	47		Listing of this segment is based on biological sampling.	Low
Myakka River	Howard Creek	52	Dissolved Oxygen, Coliforms , Nutrients		Low
Myakka River	Owen Creek	60	Dissolved Oxygen, Coliforms , Turbidity, Nutrients,,Total Suspended Solids		High
Peace River	Myrtle Slough #1	1	Dissolved Oxygen, Nutrients, Biochemical Oxygen Demand, Coliforms, Dissolved Oxygen	SSAC for upper reach. Ongoing water quality modeling for discharge relocation.	Low
Peace River	Peace River, Lower Estuary	4	Dissolved Oxygen, Nutrients, Mercury (Based on Fish Consumption Advisory)		Low

Table 3.1 Potential TMDL Water Bodies Listed in Florida DEP 303(d) List

Peace River	Peace River, Mid Estuary	9	Dissolved Oxygen, Nutrients, Mercury (Based on Fish Consumption Advisory)		Low
Peace River	Little Alligator Creek	13	Nutrients		Low
Peace River	Prairie Creek	20	Dissolved Oxygen, Nutrients, Turbidity		Low
Peace River	Hawthorne Creek	23	Coliforms, Nutrients		Low
Peace River	Myrtle Slough #2	24	Dissolved Oxygen, Nutrients, Biochemical Oxygen Demand, Coliforms		Low
Peace River	Peace River at Joshua Creek	30	Dissolved Oxygen, Nutrients, Total Suspended Solids, Mercury (Based on Fish Consumption Advisory)		High
Peace River	Horse Creek, Peace River	31	Dissolved Oxygen, Coliforms, Nutrients, Biochemical Oxygen Demand		Low
Peace River	Brandy Branch	34	Nutrients		High
Peace River	Bear Branch	35	Dissolved Oxygen, Nutrients		Low

Table 3.1 Potential TMDL Water Bodies Listed in Florida DEP 303(d) List

Peace River	C Will Outfall at Con.	36	Dissolved Oxygen, Nutrients		High
Peace River	Limestone Creek	37	Dissolved Oxygen, Coliforms, Nutrients, Total Suspended Solids		High
Peace River	Oak Creek	38	Dissolved Oxygen, Coliforms, Nutrients		Low
Peace River	Peace River about Charlie Creek	39	Coliforms, Nutrients, Turbidity, Total Suspended Solids, Mercury (Based on Fish Consumption Advisory)		High
Peace River	Peace River about Oak Creek	41	Nutrients, Turbidity, Total Suspended Solids, Mercury (Based on Fish Consumption Advisory)		High
Peace River	Oak Creek	42	Nutrients, Total Suspended Solids, Biochemical Oxygen Demand		Low
Peace River	Little Charlie Bowlegs	43	Biochemical Oxygen Demand		Low
Peace River	Alligator Branch	44	Dissolved Oxygen, Coliforms, Nutrients		High
Peace River	Troublesome Creek	49	Nutrients, Total Suspended Solids		Low

Table 3.1 Potential TMDL Water Bodies Listed in Florida DEP 303(d) List

Peace River	Thompson Branch	50	Coliforms, Nutrients		Low
Peace River	Little Charlie Creek	54	Coliforms , Nutrients		Low
Peace River	Payne Creek	55	Dissolved Oxygen, Nutrients		Low
Peace River	Payne Creek	56	Coliforms, Nutrients		Low
Peace River	Peace River about Payne Creek	57	Dissolved Oxygen, Coliforms, Nutrients Mercury (Based on Fish Consumption Advisory)		High
Peace River	Whidden Creek	61	Nutrients, Turbidity Total Suspended Solids , Dissolved Oxygen	FDEP is working on Water Quality study.	High
Peace River	Peace River about Bowlegs Creek	66	Dissolved Oxygen, Coliforms, Nutrients, Turbidity , Total Suspended Solids, Biochemical Oxygen Demand, Mercury (Based on Fish Consumption Advisory)		High
Peace River	Peace Creek Tributary Canal	68	Dissolved Oxygen, Coliforms, Nutrients Turbidity	An artificial canal through a swamp. May receive Lake Wales WWTP effluent which is going offline.	High
Peace River	West Wales Drainage Canal	71	Dissolved Oxygen, Nutrients, Turbidity	Canal through swamp.	High

Table 3.1 Potential TMDL Water Bodies Listed in Florida DEP 303(d) List

Peace River	Lake Effie Outlet	73	Nutrients	Nominated for SWIM waterbody by SWFWMD.	High
Peace River	Saddle Creek Below Lake Hancock	74	Dissolved Oxygen, Coliforms, Un-ionized Ammonia, Nutrients Turbidity, Total Suspended Solids		High
Peace River	Lake Hancock	79	Dissolved Oxygen, Un-ionized Ammonia, Nutrients		High
Peace River	Wahneta Farms Drainage Canal	81	Dissolved Oxygen, Coliforms, Nutrients, Turbidity		High
Peace River	Banana Lake	83	Dissolved Oxygen, Un-ionized Ammonia, Fluoride, Nutrients	SWIM Waterbody. SWFWMD developed interim PLRG in 1995. Plan on developing final PLRG in 1998.	1998
Peace River	Lake Eloise	85	Nutrients	SWIM Waterbody. Part of Winter Haven Chain of Lakes. SWFWMD performing modeling.	High
Peace River	Lake Lulu Outlet	89	Dissolved Oxygen, Nutrients	SWIM Waterbody. Part of Winter Haven Chain of Lakes. SWFWMD performing modeling.	High

Table 3.1 Potential TMDL Water Bodies Listed in Florida DEP 303(d) List

Peace River	Lake Shipp	91	Dissolved Oxygen, Nutrients	SWIM Waterbody. Part of Winter Haven Chain of Lakes. SWFWMD performing modeling.	High
Peace River	Banana Lake Canal	92	Dissolved Oxygen, Coliforms, Nutrients Turbidity , Total Suspended Solids	SWIM Waterbody. See comments for Banana Lake.	1998
Peace River	Lake May	93	Nutrients	SWIM Waterbody. Part of Winter Haven Chain of Lakes. SWFWMD performing modeling.	High
Peace River	Crystal Lake	95	Dissolved Oxygen, Un-ionized Ammonia, Nutrients		Low
Peace River	Lake Lena Run	96	Dissolved Oxygen, Coliforms, Nutrients Turbidity , Total Suspended Solids		High
Peace River	Peace Creek Drainage Canal	97	Dissolved Oxygen, Coliforms, Nutrients, Turbidity, Total Suspended Solids, Biochemical Oxygen Demand, Mercury (Based on Fish Consumption Advisory)		High

Table 3.1 Potential TMDL Water Bodies Listed in Florida DEP 303(d) List

Peace River	Lake Mirror	99	Nutrients	SWIM Waterbody. Part of Winter Haven Chain of Lakes. SWFWMD performing modeling.	High
Peace River	Lake Cannon	100	Dissolved Oxygen, Coliforms, Nutrients	SWIM Waterbody. Part of Winter Haven Chain of Lakes. SWFWMD performing modeling.	High
Peace River	Lake Bonny	101	Nutrients		High
Peace River	Lake Smart	102	Dissolved Oxygen, Un-ionized Ammonia, Nutrients	SWIM Waterbody. Part of Winter Haven Chain of Lakes. SWFWMD performing modeling.	High
Peace River	Saddle Creek	104	Dissolved Oxygen, Coliforms, Nutrients		High
Peace River	Lake Howard	105	Nutrients	SWIM Waterbody. Part of Winter Haven Chain of Lakes. SWFWMD performing modeling.	High
Peace River	Lake Jessie	108	Nutrients	SWIM Waterbody. Part of Winter Haven Chain of Lakes. SWFWMD performing modeling.	High
Peace River	Lake Parker	109	Nutrients		High
Peace River	Lake Lena	110	Nutrients		High

Table 3.1 Potential TMDL Water Bodies Listed in Florida DEP 303(d) List

Peace River	Lake Echo	111	Nutrients	SWFWMD Suggested. SWIM Waterbody.	High
Peace River	Lake Haines	113	Dissolved Oxygen, Coliforms, Nutrients	SWIM Waterbody. Part of Winter Haven Chain of Lakes. SWFWMD performing modeling.	High
Peace River	Lake Arianna	116	Nutrients		Low
Peace River	Lake Tenoroc	117	Dissolved Oxygen		Low
Peace River	Lake Alfred	118	Dissolved Oxygen, Nutrients		Low
Sarasota Bay	Coral Creek East Branch	4	Dissolved Oxygen, Nutrients, Lead, Cadmium Copper, Zinc		Low
Sarasota Bay	Lemon Bay	14	Dissolved Oxygen, Nutrients		Low

Note 1: The I.D. numbers in this table refer to the segments shown on the series of watershed maps available at the Department of Environmental Protection's WEB Site (<http://www2.dep.state.fl.us/water/>).

Note 2: A number of the segments in this table are outside of the defined Charlotte Harbor National Estuary Program defined study area. However, they are included for informational purposes since they are contained within the greater watersheds as defined by the Department of Environmental Protection.

3.4 Water Quality: WQ-4

A. Statement of Quantifiable Objective

WQ 4: *Achieve water quality that will meet shellfish harvesting standards throughout the Class II waters of the Charlotte Harbor NEP study area by the year 2015.*

B. Charlotte Harbor NEP Goals and Priority Problem Addressed by the Quantifiable Objective

Goal # 1: Improve the environmental integrity of the Charlotte Harbor study area.

Goal # 2: Preserve, restore, and enhance seagrass beds, coastal wetlands, barrier beaches, and functionally related uplands.

Goal # 3: Reduce point and non-point sources of pollution to attain desired uses of the estuary.

Priority Problem # 2. Water Quality Degradation -- including but not limited to pollution from agricultural and urban runoff, point source discharges, septic tank system loadings, atmospheric deposition, and groundwater.

C. Background Information

American oyster

The Eastern oyster (*Crassostrea virginica*) range extends from the Gulf of St. Lawrence, Canada, through the Gulf of Mexico to the Bay of Campeche, Mexico, and into the West Indies. The species exist in every major bay system within their range, however, areas of extensive beds are not evenly distributed either among or within bay and estuarine systems. Two genetic stocks are known to occur in Florida, an Atlantic coast stock that occurs from Maine south to Key Biscayne, and a Gulf stock that occurs along the Florida Gulf coast and extends to Corpus Christi, Texas. The distribution of eastern oyster is limited by the availability of clean, firm substrate sites for attachment. Eastern oysters filter feed for planktonic organisms and detritus. Within differing stages of their life cycle they are prey to protozoans, anemones, coelenterates, helminths, mollusks, crustaceans, and fish. In the Gulf of Mexico, eastern oysters typically reach about 3" long in 18-24 months and approximately double that in 5 or 6 years. They can apparently live up to 25-30 years and reach a maximum size of almost 12". Eastern oysters are protandrous hermaphrodites, but can become

alternate hermaphrodites after an initial male state, even alternating sex within a spawning season. Maturity is reached in as little as four weeks after setting. Spawning is initiated and maintained when water temperatures reach about 20 °C and salinities remain higher than 10 ppt.

Most of Florida's production (96%) of eastern oysters occurs along the Gulf coast, primarily in the Apalachicola Bay and Big Bend regions. In 1995, the total landings of eastern oyster in this area were approximately 1.5 million compared to an average of about 5.5 million pounds during 1981-1985. This sharp decline in landings has been attributed to the destruction of productive beds by hurricanes and extended periods of drought. Much of the production of oysters in Florida is currently derived from the construction of cultch reefs. The Gulf States Marine Fisheries Commission has developed a regional management plan for the eastern oyster fishery. The specific management recommendations of the Commission include: increasing cultch planting; the restoration of freshwater flows; the encouragement of aquaculture and replanting; increasing restrictions on size, gear, season, and area restrictions; limited access to the fishery; and increasing quota and bag limits.

The distribution of American oysters in the Charlotte Harbor NEP complex is generally widespread. Both live and dead oyster bars occur throughout the shallow bays and along inter- and sub-tidal regions near the mouths of many of the rivers and creeks within the Charlotte Harbor NEP. While there are no leased commercial beds within the Charlotte Harbor NEP, there is a limited amount of recreational use. However, even areas designated as approved shellfish waters are often closed during periods of high rainfalls due to excessive bacterial counts, or during red-tide blooms. The primary importance of oysters within the Charlotte Harbor NEP estuarine areas is primarily ecological. Oyster bars, whether alive or mostly dead, provide structural habitat which is important for many species. In some isolated areas with large living oyster bars, oyster filter-feeding can be an important factor in maintaining water clarity. Oyster larvae are important prey eaten by many species including crabs, fish and other mollusks.

Hard bottom communities are found throughout the Charlotte Harbor NEP study area. Although they include a variety of sessile invertebrates (e.g., gorgonian colonies, encrusting sponges) they are commonly represented by intertidal oyster reefs associated with mangrove forests and shoal areas. The hard substrate formed by oyster colonies creates critical harbor habitats for higher trophic level vertebrates including sport fish (gray snapper, snook, sea trout, red drum, and sheepshead). They are also exploited by avian predators (American oystercatcher, fish crow, white ibis) at low tide.

Hard Clams

Historically southern quahogs (*Mercenaria* spp.) existed in great numbers along the lower Florida West Coast from Cape Romano southward through the Ten Thousand Islands. A sizeable fishery existed until the late 1940s when there was a dramatic decline. Within many of the more saline

waters of the Charlotte Harbor NEP estuaries, there has always been a somewhat limited recreational fishery. However, many of these areas are often closed due to water quality concerns. The net ban resulted in a renewed interest in the potential development of a commercial fishery. The State has leased, and is looking to expand, a number sites for commercial clamming. As filter-feeders, clams are important component in the links between primary production and higher levels in the food-chain. A large number of species use clams as a prey species. Fish, wading birds, sea stars, crabs and other mollusks are all important predators on hard clams.

Southern Bay Scallop

Bay scallops are a popular shellfish targeted by many recreational harvesters. Once abundant in bays and estuaries along Florida's Gulf coast, bay scallops are now largely restricted to the area between Steinhatchee and Pensacola. The southern bay scallop (*Argopecten irradians concentricus*) historically supported considerable commercial and recreational fisheries along the southwest coast of Florida. In the early 1950s commercial landings in Lee County were between 10,000 and 120,000 pounds of meats. However, by the early 1960s Lee County commercial landings were near zero, and the species had all but disappeared from areas such as Tampa Bay. Although the exact causes of these marked declines are unknown, many have postulated that declining water quality may have been a prime factor. Of all the filter-feeding organisms within the Charlotte Harbor NEP systems, the southern bay scallop is far and away the most susceptible to poor water quality. Its relatively short life history and reproductive strategy make it particularly susceptible to rapid declines in water quality. There is anecdotal evidence that the southern bay scallop continued to be a recreational species in limited areas during especially dryer years in Pine Island Sound and Estero Bay until the fishery was closed in the early 1990s. In the southern regions of the Charlotte Harbor NEP it has been suggested that anthropogenic influences on not only water quality but on current patterns caused by activities such as increased navigational channels and/or the construction of causeways may have caused or been partially responsible for the observed declines. However, no systematic studies were conducted during the decline and there are very little historic water quality data from either Pine Island Sound or Estero Bay to support such contentions.

The Florida Marine Research Institute (FMRI) bay scallop research program has been created to:

- determine the historic and current distribution patterns along Florida's west coast;
- to monitor reproduction, recruitment, and water-quality patterns;
- to collect recreational-fishing information from statewide respondents; and
- to determine the genetic characteristics of Florida bay scallops.

In 1997, the University of South Florida and the state began a cooperative effort to restore the Florida bay scallop. The Molluscan Fisheries group has been monitoring the success of this effort and has tested a number of strategies to enhance spawning and recruitment of bay scallops in specific test

areas.

Environmental requirements for adult bay scallops (*Argopecten irradians concentricus*) in Tampa Bay were assessed based on correlations of scallop growth, mortality, and reproduction, with relevant measurements of water quality. Under laboratory conditions, bay scallops survived low dissolved oxygen (2 mg/L) for six hours at 25°C but were less tolerant as water temperature increased (30°C). The ranges among particular parameters for which growth and reproduction of adult bay scallops occurs are presented in Table 3.2. Larval and juvenile scallops may have narrower ranges.

Table 3.2 Water quality parameters and ranges under which growth and reproduction of adult bay scallops occurs.	
Water quality parameter	Target
Bottom temperature	25-30 °C ideal, not to exceed 30 °C for prolonged periods
Bottom salinity	Greater than 20 ppt (24-30 ppt optimal)
Bottom dissolved oxygen	Cannot be lower than 2 mg/L for more than two hours
Turbidity	5-10 NTUs
Total suspended solids	Less than 40 mg/L
Chlorophyll <i>a</i>	5-10 µg/L (=mg/m ³)
Phytoplankton	Less than 5 X 10 ⁶ cells/L. Blooms can be harmful, while high levels of some species such as <i>Gymnodinium brevis</i> can be fatal.
Seagrass	<i>Thalassia</i> and <i>Syringodium</i> mix ideal with more than 75 shoots/m ³ <i>Thalassia</i> . Beds continuous
TSS/VSS Ratio	Greater than 1.282

D. Relationship of this Quantifiable Objective to Objectives of Other Management Programs

This objective is consistent with the overall goals of the water management districts' SWIM programs and other state, local, and federal management initiatives that seek to promote water quality and

reduce current burdens of pollutants, including bacterial contamination from both point and non-point sources.

3.5 Water Quality: WQ-5

A. Statement of Quantifiable Objective

WQ 5: *Restore and maintain Lake Hancock to Class III water quality standards (or better) and improve the Trophic State Index (TSI) value for the water exiting the lake from poor to good by the year 2010.*

B. Charlotte Harbor NEP Goals and Priority Problem Addressed by the Quantifiable Objective

Goal # 1: Improve the environmental integrity of the Charlotte Harbor study area.

Goal # 2: Preserve, restore, and enhance seagrass beds, coastal wetlands, barrier beaches, and functionally related uplands.

Goal # 3: Reduce point and non-point sources of pollution to attain desired uses of the estuary.

Priority Problem # 2. Water Quality Degradation -- including but not limited to pollution from agricultural and urban runoff, point source discharges, septic tank system loadings, atmospheric deposition, and groundwater.

C. Background Information

Lake Hancock is located in the northern portion of the Peace River basin, just north of Bartow. The lake is about 4,500 acres in size, five feet deep, and drains approximately 83,840 acres of land area. Along with Lake Parker and Banana Lake, Lake Hancock and its tributary (Lake Lena Run) have some of the poorest water quality in the state, with elevated nutrients, periodically low levels of dissolved oxygen, low acidity, high bacterial counts, and severely depressed biological communities.

Three polluted streams or canals feed Lake Hancock, which has extremely poor water quality. In 1983 one of these, Lake Lena Run, had one of Florida's worst water quality measures (Hand *et al.*, 1996). In 1981 when the number of species of macroinvertebrates was sampled, a commonly used indicator of water quality conditions where a large number of macroinvertebrate species indicates good water quality, only three species of macroinvertebrates were found in Lake Lena Run. The Banana-Hancock Canal and upper Saddle Creek also contribute to the degraded water quality of Hancock.

Most of the flow through Lake Lena Run into Lake Hancock includes effluent from citrus processing companies, a chemical plant, a distillery, runoff from rangeland, a sprayfield, and a citrus waste dump site (Hand *et al.*, 1996). The City of Auburndale only has an emergency discharge to Lake Lena Run, and all its effluent is reused on citrus groves. Wasteload allocation models performed by the Florida Department of Environmental Protection (FDEP) have indicated that the flow from discharges would be beneficial to Lake Lena Run (hence Lake Hancock), if the nutrients were removed from the discharges. As a result, more strict loading limitations have been designated.

A trophic state index, or TSI, is calculated for most Florida Lakes by FDEP and provides an indication of the overall conditions of the lake. The TSI is used to rank and classify Florida lakes according to trophic state and represents an average of the main physical, chemical, and biological expressions of the trophic state concept. A TSI below 60 indicates "good" lake water quality, while 60-69 indicates "fair" water quality, and 70-100 is classified as "poor" water quality (Huber *et al.*, 1983; Hand *et al.* 1996). The average TSI for the 85 lakes in Polk County is 61.

Values for chlorophyll *a*, nitrogen, and phosphorus in Lake Hancock exceeded the limits of the screening criteria used by FDEP (Hand *et al.* 1996). Based on these data, Lake Hancock has a TSI of 92. For comparison, Table 6 provides information about other Florida lakes with similar nutrient trends. Lake Hancock is nitrogen limited, which means nitrogen is in limited amounts compared with the nutrient phosphorus. As a result, nitrogen may be depleted from the system by vegetation, for example algae, while phosphorus concentrations remain high.

Lake Hancock is designated as a Class III waterbody. This Class designation refers to the functional classification applied to all Florida waters (Classes I - V), for which particular standards and water quality criteria have been established under Chapter 62-302 of the Florida Administrative Code. As a Class III water, Lake Hancock is designated for recreation and the propagation and maintenance of a healthy, well balanced population of fish and wildlife.

As a result of poor water quality in its tributaries, agricultural runoff, and phosphate mining adjacent to the lake, Lake Hancock suffers from year-round algal blooms and frequent fish kills. Historically, the discharges from Lake Hancock during the rainy season impacted water quality downstream and were followed by massive die-offs of river fauna. Recently, the discharges have been better synchronized with seasonal variation in discharges and the die-offs have not occurred (FDEP, 1996).

Table 3.3 TSI values for Lake Hancock and some other Florida lakes with similar nutrient trends.				
Lake	County	Size (acres)	Depth (feet)	TSI
Lake Thonotosassa	Hillsborough	824	10.3	69
Manatee Reservoir	Manatee	1200	12	53
Lake Placid	Highlands	3381	22.4	42
Lake Hancock	Polk	4541	8.2	92

Although Banana Lake has undergone restoration and appears to be recovering, a restoration plan for Lake Hancock has not yet been identified. A lake restoration plan in which the lake waters would be mined was examined by a Legislatively-appointed committee, but was not considered economically feasible. However, the Winter Haven Chain-of-Lakes between Lakes Hamilton and Hancock have been adopted as a SWIM (Surface Water Improvement and Management) Program priority.

D. Relationship of this Quantifiable Objective to Objectives of other Management Programs

This objective is consistent with the overall goals of the Southwest Florida Water Management District's (SWFWMD) SWIM program and other state, local, and federal management initiatives that seek to control excess nutrient loadings. Local monitoring and resource management activities will be enhanced by setting a quantifiable objective for reducing nutrient loading and restoring and maintaining Class III water quality standards to Lake Hancock.

3.6 Water Quality: WQ-7

A. Statement of Quantifiable Objective

WQ 7: *Identify waterbodies in the Charlotte Harbor NEP study area that should be designated as Outstanding Florida Waters and support the establishment of that designation by the year 2000.*

B. Charlotte Harbor NEP Goals and Priority Problem Addressed by the Quantifiable Objective

- Goal # 1: Improve the environmental integrity of the Charlotte Harbor study area.
- Goal # 2: Preserve, restore, and enhance seagrass beds, coastal wetlands, barrier beaches, and functionally related uplands.
- Goal # 3: Reduce point and non-point sources of pollution to attain desired uses of the estuary.

Priority Problem # 2. Water Quality Degradation -- including but not limited to pollution from agricultural and urban runoff, point source discharges, septic tank system loadings, atmospheric deposition, and groundwater.

C. Background Information

All waters of the State of Florida fall into one of five surface water classifications with specific criteria applicable to each class as specified in Rule 62-302.400. In addition to its surface water classification, a water body may be designated as an Outstanding Florida Water. An Outstanding Florida Water (or OFW) is a water designated worthy of special protection because of its natural attributes. This special designation is applied to certain waters with the intent of maintaining existing good water quality. The majority of OFWs occur in existing areas managed by the state or federal government. Examples include: wildlife refuges; preserves; marine sanctuaries; estuarine research reserves; certain waters within state or national forests; scenic and wild rivers; or aquatic preserves. Generally, the waters within these managed areas are OFWs because the managing agency has requested this special protection to help protect the water quality. Other waters may be designated as "special water" OFWs if certain requirements are met including a public process of designation.

Requirements for a "Special Water" OFW Designation Authority: Section 403.061 (27), Florida Statutes, grants DEP power to: Establish rules which provide for a special category of water bodies within the state, to be referred as "Outstanding Florida Waters," which shall be worthy of special protection because of their natural attributes. In general, DEP cannot issue permits for direct pollutant discharges to OFWs which would lower ambient (existing) water quality or indirect discharges which would significantly degrade the Outstanding Florida Water. Permits for new dredging and filling must be clearly in the public interest. Factors determining the public interest:

- Whether the activity will adversely affect the public health, safety, or welfare or property of others;
- Whether the activity will adversely affect the conservation of fish and wildlife, including endangered or threatened species, or their habitats;
- Whether the activity will adversely affect navigation or the flow of water or cause harmful erosion or shoaling;
- Whether the activity will adversely affect the fishing or recreational values or marine productivity in the vicinity of the activity;
- Whether the activity will be of a temporary or permanent nature;
- Whether the activity will adversely affect or will enhance significant historical and archaeological resources under the provisions of Sec. 267.061 F.S.; and
- The current condition and relative value of functions being performed by areas affected by the proposed activity (373.414(1)(a), F.S.).

Some exceptions to OFW:

- Permitted activities existing on the date of designation, which are "grandfathered."
- Activities not regulated by DEP for water quality protection purposes, such as fishing, river setback ordinances, and boat speeds.
- Restoration of seawalls at previous locations.
- Non-commercial boat docks, on pilings, of less than 500 square feet.
- Temporary lowering of water quality during construction activities (with special restrictions).
- Activities to allow or enhance public usage, or to maintain pre-existing activities (with certain safeguards).

All state water quality standards are approved by the Environmental Regulation Commission for use by the Department of Environmental Protection (DEP). The Environmental Regulation Commission is a seven-member citizens' body appointed by the Governor. The requirements for a "Special Water" OFW Designation include:

- Rulemaking procedures must be followed pursuant to Chapter 120, F.S.;
- At least one fact-finding workshop must be held in the affected area;
- All local county or municipal governments and state legislators whose districts or jurisdictions include all or part of a water body proposed for Special Water designation must be notified at least 60 days prior to the workshop in writing by the Secretary of DEP;
- A prominent public notice must be placed in a newspaper of general circulation in the area of the proposed Special Water at least 60 days prior to the workshop;
- An economic impact analysis, consistent with Chapter 120, must be prepared which provides a general analysis of the impacts on planned or potential industrial, agricultural, or other development or expansion; and
- The Environmental Regulation Commission may designate waters of the state as a Special Water after making a finding that the waters are of exceptional recreational or ecological significance and a finding that the environmental, social, and economic benefits of the action outweigh the environmental, social, and economic costs (Rules 62-302.700 (5), F.A.C.(PDF)).

The following summarizes a number of issues relating to the designation of Outstanding Florida Waters:

- 1) The basic intent of an OFW designation is to prevent the lowering of existing water quality.
- 2) The present classification of all non OFW waters does not prevent the lowering of water quality, since for classifications such as Class II (Shellfish Propagation or Harvesting) and Class III (Recreation, Fish, and Wildlife), DEP can issue permits to lower water quality down to the minimum standards for that classification, provided that such degradation is necessary or desirable under federal standards and under circumstances which are clearly in the public interest (Rule 62-302.300(17), Florida Administrative Code). The general and minimum standards are intended to protect these uses but may not protect all species or be adequate for all water bodies. Class II and III waters have a smaller "safety margin" than Outstanding Florida Waters.

- 3) Only activities that require a DEP permit and have the potential to lower water quality would be affected by an OFW designation, such as dredge and fill and pollutant discharge activities.
- 4) Activities not regulated by DEP for water quality protection purposes, such as fishing, boating, diving, and river setback ordinances, are not affected by an OFW designation.
- 5) Only DEP permitted activities are affected by OFW designation, with the exception of stormwater permits required by water management districts that have been delegated stormwater management authority from DEP. However, some indirectly associated activities, such as dredging and filling for new marinas, are subject to OFW standards. Some activities, such as those for maintenance of existing facilities, activities to allow or enhance public usage, and construction activities which temporarily lower water quality, are exempted from regular OFW criteria if special safeguards are used. The other regulatory activities of all state and federal agencies are not affected by OFW designation.
- 6) No additional permit applications are necessary for an activity in an OFW, since an OFW designation affects only the criteria used in permitting decisions. There is no new or separate permit process.
- 7) Existing legal pollutant permitted discharges are "grandfathered" and may continue without any new OFW requirements. In addition, those pollutant activities are exempt from DEP permitting are not affected.
- 8) Exemptions are still be possible within OFW designated waters. An OFW designation affects only activities which require a DEP permit. Activities eligible for an exemption from DEP permitting do not have any new requirements placed on them.
- 9) New direct and indirect pollutant discharges to OFWs must meet specific requirements.
 - a) New direct pollutant discharges must not lower existing ambient water quality.
 - b) New indirect pollutant discharges (discharges to waters which influence OFWs, although not placed directly into an OFW) must not significantly degrade nearby Outstanding Florida Waters.
 - c) Activities receiving DEP permits must also be "clearly in the public interest."

- 10) Some activities which result in direct discharge of stormwater to OFWs are required to retain or treat a larger amount of stormwater than facilities which discharge to non-OFW waters. Water management districts (SFWMD, SWFWMD) have been delegated stormwater permitting authority.
- 11) In general, facilities for treatment of stormwater from agricultural lands are exempted from the stormwater requirements provided that they are managed as part of an approved Conservation Plan which is implemented according to its terms (Rule 62-25.030(l)(e), F.A.C.). Facilities for silviculture that are constructed and operated in accordance with Silviculture Best Management Practices Manual (1993) are also exempt, as specified in Rule 62-25.030(l)(f), F.A.C. These specific exemptions vary somewhat among the water management districts.
- 12) All activities allowed under current maintenance dredging and spoil disposal permits would be grandfathered under an OFW designation. A substantially different or expanded dredging operation would either have to meet the general OFW requirements or qualify for one of the exemptions.
- 13) The jurisdiction of DEP is no more broad or narrow after an OFW designation. However, within that same geographic area, there are more stringent standards for the issuance of DEP permits.
- 14) Anyone can propose waters for an Outstanding Florida Water designation by submitting a petition to DEP in accordance with Chapter 120.54 of the Florida Statutes.

D. Relationship of this Quantifiable Objective to Objectives of Other Management Programs

This objective is consistent with the overall goals of the water management district's SWIM programs and other state, local, and federal management initiatives that seek to promote water quality and reduce current burdens of pollutants, including bacterial contamination from both point and non-point sources.

Table 3.4 Matrix of Relationships Between Degradation of Water Quality
Quantifiable Objectives and Action Plans

Quantifiable Objective	Action Plan																
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
WQ1	X	X	X	X	X	X	X	X									
WQ2			X	X	X		X										
WQ3			X	X	X	X	X		X					X	X	X	
WQ4	X	X			X	X	X							X			
WQ5		X			X			X		X	X	X					
WQ6		X			X	X	X						X				X
WQ7		X															

The *Priority Actions* (WQ-A through WQ-Q) that are detailed in the following pages describe the types of actions that would help achieve these *Quantifiable Objectives*.

3.7 WQ-A**Action**

Establish a shellfish monitoring network to ensure sampling of 100% of Class II waters in the Charlotte Harbor NEP study area.

Background

There has been a documented historical decline in the areal extent of oyster beds throughout many areas of the Charlotte Harbor NEP. Currently the shellfish state's monitoring program does not include all areas designated as Class II waters.

- **Quantifiable Objective** - WQ-1, W-4
- **Areas for Implementation** - Oyster and Clam beds

Strategy

Implement comprehensive area wide program for both the bacteriological testing of water, as well as regular tissue analysis for potential health related potential pollutants.

Potential Responsible Agencies & Organizations

Florida Department of Environmental Protection

Expected benefits

Accurate assessment of potential shell fish areas, including both natural and commercial lease areas. Aid in the identification of potential areas for the construction of artificial beds.

Monitoring Response

Established in Action.

Related Actions

None.

3.8 WQ-B

Action

Promote general public awareness and education on water quality issues and demonstration projects.

Background

General public has limited knowledge of the goals and work of the NEP. Need to develop greater awareness of benefits which can accrue from individual actions.

- **Quantifiable Objective** - WQ-1, WQ-4, WQ-5, WQ-6, WQ-7
- **Areas for Implementation** - Entire Charlotte Harbor NEP study area

Strategy

- 1) Stencils at stormwater drains.
- 2) Signs at road/canal crossings.
- 3) Develop school curriculum and guest speaker programs.
- 4) Recycling programs.
- 5) New resident education package.
- 6) Support and enhance local and regional Florida Yards and Neighborhood programs.
- 7) Information material for local developers, engineering firms and contractors.
- 8) Expand and provide coordination of volunteer water quality sampling programs.
- 9) Work with media in getting water quality information to the public.
- 10) Increase public awareness of potential sources of pollution, and potential agencies responsible for enforcement.
- 11) Implement "River Keeper" program in conjunction with volunteer and educational programs.

Potential Responsible Agencies & Organizations

County and Municipal Governments (in conjunction with NPDES permit requirements)

Institute of Food and Agricultural Sciences (IFAS)

Water Management Districts

Chambers of Commerce

Departments of Education

Not for profit organizations

Expected benefits

Provision of mechanisms for greater public awareness.

Monitoring Response

None.

Related Actions

None.

3.9 WQ-C

Action

Identify gaps in water quality data needed to calibrate the appropriate models used to determine Total Maximum Daily Load (TMDL) limits.

Background

The Florida Department of Environmental Protection is currently in the process of beginning to establish TMDL for water bodies within the state which have been identified as not meeting current water quality standards. It was the consensus of the Charlotte Harbor NEP working groups that within the NEP study area, this effort be expanded to address entire subbasins and/or watersheds.

- **Quantifiable Objective** - WQ-1, WQ-2, WQ-3
- **Areas for Implementation** - Entire Charlotte Harbor NEP study area

Strategy

- 1) Determine bodies of water, and segments of riverine systems for which the determination of TMDLs needs to be accomplished.
- 2) Assess previously collected data and determine gaps.
- 3) Develop monitoring programs to address gaps in data needed to develop accurate TMDLs.

Potential Responsible Agencies & Organizations

Florida Department of Environmental Protection

Water Management Districts

Expected benefits

Assistance in determining appropriate background information for the establishment of TMDLs.

Monitoring Response

None.

Related Actions

WQ-D, WQ-E

3.10 WQ-D

Action

Implement monitoring programs to fill data gaps for Total Maximum Daily Loads (TMDLs).

Background

It is expected that in many areas identified for the determination of TMDLs there may be insufficient water quality data to accurately calibrate models.

- **Quantifiable Objective** - WQ-1, WQ-2, WQ-3
- **Areas for Implementation** - Entire Charlotte Harbor study area

Strategy

- 1) Collect data appropriate to the establishment of TMDLs for all water bodies and river segments within the Charlotte Harbor NEP.
- 2) Analyze data and establish appropriate TMDLs.

Potential Responsible Agencies & Organizations

Florida Department of Environmental Protection

Water Management Districts

Stormwater Utilities

Permitted Dischargers

Expected benefits

Provision of accurate estimated loads and assess associated negative impacts.

Monitoring Response

Monitoring programs should be tailored to each identified priority water body.

Related Actions

WQ-C, WQ-E

3.11 WQ-E

Action

Install or retrofit Best Management Practices (BMPs) as necessary to maintain water quality, by not exceeding the assimilative capacity of the water body (TMDLs).

Background

Once the assimilative capacity of waterbodies within the Charlotte Harbor NEP study have been established and the primary sources of potential pollutants have been identified, the goal will be to identify effective programs to reduce and/or maintain loading levels within the assimilative capacity of each surface water system.

- **Quantifiable Objective** - WQ-1, WQ-2, WQ-3, WQ-4, WQ-5, WQ-6
- **Areas for Implementation** - Entire Charlotte Harbor NEP study area

Strategy

- 1) Inventory existing programs.
- 2) Evaluate and rank potential expansions of current programs.
- 3) Implementation.

Potential Responsible Agencies & Organizations

Florida Department of Environmental Protection

Water Management Districts

County and Municipal Governments

U.S. Environmental Protection Agency

U.S. Department of Agriculture

Expected benefits

Reduction of pollutant loads to meet established goals.

Monitoring Response

Monitoring programs should be established to assess success of implemented management practices

Related Actions

WQ-C, WQ-D

3.12 WQ-F

Action

Assess the cumulative impact of the density of septic tank systems and where appropriate take effective corrective action.

Background

The Charlotte Harbor NEP working groups strongly felt that there were legitimate concerns with regard to the potential pollutant impacts to both ground and receiving surface waters from high and moderate density development relying on septic systems.

- **Quantifiable Objective** - WQ-1, WQ-2, WQ-3, WQ-4
- **Areas for Implementation** - Entire Charlotte Harbor study area

Strategy

- 1) Conduct appropriate groundwater and surface water studies necessary to determine the cumulative impacts of high densities of septic tanks.
- 2) Make appropriate changes in state laws and local septic tank ordinances to mitigate impacts to the greatest practical extent.
- 3) Require, every other year, inspection of all septic systems where impacts to groundwaters / surface waters have been shown. Counties should be encouraged to include such language within their updated COMP plans.
- 4) Enhance enforcement to ensure appropriate repairs are made when necessary.
- 5) Establish a home owner education program.

Potential Responsible Agencies & Organizations

Florida Department of Environmental Protection

Florida Department of Health

County and Municipal Governments

U.S. Environmental Protection Agency

Expected benefits

Reduction of pollutant loads to meet established goals.

Monitoring Response

Monitoring programs should be established to assess the potential of septic tank pollution to groundwaters and surface waters.

Related Actions

WQ-C, WQ-D, WQ-E, WQ-G

3.13 WQ-G

Action

Provide central sewer or other alternative technology to residential areas (parcels of land one acre or less) and all commercial and industrial development within 900 feet of waters (canals, streams, and lakes) within the Charlotte Harbor NEP study area.

Background

The Charlotte Harbor NEP working groups felt that emphasis in the protection of groundwaters from potential pollutant loadings from septic systems should be initially given to those areas near surface waters.

- **Quantifiable Objective** - WQ-1, WQ-2, WQ-3, WQ-4, WQ-6
- **Areas for Implementation** - Entire Charlotte Harbor NEP study area

Strategy

- 1) Based on the results of WQ-F prioritize areas for implementation.
- 2) In such areas where densities are low, require advanced on-site septic systems.
- 3) Improve quality and availability of package plants to service areas more developed areas.
- 4) Develop and implement plans to provide central sewer to highly developed areas.

Potential Responsible Agencies & Organizations

Florida Department of Environmental Protection

County and Municipal Governments

Florida Department of Community Affairs

Department of Health

U.S. Environmental Protection Agency

Florida Department of Coastal Zone Management

Expected benefits

Reduction of nutrient loads and sources of human bacterial contamination.

Monitoring Response

Integrate shallow groundwater network with county stormwater and other appropriate ambient monitoring efforts.

Related Actions

WQ-C, WQ-D, WQ-E, WQ-F

3.14 WQ-H

Action

Install and maintain filtration marshes at appropriate locations around Lake Hancock.

Background

As a result of the thick layers of unconsolidated “muck” on the bottom of Lake Hancock, nutrient levels within the surface waters of the lake are often extremely high and water quality (based on a Trophic State Index) is usually “Poor.” The waters leaving Lake Hancock can result in degraded water quality and algal bloom in the upper Peace River. It has been suggested that construction of a “filtration marsh system” to reduce pollutant loads leaving Lake Hancock would help improve water quality in these areas of the Peace River.

- **Quantifiable Objective** - WQ-1, WQ-5
- **Areas for Implementation** - Lake Hancock norther Peace River basin

Strategy

- 1) Determine the design criteria for the construction of one or more effective filtration marshes to remove nutrient loads entering the Peace River from Lake Hancock.
- 2) Construct marsh(es).
- 3) Maintain marsh system(s) at such conditions to optimize removal of key limiting nutrients to the Peace River / Charlotte Harbor system.

Potential Responsible Agencies & Organizations

Florida Department of Environmental Protection

Southwest Florida Water Management District

U.S. Fish and Wildlife Service

Florida Game and Freshwater Fish Commission

Polk County

Expected benefits

Reduction of nutrient loads and algal bloom in the Peace River and Charlotte Harbor.

Monitoring Response

Determine nutrient concentrations in Lake Hancock and the upper Peace River, as well as determine the frequency and extent of algae blooms in the Peace River.

Related Actions

WQ-B, WQ-E

3.15 WQ-I

Action

Expand the Florida Yards and Neighborhoods program to all counties in the Charlotte Harbor NEP study area and actively implement the program.

Background

One of the primary goals of the Florida Yards and Neighborhoods programs is to the greatest extent possible encourage, to the greatest extent possible, the planting of native, drought tolerant plant species in both yards and public areas. Such native species typically require far less water, fertilizers, and pesticides than commonly used non-native landscaping species, thus reducing both water consumption as well as non-point source pollutants in stormwater runoff.

- **Quantifiable Objective - WQ-3**
- **Areas for Implementation - Entire Charlotte Harbor NEP study area**

Strategy

- 1) Improve education of homeowners as to methods they can easily implement to reduce sources of pollution.
- 2) Make the business community aware of the kinds of activities and programs they can undertake to reduce non-point stormwater sources from their property.
- 3) Develop programs for providing training and certification for landscaping contractors.
- 4) Use mobile irrigation lab to reduce water use.
- 5) Promote xeriscaping, and where necessary provide for changes in zoning to allow and encourage such landscaping practices.

Potential Responsible Agencies & Organizations

County and Municipal Governments

Cooperative Extension Services

Institute for Food and Agricultural Sciences (IFAS)

Chambers of Commerce

Master gardeners and other civic associations

Non-Profit organizations

Expected benefits

Reduction of the use of water.

Reduction of the amounts of pollutants from yards and businesses.

WQ-I (continued)

Monitoring Response

County stormwater programs.

Related Actions

WQ-B, WQ-E

3.16 WQ-J**Action**

Establish a buffer zone around Lake Hancock.

Background

Currently much of the land surrounding Lake Hancock has yet to be developed. This provides a potential window of opportunity to both preserve existing wildlife habitat as well as reduce future non-point source pollution to the lake through the establishment of buffer zones.

- **Quantifiable Objective** - WQ-2
- **Areas for Implementation** - Lake Hancock and upper Peace River basin

Strategy

- 1) Identify areas around Lake Hancock for public purchase or the acquisition of development rights.
- 2) Develop and implement plans for the reduction of non-point pollution.

Potential Responsible Agencies & Organizations

Polk County

Southwest Florida Water Management District

State endangered lands purchase programs

Expected benefits

Protection of native habitats surrounding the lake and reduction of nutrient loads.

Monitoring Response

Long-term ambient monitoring program for Lake Hancock.

Related Actions

WQ-H, WQ-K, WQ-L

3.17 WQ-K

Action

Remove or inactivate the muck component from the sediments of Lake Hancock.

Background

There are thick layers of unconsolidated “muck” on the bottom of Lake Hancock, which in turn provide a constant source for the characteristically high nutrient levels within the surface waters. As a result, water quality (based on a Trophic State Index) is generally “Poor” and dense concentrations of algae are common. It has been suggested that either removal or inactivation of these unconsolidated sediment layers would significantly improve water quality both in Lake Hancock and the upper Peace River.

- **Quantifiable Objective** - WQ-5
- **Areas for Implementation** - Lake Hancock, upper Peace River

Strategy

- 1) Determine which (or what combination of) method(s) would provide a cost-effective and environmentally sound technique for the removal or trapping of the nutrients within the unconsolidated sediments on the bottom of Lake Hancock.
 - draw down
 - alum treatment
 - mining and restoration, and/or
 - sediment dredging/muck removal.

Potential Responsible Agencies & Organizations

Florida Department of Environmental Protection

Southwest Florida Water Management District

Polk County

Florida Game and Freshwater Fish

U.S. Fish and Wildlife Service

Expected benefits

Reduction of nutrient concentration and the occurrence of algal bloom in Lake Hancock and the Peace River.

Monitoring Response

Ambient nutrient concentrations in the Lake Hancock and Peace River.

Related Actions

WQ-H, WQ-J, WQ-L

3.18 WQ-L

Action

Create and establish a public involvement program for Lake Hancock.

Background

Local area support will be a key component in any of the proposed programs to restore water quality and preserve habitat within Lake Hancock and its watershed.

- **Quantifiable Objective - WQ-5**
- **Areas for Implementation - Polk County**

Strategy

- 1) Articles in public media.
- 2) School awareness programs.
- 3) Target civic associations and chambers of commerce.

Potential Responsible Agencies & Organizations

Polk County

Southwest Florida Water Management District

Expected benefits

Increased public awareness of water quality problems associated with Lake Hancock and support for programs to improve existing conditions.

Monitoring Response

None.

Related Actions

WQ-H, WQ-J, WQ-K

3.19 WQ-M**Action**

Implement incentives for composting toilets in appropriate areas.

Background

Within certain portions of the study area where septic systems pose a significant potential threat of pollution to ground and surface waters and central sewer systems are impractical such systems may present a viable alternative.

- **Quantifiable Objective - WQ-6**
- **Areas for Implementation -** Entire Charlotte Harbor NEP study area

Strategy

- 1) Develop public awareness program.
- 2) Provide incentive programs.

Potential Responsible Agencies & Organizations

County and Municipal Governments

Florida State Department of Health

Water Management Districts

Expected benefits

Reduction of water consumption

Reduction of nutrients loads from wastewater treatment facilities

Monitoring Response

None.

Related Actions

None.

3.20 WQ-N

Action

Reduce non-point source pollutants associated with stormwater runoff.

Background

As indicated within the Synthesis of Existing Information document prepared by the Charlotte Harbor NEP, the largest source of potential pollutants within each of the identified basins comes from non-point source stormwater runoff.

- **Quantifiable Objective** - WQ-2, WQ-3, WQ-4, WQ-6
- **Areas for Implementation** - All Charlotte Harbor NEP watersheds

Strategy

- 1) Elevate water quality criteria as part of county stormwater planning and develop integrated programs to reduce levels.
- 2) Encourage redevelopment of older properties and businesses to meet current stormwater treatment standards whenever possible.
- 3) Reduce impervious paved surface required by parking space and large commercial developments.
- 4) Encourage local governments to adopt integrated pest management policies and implement environmentally beneficial landscaping practices on all public property.
- 5) Assure and/or improve agricultural Best Management Practices (BMPs).

Potential Responsible Agencies & Organizations

County and municipal governments

Water Management Districts

Department of Environmental Protection

Department of Agriculture

Regional Planning Agencies

Department of Community Affairs

U.S. Environmental Protection Agency

Expected benefits

Reduction in stormwater pollutant loadings to receiving waters.

Monitoring Response

Existing and expanded surface water monitoring programs, as well as testing which may be required as part of NPDES permit requirements.

Related Actions

WQ-A, WQ-D, WQ-E, WQ-I, WQ-J

3.21 WQ-O

Action

Investigate sources and effects of atmospheric deposition and develop action plans to address findings.

Background

There is only a single site within the entire Charlotte Harbor NEP study area where rates of atmospheric deposition are being collected. Due to the size and differing natures of the watersheds it is important that additional information be collected in order to account for potential sources of pollutants.

- **Quantifiable Objective - WQ-3**
- **Areas for Implementation** - site(s) selected as being representative of watersheds within the Charlotte Harbor NEP

Strategy

- 1) Determine rates of atmospheric deposition of specific potential pollutants.
- 2) Assess if and where atmospheric deposition poses potential threats to pollutant loads in surface waters and/or biological communities.
- 2) Identify the sources of such pollutants.
- 3) Determine if identified sources can be reduced with existing technology and/or best management practices.
- 4) Develop plans to reduce, where practical, amounts of pollutants from identified sources.
- 5) Implement the developed integrated strategy to reduce to the greatest practical extent.
- 6) Promote energy conservation to reduce emissions from power facilities.

Potential Responsible Agencies & Organizations

U.S. Environmental Protection Agency

Florida Department of Environmental Regulation

Water Management Districts

Power Utilities

Forest Service

County and Municipal Governments

Expected benefits

Determination of levels of potential pollution associated with atmospheric deposition, and address identified sources where feasible and implement plan to reduce sources.

Monitoring Response

Install and collect appropriate information on levels of potential pollutants associated with atmospheric deposition within the Charlotte Harbor NEP watersheds.

Related Actions

WQ-C, WQ-D, WQ-E, WQ-N

3.22 WQ-P

Action

Encourage, expand, and develop incentives for the use of reclaimed water.

Background

It is estimated that for many utilities in home use of water accounts for approximately half of demand. Water reuse programs thus can be effective methods of reducing current and future pressures on surface and groundwater for potable supplies.

- **Quantifiable Objective - WQ-3**
- **Areas for Implementation - All watersheds within the Charlotte Harbor NEP.**

Strategy

- 1) Evaluate effectiveness and benefits of existing water reuse programs.
- 2) Assess the net effects of reducing or eliminating existing discharges, or groundwater injections, with regard to impacts to surface and groundwater.
- 3) Determine areas where reuse programs would be of potential greatest benefit.
- 4) Evaluate potential actions with regard to public health concerns and perceptions concerning the use of reclaimed water.
- 5) Implement and expand programs where they meet health and environmental standards and are economically practical.

Potential Responsible Agencies & Organizations

County and Municipal Governments

Florida Department of Environmental Regulation

Water Management Districts

Industry

Agriculture

U.S. Environmental Protection Agency

Expected benefits

Reduction in new and increasing potable demands on surface and groundwaters.

Monitoring Response

Determine and track water reuse in relation to overall increases in water consumption.

Related Actions

WQ-E, WQ-M

3.23 WQ-Q

Action

Reduce contaminants from marina and dock operations.

Background

The Charlotte Harbor NEP working groups felt that current rules and regulations probably sufficiently address such issues. However, there were concerns with regard to both enforcement as well as the regulation of boat hull cleaning operations and practices within NEP waters.

- **Quantifiable Objective - WQ-6**
- **Areas for Implementation -** Coastal areas, rivers, and larger lakes with the Charlotte Harbor NEP study area.

Strategy

- 1) Identify potential problem sources of pollutants and toxins associated with marina and dock operations within waters of the Charlotte Harbor NEP.
- 2) Design monitoring programs to assess potential impacts.
- 3) Implement or enhance monitoring programs to determine pollutant levels within previously identified areas.
- 4) Require effective corrective actions to reduce sources of identified pollutants.

Potential Responsible Agencies & Organizations

Department of Environmental Protection

Commercial Marine and Boating Industry

U.S. Environmental Protection Agency

Expected benefits

Reduction in sources of pollutants and toxins associated with boating operations.

Monitoring Response

Specific monitoring programs of potential pollutants from identified marina and dock facilities.

Related Actions

WQ-A, WQ-B

**4.0 Quantifiable Objectives
&
Priority Action Plans
for

Fish and Wildlife Habitat Loss**

4.1 Fish & Wildlife Habitat Loss *Quantifiable Objectives*

The following four *Quantifiable Objectives* were established to address regional problems associated with Fish and Wildlife Habitat Loss.

FW1: Achieve a 25 % increase in conservation, preservation, and stewardship lands within the boundaries of the Charlotte Harbor NEP study area by the year 2018. The increase will be based upon 1998 acreages of existing conservation, preservation, and stewardship lands.

FW2: Meet the stated objectives for the target extent, location, and quality of the following habitats in the Charlotte Harbor NEP study area:

- a) native submerged aquatic vegetation should be maintained and restored at a total extent and quality no less than caused by natural variation;
- b) maintain the existing extent and location within range of natural variability of intertidal un-vegetated habitats (especially mud flats and salt terns) and improve the habitat quality;
- c) manage natural mangrove habitats to their historic extent (1980) to enhance and improve their ecological functions and, where feasible, restore mangrove habitats in urban areas;
- d) restore and maintain saltwater marsh habitats where feasible (e.g. public lands or undeveloped areas) and prevent loss or conversion of existing salt marsh habitats;
- e) restore, maintain, and manage freshwater wetland systems in current extents and to a quality capable of maintaining all natural functions within the range or natural variability;
- f) restore, manage, and improve the habitat quality of oyster bars in the Charlotte Harbor NEP area based on the existing historic data; and
- g) protect, enhance, restore native upland communities vital to the ecological function of the Charlotte Harbor NEP study area.

FW3: Reduce propeller damage to seagrass beds, identified from the 1992-1993 baseline data, within the Charlotte Harbor NEP area by the year 2010. Reduce all severely scarred areas to light scarring and reduce 70% or more of the moderately scarred areas to light scarring.

FW4: On conservation, preservation, stewardship, and other public lands achieve controllable levels of invasive exotic plants as defined by the Florida Exotic Pest Plant Council by the year 2020. Encourage and support the removal and management of invasive exotic plants on private lands.

The following sections provide background information about each objective. Following the detailed descriptions are the *Priority Actions* recommended to achieve these objectives..

4.2 Fish and Wildlife Habitat Loss: FW-1

A. Statement of Quantifiable Objective

FW-1 *Achieve a 25 % increase in conservation, preservation, and stewardship lands within the boundaries of the Charlotte Harbor NEP study area by the year 2018. The increase will be based upon 1998 acreages of existing conservation, preservation, and stewardship lands.*

B. Charlotte Harbor NEP Goals and Priority Problem addressed by the Quantifiable Objective

Goal # 1: Improve the environmental integrity of the Charlotte Harbor study area.

Goal # 2: Preserve, restore, and enhance seagrass beds, coastal wetlands, barrier beaches, and functionally related uplands.

Goal # 5: Develop and implement a strategy for public participation and education.

Priority Problem # 3. Degradation and elimination of headwater streams and other habitats caused by development, conversion of natural shoreline, cumulative impacts of docks and boats, invasion of exotic species, and cumulative and future impacts.

C. Background Information

Many animal species such as scrub-jays, black bears, and Florida panthers are dependent on areas of relatively undisturbed habitat. Degradation and elimination of headwater streams and other habitats have occurred as a result of development, conversion of natural shoreline, cumulative impacts of docks and boats, and invasion of exotic species. To provide such habitats for sustainable breeding communities of these species, areas ranging from only a few hundred to many thousands of acres may be required. Critical areas of existing habitat will need to be removed from projected development pressure if populations of these species are going to be maintained.

There are currently federal, state, water management district, and local governmental programs that seek to identify and purchase such critical habitats. Additional purchases, or permanent easements are made by private foundations and businesses. The proposed Greenways and Regional Wildlife

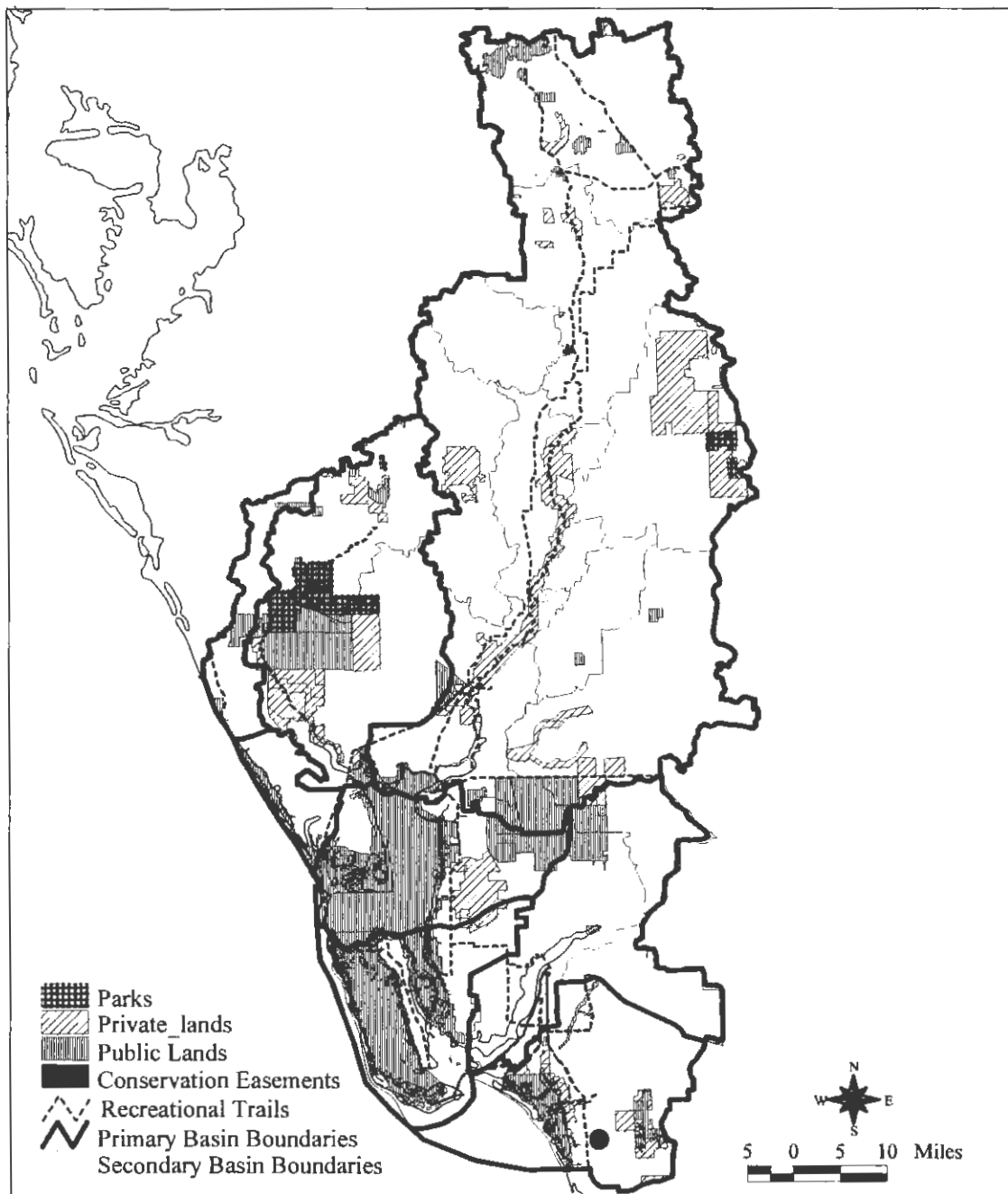


Figure 4.1 1998 Acreages of existing conservation, preservation, and stewardship lands.

Habitat map appears in Figure 4.1 and provides a means of quantifying these habitats in the Charlotte Harbor NEP. The Charlotte Harbor NEP study area, probably represents the most important region in Florida for maintaining several wide-ranging species that make up an important component of wildlife diversity in Florida. In its *Closing the Gaps in Florida's Wildlife Habitat Conservation System (Gaps Analysis)* (1994), the Florida Game and Freshwater Fish Commission identified areas important to endangered, threatened, and declining species, and species of concern which are intended to "umbrella" the habitat needs of many other species. The *Gaps Analysis* also identified species-level information on known occurrences of species, land cover, and vegetation type, as well as documented information on life-history requirements of species, and Strategic Habitat Conservation Areas. Information from the *Gaps Analysis* relevant to the Charlotte Harbor Study Area is presented below.

The Southwest region has the only stable population of panther found east of the Mississippi River and the only stable population of black bear south of Lakeland. It has the greatest concentration of territories of Audubon's crested caracara in all of the United States. The region also supports core populations of sandhill cranes, swallow-tailed kites, and burrowing owls. This region contains areas that provide important foraging and nesting habitat for large, diverse wading bird colonies. In addition, the regional climate of the area provides suitable conditions for several species of tropical plants that are rare elsewhere in Florida (Ward, 1979).

Despite the outstanding biological richness of the remaining natural areas in this region, the region falls just below the statewide average for percentage of conservation lands (19.1% vs. 19.6% average). Hendry, Sarasota, and Glades counties fall well below the statewide average for individual counties.

Portions of prairie and forested lands southwest of Cecil Webb Wildlife Management Area in the Charlotte Harbor NEP area make up a Strategic Habitat Conservation Area for red-cockaded woodpecker. Other species recorded in this area include Florida black bear, fox squirrel, Florida mastiff bat, southern bald eagle, southeastern American kestrel, American swallow-tailed kite, limpkin, mottled duck, eastern indigo snake, gopher tortoise, beautiful pawpaw, and sleeping-beauty water-lily.

Lehigh Acres (Able Marsh, north to Hickey Creek, Twelve mile Slough, Fussel Slough) includes Strategic Habitat Conservation Area for the Everglades snail kite. Other species recorded in the area include southern bald eagle, American swallow-tailed kite, limpkin, mottled duck, Florida scrub jay, and eastern indigo snake.

Mixtures of prairies, cypress swamp, pinelands, rangeland and upland hardwood forests in East Charlotte County include Strategic Habitat Conservation Area for Florida panther, red-cockaded woodpecker, Florida sandhill crane, short-tailed hawk, Florida grasshopper sparrow, American swallow-tailed kite, and Audubon's crested caracara. East of Palmdale: Florida panther, fox squirrel, Florida scrub-jay, tricolored heron rookery, Florida burrowing owl, gopher tortoise, south Florida rainbow snake, eastern indigo snake, and Edison's ascyrum.

Dry prairie, freshwater marsh, and pineland are important habitat areas in east Sarasota County (surrounding Myakka River State Park and other conservation areas in the region, existing south along Big Slough Canal and Deer Prairie Slough). Portions of the area constitute Strategic Habitat Conservation Areas for the Florida sandhill crane. Other rare species recorded in the area include Florida panther, Florida burrowing owl, mottled duck, Florida scrub-jay, American swallow-tailed kite, southeastern American kestrel, Audubon's crested caracara, wood stork (rookery), tricolored heron (rookery), little blue heron (rookery), snow egret (rookery), great egret (rookery), least bittern, limpkin, Bachman's sparrow, gopher tortoise, eastern indigo snake, gopher frog, and sleeping-beauty water-lily.

Habitat for the American swallow-tailed kite remains widely distributed throughout much of Florida. Hendry, Collier, Lee, Glades, and Charlotte counties in Southwest Florida contain several large patches of habitat and represent a core population center for this species in Florida (Meyer and Collopy, 1990). The pinelands and prairie land cover in Hendry and Glades counties represent particularly important habitat areas since nests located in pine areas are generally more productive than nests located in other habitats. Audubon's crested caracara primarily occur dry prairies, freshwater marshes, and improved pasture. This species lacks adequate representation in Florida's current system of conservation areas.

Florida black bear

Primary Florida black bear habitat includes pineland, oak scrub, sand pine scrub, mixed hardwood-pine, upland hardwood forest, cypress swamp, mixed hardwood swamp, bay swamp, and bottomland hardwoods (Maehr and Wooding, 1992). Secondary habitat includes dry prairie, sandhill, tropical hardwood hammock, shrub swamp, and shrub and brush classes. These cover types may be used frequently by black bears, but use of the areas may be a function of adjacent land cover. Importantly, recent studies have found that black bears frequently use mangrove swamps in southwest Florida. Black bear habitat in the Charlotte Harbor NEP area has a small number of major roads, several large tracts of forested lands, and may serve as an extension of Corkscrew Swamp and other areas surrounding Big Cypress National Preserve.

Densities of black bears in the southeastern United States are in the range of 0.05 - 0.10 breeding individuals per km² (Hellgren and Vaughn, 1989). A potentially secure population of black bears would require a habitat base of approximately 500,000 to one million acres. Black bears may move great distances, occasionally dispersing more than 140 km, although fewer than two percent of these movements occur more than 100 km. Current conservation areas in Florida are not large enough to support the continued long term existence of the Florida black bear.

Florida panthers

Florida panthers are solitary animals requiring large expanses of mixed cypress and hardwood swamp, dry prairie, and pinelands for their home ranges. This species is thought to have once occurred throughout much of Florida. However, as with most large terrestrial predators their numbers and ranges have historically declined with the steady increase in the human population. Long-term residential and agricultural growth within Florida have resulted in a reduction in the species' available range and diminished food supplies. In recent times, the Florida panther has been forced into smaller increasingly poorer or marginal habitats. Within the Charlotte Harbor NEP, the state's proposed strategic habitat conservation areas for the Florida panther include portions of southeastern DeSoto County, and eastern portions of both Charlotte and Lee counties.

Although the current population of Florida panthers found in Southwest Florida is viable, the population is by no means adequately represented on conservation lands in the region. Belden *et al.* (1988) and Maehr *et al.* (1991) found that panthers inhabit a landscape consisting of large patches of hardwood hammock, pineland, hardwood swamp, and cypress swamp cover types (see Figures 4.2 through 4.4). Large areas without roads, large public conservation areas, and large private land ownership patterns are also important features of the landscapes occupied by panthers. Intensive agricultural areas and barren land cover are not regularly used by Florida panthers (Maehr *et al.*, 1991).

D. Relationship of this Quantifiable Objective to Objectives of Other Management Programs

There are currently federal, state, water management district, and local governmental programs which seek to identify and/or purchase critical habitats. Various governmental land purchase programs also target key upland areas critical to adjoining wetland areas at risk. Additional purchases, or permanent easements are made by private foundations and businesses. The Florida Game and Freshwater Fish Commission, the state-funded CARL (Conservation and Recreation Lands) program, Preservation 2000 programs (funded by Florida Department of Environmental Protection through the Water Management Districts), along with county agencies can identify environmentally sensitive areas and

purchase lands or match funds from other agencies for purchase. While none of the larger federally-owned and managed conservation areas besides the J.N. "Ding" Darling National Wildlife Refuge are located in the Charlotte Harbor NEP study area, the Cecil Webb Wildlife Management Area is one of the largest state-owned parcels. The Bureau of State Lands owns aquatic preserve areas in the NEP area.

4.3 Fish and Wildlife Habitat Loss: FW-2

A. Statement of Quantifiable Objective

FW2 *Meet the stated objectives for the target extent, location, and quality of the following habitats in the Charlotte Harbor NEP study area:*

- a) native submerged aquatic vegetation should be maintained and restored at a total extent and quality no less than caused by natural variation;*
- b) maintain the existing extent and location within range of natural variability of intertidal un-vegetated habitats (especially mud flats and salt terns) and improve the habitat quality;*
- c) manage natural mangrove habitats to their historic extent (1980) to enhance and improve their ecological functions and, where feasible, restore mangrove habitats in urban areas;*
- d) restore and maintain saltwater marsh habitats where feasible (e.g. public lands or undeveloped areas) and prevent loss or conversion of existing salt marsh habitats;*
- e) restore, maintain, and manage freshwater wetland systems in current extents and to a quality capable of maintaining all natural functions within the range or natural variability;*
- f) restore, manage, and improve the habitat quality of oyster bars in the Charlotte Harbor NEP area based on the existing historic data; and*
- g) protect, enhance, restore native upland communities vital to the ecological function of the Charlotte Harbor NEP study area.*

B. Charlotte Harbor NEP Goals and Priority Problem Addressed by the Quantifiable Objective

- Goal # 1: Improve the environmental integrity of the Charlotte Harbor study area.
- Goal # 2: Preserve, restore, and enhance seagrass beds, coastal wetlands, barrier beaches, and functionally related uplands.
- Goal # 5: Develop and implement a strategy for public participation and education.

Priority Problem # 3. Degradation and elimination of headwater streams and other habitats caused by development, conversion of natural shoreline, cumulative impacts of docks and boats, invasion of exotic species, and cumulative and future impacts.

C. Background Information

Wetland and Upland Habitats

Wetlands provide a variety of benefits to both the natural communities and human oriented activities of the Charlotte Harbor NEP area. Wetlands provide a buffer between uplands and open water and remove pollutants from runoff, retain surface water for flood attenuation, and provide bank and shoreline stabilization. Surface water/groundwater interactions are also enhanced by wetlands, which often provide conduits for groundwater recharge. Swamps and marshes are also critical habitats for numerous important species. Breeding, nesting, and feeding activities of many beneficial and listed species occur in wetlands. The distribution of forested and non-forested freshwater wetlands and open water habitats in the Charlotte Harbor NEP major basins are discussed below.

Swamps - are broadly defined as forested wetlands. Although more than half of Florida was originally wetland (swamp and marsh), it has been estimated that more than half of that coverage has been lost. Wooded swampland still comprises approximately 10% of Florida's land cover. In the Charlotte Harbor NEP area, swamps comprised of cypress and mixed hardwoods are distributed adjacent to lakes and rivers, in sloughs, and in shallow ponds. The upper Myakka River and the Peace River both support extensive swamp fringes.

Six-mile Slough, south of the Caloosahatchee River is a major southern cypress stand within the Charlotte Harbor NEP area, and is at the northern end of the swamp system that includes Corkscrew Swamp, Big Cypress Swamp, and Fakahatchee Strand and extends south to Florida Bay.

Marshes - or non-forested wetlands, make up about one-third of all wetlands in Florida and are well-represented in the Charlotte Harbor NEP area. However, most of the marshes in the Charlotte Harbor watersheds are small. These small marsh areas, characterized as seasonal ponds, extend throughout the pine flatwoods of the system. Highland marshes are formed through an interaction of topography and geologic solution features, and can be unstable. Marshes provide all of the water quality, water quantity, and habitat benefits of forested wetlands, as listed above.

Lakes - are not common in the Charlotte Harbor NEP watersheds, with the exception of the extreme headwaters of the Peace River. Lakes Hancock, Parker, and the Lakeland "Chain of Lakes" are at the northern extent of the peninsular Florida lake district. Florida lakes can include a diversity of habitats because of the range in sizes, shoreline convolutions, and variations in water chemistry. Many of the lakes in the upper Peace River Basin are in or near urban areas, and support much recreational use. Also, there are many lakes in this basin that have been created through phosphate mining operations.

Riverine - habitats provide a linkage between the estuary and inland areas. River channels and associated fringe wetlands are very important habitats for birds, mammals, and other native biota. Pollutant assimilation, floodwater attenuation, and groundwater recharge also occur in riverine systems. Major rivers of the Charlotte Harbor NEP include the Peace, Myakka, and Caloosahatchee, as well as the smaller coastal rivers including the Orange, Estero, Imperial, and others.

Pine Flatwoods - are the most extensive type of terrestrial ecosystem in Florida. It typically has acidic, sandy soil, is poorly drained, and has a low, flat topography. Pine flatwoods extend over most of the Charlotte Harbor NEP area, from just inland of coastal systems to the river headwaters. Pine flatwood represents by far the most common land cover of upland, non-urban lands. Humans have had a significant effect on pine flatwoods, clearing vast acreages for timber. The resulting prairies have become a stable land cover in and of themselves.

Scrub and high pine - habitats are uncommon, and are best represented in the Charlotte Harbor NEP watersheds along reaches of the Peace River and towards the Highlands Ridge area, which is near the southernmost extent of these areas. Scrub and high pine are characterized by tall, twisted sand pines, scrub oaks, and an understory of shrubs and vines, with dry, sandy soil. Like pine flatwood, scrub and high pine depend on periodic fire to maintain its viability.

Submerged Habitats

Historically, dredging and filling activities within coastal bottom and wetland areas have not only reduced the extent of these valuable habitats but have also resulted in changes in the relative balance among such habitats. As permitting restrictions increased during the 1970s and 1980s coastal development moved to less protected areas. In some areas of the Charlotte Harbor NEP this development resulted in large losses in specific types of habitats, such as high marshes and salterns.

The relative extent of seagrass beds, mud flats, mangroves, salterns, and marsh habitats in the intertidal and subtidal zones of the Charlotte Harbor NEP study area have been mapped.. Approximate acreages of each habitat (Table 4.1, by quad sections) can provide relative estimates of

the extent of these habitats for the purpose of developing actions plans for accomplishing this quantitative objective.

Natural submerged habitats may be operationally defined and categorized as seagrasses, oyster reef/hard bottom areas, tidal/mud flats, and artificial reefs. These habitats provide food sources, solid foundations, and protective structure for living resources, and they exist throughout all of the riverine and estuarine regions of the Charlotte Harbor NEP study area. Although the current distributions of these habitats have been mapped, the distributions are both relative and in a state of constant slow change. Most current information is based on aerial photography with limited direct field observations. Further, sand shoals drift, seagrass meadows expand and are washed out by storms, oyster bars expand and are overtaken by mangroves.

Seagrasses - Five species of marine and estuarine seagrasses occur in the shoal waters of the Charlotte Harbor complex. Four of the five species are commonly found in shallow waters (less than six feet) of the harbor. Two of these species can be found in 12-40 ft of water elsewhere in Florida where the water is much clearer. Seagrasses are most likely depth limited by light transparency in the Charlotte Harbor estuarine system as they are in Tampa Bay and the Indian River Lagoon. Factors affecting transparency include seasonal change in total light each day, physical characteristics associated with absorption and scattering of light caused by dissolved organics, suspended material, and water depth. Microscopic plant and animal life, when abundant enough can affect light levels both in the water column and as epiphytes. Excessive nutrients may be an important factor for the production of epiphytes on seagrasses and loss of seagrasses with higher turbidity. One seagrass genus (*Halophila*) may prefer lower light levels and is generally found in water deeper than six feet and may sporadically occur in the harbor. Dixon and Leverone (1993) have summarized literature light requirements for *Thalassia* and *Halodule*.

Another species, *Vallisneria americana* can be found in freshwater and very low salinities. It is most common in the Caloosahatchee River. Small patches can be found in the oxbows of the Peace River below the State Road 761 bridge. Elsewhere in the study area, *Vallisneria* is relatively uncommon.

Each seagrass species has a general range of salinity tolerances. *Thalassia*, *Syringodium*, and *Halophila* are most likely to be limited by light levels within their preferred salinity range in Charlotte Harbor. Inorganic nitrogen may seasonally affect epiphytic growth on seagrasses given its role as the likely limiting macro-nutrient in the harbor. Low salinity and high color levels appear clearly to control distribution of seagrasses toward each river mouth. *Halodule* and *Ruppia* are most common in very shallow water.

Table 4.1 Charlotte Harbor Habitat Component Acreage (from Harris <i>et al.</i>, 1983).										
Habitat Component	Mangrove		Non-Vegetated Tidal Flat		Oyster Reef		Salt Marsh		Seagrass	
Year	1945	1982	1945	1982	1945	1982	1945	1982	1945	1982
USGS Quadrangle										
El Jobean	3433	4321	757	126	0	4	1762	1528	1632	894
Punta Gorda SW	6885	8251	2930	1079	173	28	436	169	6881	5760
Placida	1083	968	267	142	55	56	157	0	2610	1566
Bokeelia	3544	3731	52	31	0	38	29	24	12154	11367
Port Boca Grande	39	32	0	0	0	0	0	0	382	66
Captiva	1033	1121	57	0	0	2	0	7	19907	10162
Wulfert	1392	1426	0	0	0	0	0	0	2749	1674
Sanibel	3067	2943	148	3	8	10	22	0	5296	3940
Punta Gorda	4310	2799	858	95	4	5	550	140	892	772
Punta Gorda SE	2821	3502	1081	255	0	0	424	0	4246	3562

Table 4.1 Charlotte Harbor Habitat Component Acreage (from Harris <i>et al.</i>, 1983).										
Habitat Component	Mangrove		Non-Vegetated Tidal Flat		Oyster Reef		Salt Marsh		Seagrass	
Year	1945	1982	1945	1982	1945	1982	1945	1982	1945	1982
USGS Quadrangle										
Matlacha	4243	5821	1268	51	0	8	462	0	5780	4940
Pine Island Center	8937	11291	2324	358	515	303	709	197	11462	9684
Fort Myers Beach	6032	5855	775	362	2	3	767	747	3586	2626
Fort Myers SW	1936	1190	378	53	0	0	1384	341	1465	189
Estero	2769	3280	311	168	49	31	549	394	3917	1293
Total	51524	56631	11206	2723	806	488	7251	3547	82959	58495
Acreage Change	+5107		-8483		-318		-3704		-24464	
Percent Change	+10%		-76%		-39%		-51%		-29%	

The Charlotte Harbor complex was reported to have a decline in seagrasses by Harris *et al* (1983). The study area included most of the Charlotte Harbor NEP area minus Lemon Bay and the Caloosahatchee River. They reported a decline of 29% for the area. Adjusting for the lack of ground verification in Estero Bay by removing this system from the calculations, the total decline would be about 26%. The reported decline is not uniform across basins. The largest seagrass change, an estimated loss of 35%, occurred within Pine Island Sound. The Pine Island Sound loss represented 71% of the total estimated change from 1945 to 1982 or 18.5% of the 26% total. Harris *et al.* provided an extensive discussion of the potential causes. High on the list of suspected causes were the construction of the intracoastal waterway and the Sanibel bridges and causeways, finished in 1962. Bar graphs comparing estimated acreages of seagrass, saltmarsh, and mangrove habitats in 1945 and 1982 within selected estuarine areas appear in Figures 4.2 through 4.5.

Oyster Reef/Hard Bottom - Hard bottom communities are found throughout the Charlotte Harbor NEP study area. Although they include a variety of sessile invertebrates (e.g., gorgonian colonies, encrusting sponges) they are most commonly represented by intertidal oyster reefs associated with mangrove forests and shoal areas. The hard substrate formed by oyster colonies creates critical harbor habitats for higher trophic level vertebrates including sport fish (gray snapper, snook, sea trout, red drum, and sheepshead). They are also exploited by avian predators (American oystercatcher, fish crow, white ibis) at low tide.

Tidal/Mud Flats - Tidal/mud flats provide critical harbor habitats throughout the Charlotte Harbor system. Tidal flats are productive areas vegetated with epibenthic and drift algae, and they are inhabited by invertebrates such as crabs, oysters, clams, and worms. They are exploited as feeding areas by a diverse group of wading birds including white ibis, American oystercatcher, reddish egrets, Roseate Spoonbills, and little blue herons, and they provide protected staging and resting areas for smaller migratory birds. The tidal flats in this region consist of estuarine beaches, areas waterward of mangroves, salt barrens at higher elevations, dredge spoil areas, mud flats, and channel shoals.

Emergent Saltwater Wetlands

Emergent habitats may be defined as intertidal habitats that maintain vegetation that extends both above and below the waterline at normal high tides. These habitats included mangroves, saltmarshes, and shorelines. The emergent habitats were termed as a group "Emergent Saltwater Wetlands" in order to distinguish them from the freshwater and tidal oligohaline wetlands discussed under the Inland Habitat section of this document.

Mangroves - Mangrove trees are the most dominant emergent vegetation in the estuary. Four mangrove species occupy the inner, low energy shorelines of the estuary. These trees generally

range from 12 to 60 feet in height, but may occur as stunted morphotypes on tidal flats with elevated salinities such as salt barrens. The four species include red mangroves (*Rhizophora mangle*) that inhabit the areas closest to the water's edge, black mangroves (*Avicennia germinans*) that are generally upland of red mangroves, white mangroves (*Laguncularia racemosa*) that are usually upland of black mangroves, and buttonwoods (*Conocarpus erectus*) which occur upland of white mangroves. Mangrove forests provide critical harbor habitats for the living resources of the estuary. The branches of these trees provide nesting sites, hunting perches, and protection for a very diverse group of estuarine birds including white ibis, wood stork, heron species, egret species, brown pelicans, white pelicans, ospreys, and bald eagles. The partially submerged prop roots of these trees support an even greater diversity of living resources including oysters, snook, red drum, mangrove snapper, crabs, and other organisms.

The distribution of mangroves in the Charlotte Harbor NEP study area was compiled from delineation completed in 1990 by the SWFWMD and in 1988 by the SFWMD (Table 4.2). The wetlands were delineated from color infrared aerial photographs. A series of maps from these data is presented and described in the following text. These data are currently being updated by both of the Water Management Districts using photographs made in 1995.

Table 4.2 Acreages of mangrove swamps in the Charlotte Harbor NEP area by major basin and subbasin.

Major Basin	Subbasin	Mangrove Swamps (acres)
Myakka River	Coastal Lower Myakka	835
Peace River	Coastal Lower Peace	2858
Coastal Harbor Proper		14219
Lemon Bay		757
Pine Island Sound/Matlacha Pass		19107
Tidal Caloosahatchee River	Lower Caloosahatchee	2995
Estero Bay		11352
Coastal Venice		147

Saltmarshes - Saltmarshes are the most common emergent habitats in the riverine portions of the study area, and exist to some extent throughout the estuary. Saltmarsh communities often occur in the transitional area between mangroves, freshwater marshes, and salt barrens.

Dominant saltmarsh plant species include cordgrass (*Spartina alterniflora*) in the lower elevational zones, black needlerush (*Juncus roemerianus*) in the mid-level zones, and salt grass (*Distichlis spicata*) and slender cordgrass (*Spartina patens*) in the higher elevation zones that are only inundated on occasion.

Similar to mangrove habitats, the submerged and emergent portions of the saltmarsh plants provide diverse functions for living organisms in the estuary. The emergent tops of the marsh plants provide hunting cover for animals such as bobcats and gray foxes; nesting sites for unique aquatic mammals such as rice rats (*Oryzomys palustris*); hunting and display perches for birds such as redwing blackbirds, boat-tailed grackles, and green herons, and protective cover for many animals such as raccoons and marsh rabbits. The submerged portions of the marsh plants provide attachment sites for sessile organisms such as mussels and oysters, cover for intertidal aquatic animals such as fiddler crabs and killifish, and retain rich deposits of detrital food in riverine areas.

The distribution of saltmarshes (Table 4.3) in the Charlotte Harbor NEP study area was also compiled from delineations completed in 1990 by the SWFWMD and in 1988 by the SFWMD.

Table 4.3 Acreages of saltmarsh in the Charlotte Harbor NEP area by major basin and subbasin.		
Major Basin	Subbasin	Saltmarsh (acres)
Myakka River	Coastal Lower Myakka	1369
Peace River	Coastal Lower Peace	1681
Charlotte Harbor Proper		3855
Lemon Bay		344
Pine Island Sound/Matlacha Pass		25
Tidal Caloosahatchee River	Lower Caloosahatchee	238
Estero Bay		1644
Coastal Venice		62

Shorelines - During the historical development of coastal and waterfront areas within the Charlotte Harbor NEP many natural shorelines were cleared and hardened to prevent subsequent problems with erosion. Such hardened shorelines typically provide habitats of much lower structural diversity than natural areas, and have characteristically lower species diversity.

D. Relationship of this Quantifiable Objective to Objectives of Other Management Programs

This quantifiable objective is consistent with the overall goals of the South Florida Water Management District's (SFWMD's) SWIM program and other state, local, and federal management initiatives that seek to promote seagrass growth. The Florida Department of Environmental Protection aquatic preserve and buffer programs, as well as the Southwest Florida Water Management District (SWFWMD) Charlotte Harbor SWIM and lands acquisition programs have sought to maintain and restore such habitats. The U.S. Army Corps of Engineers and Florida Department of Environmental Protection are the primary permitting agencies responsible for controlling such activities. A number of other federal, state, and local governmental agencies provide additional review and comment on activities below the mean high water line.

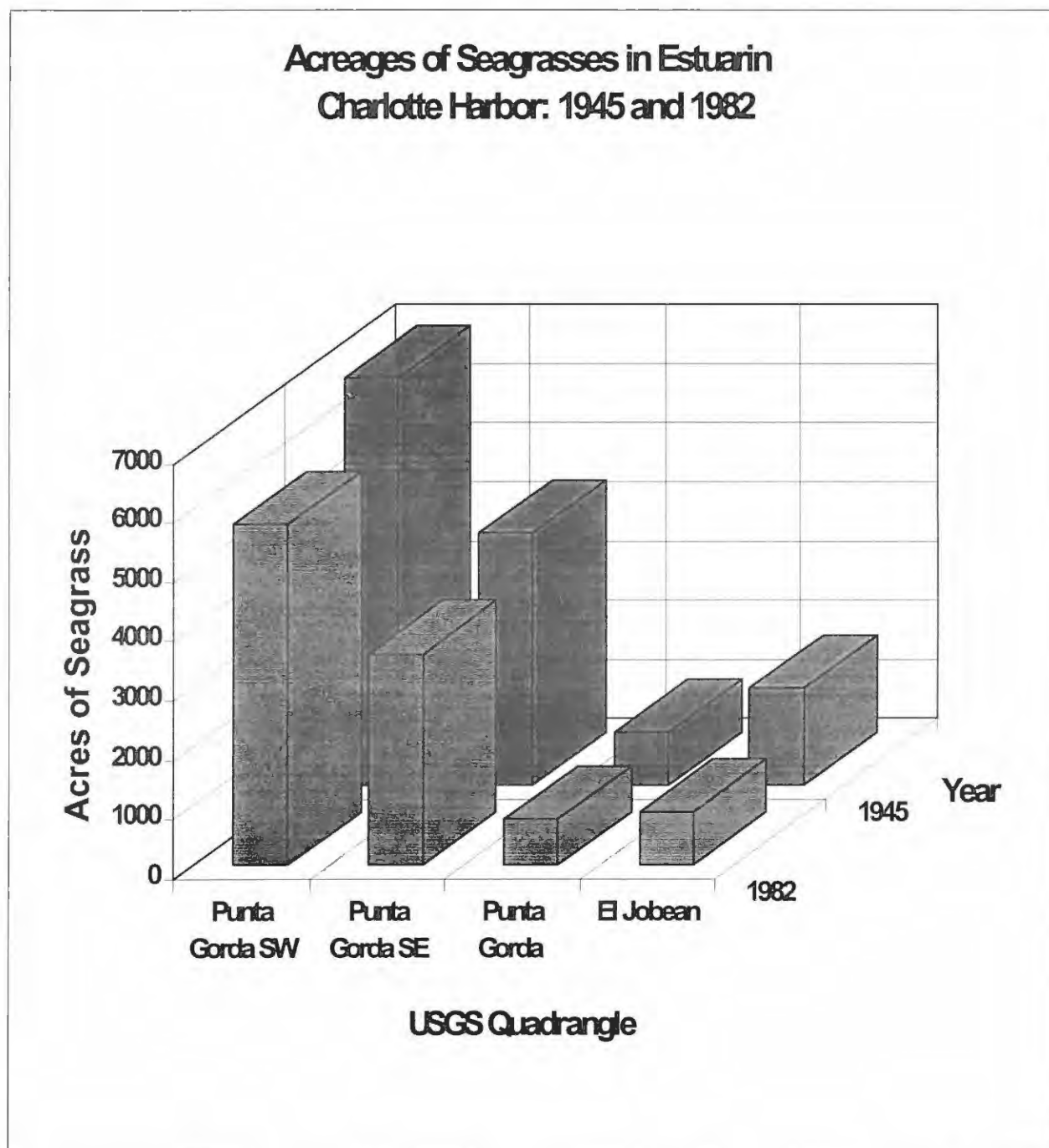


Figure 4.2 Acreages of seagrasses in estuarine Charlotte Harbor: 1945 and 1982.

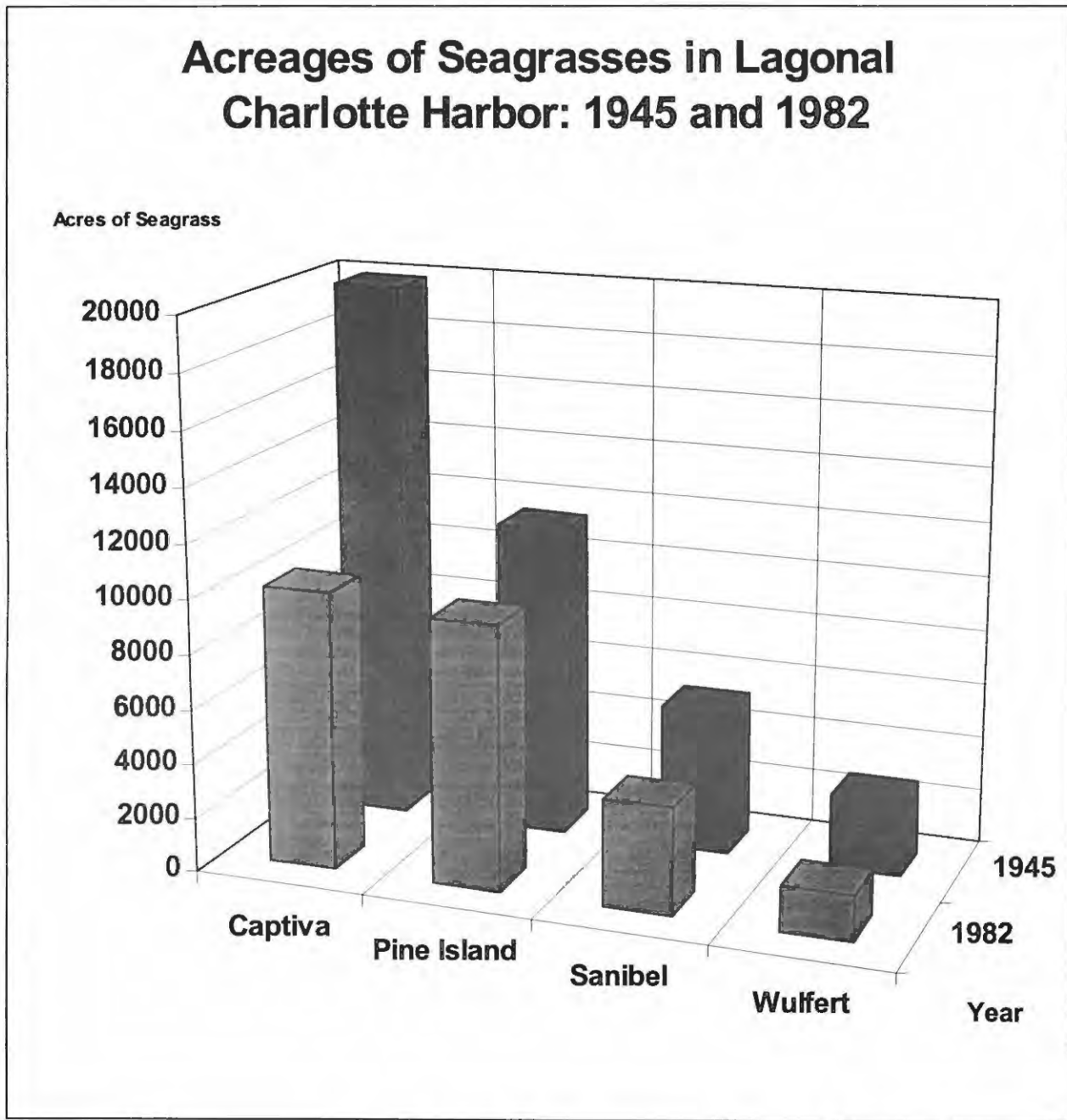


Figure 4.3. Acreages of seagrasses in lagoonal Charlotte Harbor: 1945 and 1982.

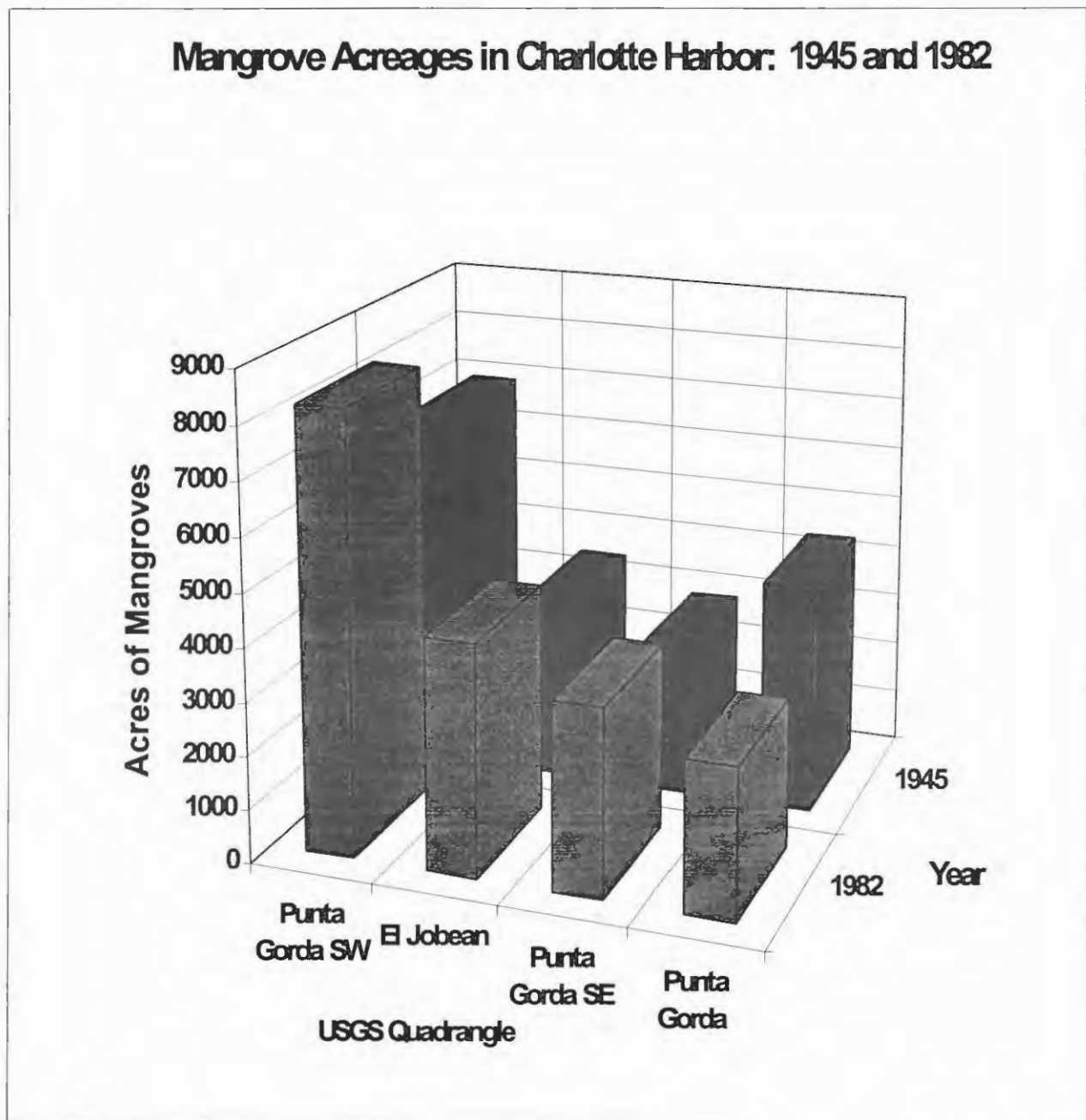


Figure 4.4 Acreages of mangroves in Charlotte Harbor: 1945 and 1982.

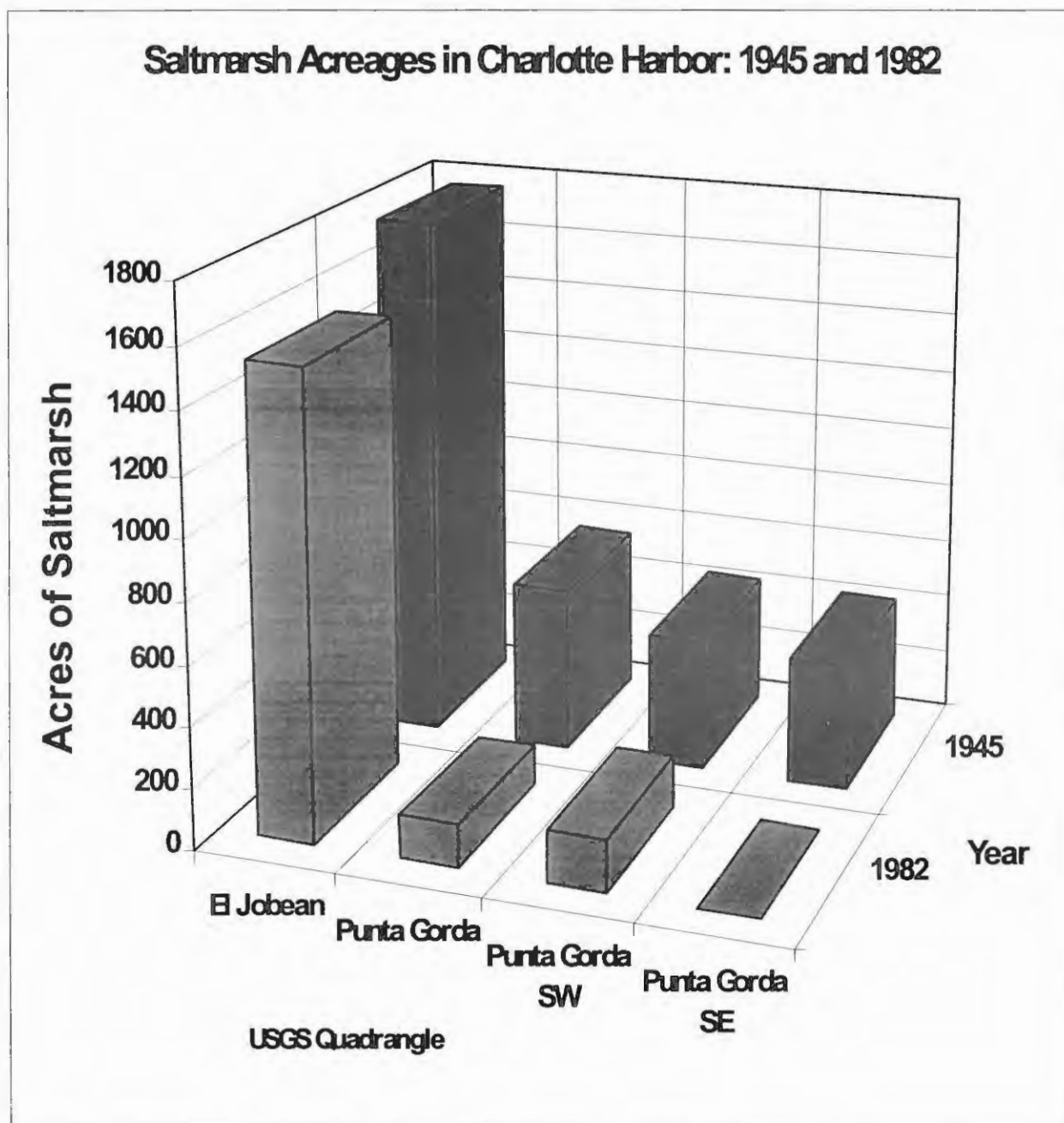


Figure 4.5 Acreages of saltmarshes in Charlotte Harbor: 1945 and 1982.

4.4 Fish and Wildlife Habitat Loss: FW-3

A. Statement of Quantifiable Objective

FW3: *Reduce propeller damage to seagrass beds, identified from the 1992-1993 baseline data, within the Charlotte Harbor NEP area by the year 2010. Reduce all severely scarred areas to light scarring and reduce 70% or more of the moderately scarred areas to light scarring.*

B. Charlotte Harbor NEP Goals and Priority Problem addressed by the Quantifiable Objective

- Goal # 1: Improve the environmental integrity of the Charlotte Harbor study area.
- Goal # 2: Preserve, restore, and enhance seagrass beds, coastal wetlands, barrier beaches, and functionally related uplands.
- Goal # 5: Develop and implement a strategy for public participation and education.

Priority Problem # 3. Degradation and elimination of headwater streams and other habitats caused by development, conversion of natural shoreline, cumulative impacts of docks and boats, invasion of exotic species, and cumulative and future impacts.

C. Background Information

The general distribution of seagrasses in Charlotte Harbor has a varied foundation of information. McNulty *et al.*, (1972) estimated about 23,383 acres of submerged vegetation. This estimate was made by using many different sources and may not have been verified by on-site inspections. The first attempt at a comprehensive study was completed by the Florida Department of Natural Resources in 1982 (Harris *et al.*, 1983). Black and white aerial photographs taken in 1946 and 1951 exist in Florida Department of Transportation (FDOT) files, and they have been digitized by Florida Marine Research Institute (FMRI). False color infrared aerial photographs were taken in 1981-1982 by FDOT, interpreted by FDOT and the results analyzed by FMRI. Verification of the aerial interpretations was done in most areas except for Estero Bay (per. comm., Ken Haddad).

Seagrass coverage is extensively analyzed and they estimated some 22,421 acres of seagrass to be present in 1982 in Charlotte Harbor (quads: El Jobean, Punta Gorda SW, Punta Gorda, Punta Gorda SE, Bokeelia, Port Boca Grande, and Matlacha). A more recent seagrass mapping program was completed by the SWFWMD in the Charlotte Harbor and Lemon Bay portions of the Charlotte Harbor NEP study area.

The Charlotte Harbor complex was reported to have a decline in seagrasses by Harris *et al.*, (1983). The study area included most of the Charlotte Harbor NEP area, except Lemon Bay and the Caloosahatchee River. They reported a decline of 29% in the total area of seagrass beds for the area. Adjusting for the lack of ground verification in Estero Bay by removing this system from the calculations, the total decline would be about 26%. The reported decline is not uniform across basins. The largest seagrass change, an estimated loss of 35%, occurred within Pine Island Sound. The Pine Island Sound loss represented 71% of the total estimated change from 1945 to 1982 or 18.5% of the 26% total. Harris *et al.*, (1983) provided an extensive discussion of the potential causes. High on the list of suspected causes were the construction of the intracoastal waterway and the Sanibel bridges and causeways, which were completed in 1962.

Charlotte Harbor seagrasses declined by approximately 19.5% and represented 3.6% of the 26% total. However, Tomasko *et al.*, (in press) and unpublished Southwest Florida Water Management District (SWFWMD) data suggest that Charlotte Harbor seagrass coverage is dependent on freshwater discharge and can be variable, losing coverage in very wet years and regaining in dry years.

The total acreage of scarred seagrasses in Sarasota, Charlotte, and Lee counties along the Gulf Peninsula was considered extensive by Sargent *et al.*, 1995, in their report *Scarring of Florida's Seagrasses: Assessment and Management Options*. Medium/severe scarring (M/S) totaled 25,910 acres and was the largest acreage of this class in the state. Lee County had the most extensive total and M/S scarring of the six counties making up the Gulf Peninsula Region study area. The seagrass flats of Estero Bay, Pine Island Sound, and Matlacha Pass in Lee County had extensive M/S scarring.

The less-developed Charlotte Harbor has approximately 23,000 more acres of seagrass than Tampa Bay, although total and M/S scarring are nearly the same for the two bays. Relative to the whole state, Lee and Charlotte Counties had the third and fourth greatest amount of M/S scarring after Monroe and Dade counties (Sargent *et al.*, 1995). Combined seagrass acreages for Sarasota (4,160 acres), Charlotte (14,190 acres), and Lee (50,510 acres) were nearly 7,000 acres.

Importantly, while these three counties include 68,860 acres of seagrasses in the state, they also make up over 13% of the scarred seagrasses (22,800 acres) in the state. Extensive seagrass scarring is

correlated with population density (Sargent *et al.*, 1995) and the M/S scarring of seagrass beds is greater in the densely populated Gulf Peninsula Region than it is in the sparsely populated Big Bend region.

Florida's population nearly doubled between 1970 and 1990 from nearly seven million to nearly thirteen million people. Boat registrations (recreational and commercial) more than tripled from 235,000 to 716,000 in the same time period. Substantial increases in both population and number of vessels suggest that our state's water resources are being used at an increasing rate, and therefore its seagrasses are in increasing danger of damage.

The number of vessels registered in a county is not always a predictor of seagrass scarring in that county. Many counties with large numbers of registered watercraft lack substantial seagrass acreage, while Monroe County has a moderate number of registered boats but has the greatest acreage of M/S scarring in the state. In addition, whether a vessel is used for commercial or recreational purposes may influence where it is used. Commercial vessels are generally larger, work farther offshore, and are limited to fewer ports with deeper access. Smaller vessels can be trailered to attractive inshore fishing and watersports areas such as the Florida Keys and Charlotte Harbor. Pleasure boats (excluding sailboats) compose more than ninety percent of registered vessels in most counties. In Monroe County, however, only eighty percent of the vessels are registered as pleasure boats; the remainder are registered as commercial vessels.

The Gulf Peninsula region has both the greatest number of vessel registrations and number of pleasure craft of any region in Florida. Situations that promote scarring can be grouped into two general categories: (1) boaters accidentally or intentionally pass through water too shallow for the draft of their vessels; and (2) coastal property is popular and extensive shoreline development in shallow bays and adjacent to shallow seagrass flats results in increased scarring.

Sargent *et al.* (1995) recommend that when state funds for seagrass management are limited, the money should be invested in those counties with the greatest acreage of M/S scarred seagrasses (e.g. Monroe County). However, if the severity of seagrass habitat loss in a county is related to the extent of seagrasses in that county, then counties with both moderate seagrass acreage and more intense scarring may merit similar attention when management programs are being developed.

Based on a scarring index in which the relative percentage of M/S scarring in a county is divided by the relative percentage of total seagrass acres for that county, the more threatened counties include Charlotte (18.4) and Lee (6.9), ranking 2 and 7, respectively, out of seven counties.

Sargent *et al.* (1995), have presented a four-point management approach for reducing seagrass scarring which is used by some local governments. Effective implementation of this comprehensive approach in plans designed for specific locales should initially reduce seagrass losses at moderately and severely scarred sites and slow the increase in scarring at sites with light scarring. The four points are:

- Education. Examples include education of boaters through pamphlets, boating classes, boat-user's guides and maps; seminars, signs, and organizations.
- Channel Marking (aids to navigation). For example, conventional U.S. Coast Guard approved markers are helpful in deeper channels, but markers should be located away from the edges of shallow seagrass flats to provide a wider buffer against scarring.
- Enforcement. Voluntary compliance has not proven effective in the past in resolving many resource-damage problems. Citations and warning for scarring seagrasses must be issued if enforcement is to be effective.
- Limited-motoring Zones. Programs initiated by the Florida Department of Environmental Protection (FDEP), the U.S. Fish and Wildlife Service, and several counties use moderate restrictions, such as idle-speed or limited motoring zones, to protect sensitive resources while allowing public access compatible with environmental protection. There are many other examples.

Pleasure-boat registrations indicate a point of origin, but boats may be trailered from anywhere. Nevertheless, seagrass scarring is not limited to a single group of boaters; all user-groups scar seagrasses to some degree.

D. Relationship of this Quantifiable Objective to Objectives of Other Management Programs

The Florida Department of Environmental Protection (FDEP) has collected data on areas impacted by boat traffic, and programs to reduce such impacts are addressed within the aquatic preserve plans. FDEP, the Water Management Districts and County governments all have undertaken efforts to limit such impacts.

4.5 Fish and Wildlife Habitat Loss: FW-4

A. Statement of Quantifiable Objective

FW4: *On conservation, preservation, stewardship, and other public lands achieve controllable levels of invasive exotic plants as defined by the Florida Exotic Pest Plant Council by the year 2020. Encourage and support the removal and management of invasive exotic plants on private lands.*

B. Charlotte Harbor NEP Goals and Priority Problem Addressed by the Quantifiable Objective

- Goal # 1: Improve the environmental integrity of the Charlotte Harbor study area.
- Goal # 2: Preserve, restore, and enhance seagrass beds, coastal wetlands, barrier beaches, and functionally related uplands.
- Goal # 5: Develop and implement a strategy for public participation and education.

Priority Problem # 3. Degradation and elimination of headwater streams and other habitats caused by development, conversion of natural shoreline, cumulative impacts of docks and boats, invasion of exotic species, and cumulative and future impacts.

C. Background Information

Florida is an unwilling host to numerous species of non-indigenous (exotic) plants and animals. In some instances these non-native species are rare and seldom seen by most people. However, in far too many cases such species, no longer confined by competition and predation within their natural communities, thrive and reproduce in Florida, displacing native species and altering native ecosystems. A number of these species are of both economic as well as ecological concern.

The following lists a few of the most notorious of Florida's exotic plants which have invaded Florida's natural systems within the Charlotte Harbor NEP and summarizes their effects.

Australian Pine	Their ability to quickly colonize disturbed areas and displace native species. This tree grows in sandy soils and is tolerant of high salt levels in soils.
Air Potato	An aggressively growing vine that shades out native species in areas of heavy infestation. Growth occurs from the annual dispersement of tubers from the vines.
Melaleuca	Explosive growth habits of this plant and its ability to form dense stands crowds out native plants.
Mimos	This ornamental tree often escapes cultivation and displaces native vegetation in both upland and wetland habitats.
Hydrilla	This aquatic plant produces a dense mat at the water surface, shading out bottom vegetation, creating low dissolved oxygen levels, and affecting animal life.
Brazilian Pepper	Birds spread the seeds of this invasive species. It displaces native understory plants and affects bird population densities.
Cogon Grass	This hearty South American species was imported for pasture grass. It has proven unsuitable for livestock grazing and proliferated into 27 counties where it has displaced native forage grasses.
Chinese Tallow	A native of China, it invades bottomland hardwood forests and wetlands. This plant may replace native species. Its leaf litter can be toxic to aquatic invertebrates.
Pathos	This ornamental vine can shade out native vegetation within the mid- to upper canopies of native communities.
Torpedo Grass	This plant can completely displace native vegetation along waterfronts. This plant provides little or no habitat value for native Florida wildlife.

Tropical Soda Apple	This plant forms dense single-species stands in agricultural and pasture lands, ditch banks and roadsides, and it threatens natural areas with invasion.
Wedelia	Initially used as an ornamental ground cover, in natural habitats it crowds out native species in areas of open light.
Water Hyacinth	In the 1950s, water hyacinth covered more than 120,000 acres of Florida waterways, where it shades out water bottom areas and depletes dissolved oxygen in the water column.

These are only a few of the more than 1000 alien plant species that have become established in Florida, infesting more than 1.5 million acres of land throughout the state.

Additional background information is currently being acquired from both the Florida Exotic Pest Plant Council and the Aquatic Plant Management division of the Florida Department of Environmental Protection.

D. Relationship of this Quantifiable Objective to Objectives of Other Management Programs

Both the Southwest and the South Florida Water Management Districts have extensive programs to attempt to control the spread of evasive exotic vegetation. At a more local level, a number of the County and Municipal Governments within the Charlotte Harbor NEP study area also have active programs to reduce the invasion of exotic plant species on their public lands.

Table 4.4 Matrix of Relationships Between Loss of Fish and Wildlife Habitat
Quantifiable Objectives and Action Plans

Quantifiable Objective	Action Plan																					
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
FW1																			X		X	
FW2	X	X	X	X		X										X	X	X		X		X
FW3					X	X	X	X	X	X	X	X	X	X	X		X					
FW4	X																X					

The *Priority Actions* (FW-A through FW-V) that are detailed in the following pages describe the types of actions that would help achieve these *Quantifiable Objectives*.

4.6 FW-A

Action

Where practical, identify and remove areas of heavy invasive exotic vegetation from the Charlotte Harbor NEP study area.

Background

Many areas of significant or key wildlife habitat within the Charlotte Harbor NEP study area have been extensively invaded, and altered, by invasive exotic vegetation. Where practical, the Charlotte Harbor NEP working groups strongly felt that programs and incentives need to be developed to reduce and control both the extent and spread of such invasive exotic vegetation.

- **Quantifiable Objective** - FW-2, FW-4
- **Areas for Implementation** - Entire Charlotte Harbor NEP study area

Strategy

- 1) Identify areas of heavy invasive exotic vegetation.
- 2) Develop plans to reduce coverage in areas containing or linking significant habitats.
- 3) Require exotic removal and maintenance as a condition of all new permits (dock, surface water, land clearing, etc.) for development.
- 4) Develop and encourage county and community-based programs for the removal of exotics and the maintenance of native vegetation on public lands.
- 5) Develop and implement incentive (rebate) programs to encourage removal of exotics and the maintenance of native vegetation on private lands.
- 6) Alter permitting regulations to encourage land owners to remove exotic vegetation prior to land development.

Potential Responsible Agencies & Organizations

County and Municipal Governments

U.S. Fish and Wildlife Service

Florida Game and Freshwater Fish Commission

Mosquito Control District

Water Management Districts

State and local permitting agencies

Expected benefits

Reduction in the coverage of exotic vegetation of both existing and new areas.

Increased habitat value.

Monitoring Response

Determine existing extent and maintenance of restored habitats.

Related Actions

FW-C

4.7 FW-B

Action

Modify previously natural shorelines that have been hardened with vertical seawalls within aquatic preserves and adjacent riverine systems to improve habitat.

Background

In many areas of the Charlotte Harbor NEP, natural marine and estuarine shorelines have been hardened or modified during development. The Charlotte Harbor NEP working groups felt that programs and incentives should be developed to encourage “softening” and increase the habitat structure of these previously modified areas. In addition, such procedures should become standard operation procedures for any future permitted shoreline alterations.

- **Quantifiable Objective** - FW-2
- **Areas for Implementation** - Developed waterfront areas within the Charlotte Harbor NEP

Strategy

- 1) Encourage use of artificial reef structures under docks and along existing seawalls.
- 2) Encourage rip-rap ordinances at the local level and encourage rip-rapping the toe of existing seawalls.
- 3) Develop public education and awareness programs.
- 4) Review and improve the existing permit process to reduce hurdles.
- 5) Develop and encourage incentive programs for private land owners.

Potential Responsible Agencies & Organizations

Individual property owners

Local and Municipal Governments

Florida Department of Environmental Protection

U.S. Army Corps of Engineers

U.S. National Marine Fisheries Service

Florida Game and Freshwater Fish Commission

Artificial Reef Organizations

Expected benefits

Improved diversity of structure and increased estuarine/marine habitat along modified shorelines.

Monitoring Response

None.

Related Actions

FW-O

4.8 FW-C

Action

Restore wetland areas adversely impacted by mosquito ditching including, but not limited to, the backfilling of ditches, the removal of spoil piles, and the elimination of invasive exotic vegetation.

Background

Many tidally flooded wetland areas within the coastal areas of the Charlotte Harbor NEP were historically "ditched" to hydrologically alter these habitats to reduce the breeding of saltmarsh mosquitos. Many of these areas have been heavily invaded by invasive exotic vegetation as a result of the spoil piles left by such ditching activities.

- **Quantifiable Objective - FW-2**
- **Areas for Implementation -** State buffer and preserve lands, county and municipal lands, and marsh areas currently held in private ownership.

Strategy

- 1) Develop a plan to identify impacted areas.
- 2) Develop an-area wide plan and rank areas for restoration.
- 3) Implement restoration program.
- 4) Develop program for off-site mitigation credits.

Potential Responsible Agencies & Organizations

Florida Game and Freshwater Fish Commission

Water Management Districts

U.S. Army Corps of Engineers

Florida Department of Environmental Protection

Mosquito Control Districts

Aquatic Preserves

Expected benefits

Improved hydrologic function of currently impacted high marsh/low marsh systems.

Increased native vegetation.

Monitoring Response

Survey studies to determine effectiveness of exotic removal, and the potential for additional clearing.

Related Actions

FW-A

4.9 FW-D

Action

Develop a program to educate people about environmentally responsible boating practices that can be given to clubs and boating organizations.

Background

The development, distribution and communication of information to the public concerning actions which they can take to protect and preserve shallow water habitats and prevent pollution should one of the primary goals of the Charlotte Harbor NEP.

- **Quantifiable Objective** - FW-2, FW-3
- **Areas for Implementation** -Coastal Counties within the Charlotte Harbor NEP study area

Strategy

- 1) Develop slide programs for each of the major estuarine areas that show the habitat losses associated with prop damage, and how boaters can avoid damage to grass beds.
- 2) Train volunteer speakers to make such presentations at local civic and business groups, local schools, as well as boating and fishing associations.
- 3) Integrate presentation into local area environmentally responsible boating courses.

Potential Responsible Agencies & Organizations

Sea Grant Program

U.S. Coast Guard

Florida Department Environmental Protection

County and Municipal Governments

Marine advisory committees

State wide and local boating and fishing organizations

School Districts

Expected benefits

Increase boater awareness of potential damage to marine habitats.

Monitoring Response

Feedback from target group evaluations and surveys.

Related Actions

FW-E, FW-F, FW-G, FW-H, FW-I, FW-J, FW-K, FW-M, FW-O, FW-T

4.10 FW-E**Action**

Develop both a Public Service Announcement (PSA) and longer video on boating impacts to seagrass beds and how to avoid seagrass damage.

Background

The development, distribution, and communication of information to the public concerning actions which they can take to protect and preserve shallow water habitats and prevent pollution should one of the primary goals of the Charlotte Harbor NEP.

- **Quantifiable Objective - FW-3**
- **Areas for Implementation - Coastal counties within the Charlotte Harbor NEP**

Strategy

- 1) Develop short public service announcement for radio and television explaining boating impacts on local seagrass beds, the effects and how to avoid prop damage.
- 2) Work with local broadcast organizations.

Potential Responsible Agencies & Organizations

Sea Grant Program

Florida Department Environmental Protection

County and Municipal Governments

School Boards and Districts

Florida Gulf Coast University

Public Broadcasting Stations

Marine advisory committees

State wide and local boating and fishing organizations

Expected benefits

Increase public awareness of potential habitat losses resulting from prop damage to seagrass beds.

Monitoring Response

Feedback from target group evaluations and surveys.

Related Actions

FW-D, FW-F, FW-G, FW-H, FW-I, FW-J, FW-K, FW-M, FW-O, FW-T

4.11 FW-F

Action

Develop, install, and maintain custom signs indicating shallow areas (such as seagrass beds, mudflats, oyster beds, etc.) to be placed at boat ramps and other appropriate locations where there is high boat use.

Background

An effective method used to protect shallow estuarine habitats is to provide adequate information regarding local waters and potential shallow areas to be avoided at locations such as ramps and marinas.

- **Quantifiable Objective** - FW-2, FW-3
- **Areas for Implementation** - coastal counties within the Charlotte Harbor NEP

Strategy

- 1) Within each of the major estuarine areas, develop signs specifically designed for given ramps and marina depicting how to avoid damage to local area seagrass beds, as well as the locations of oyster beds, etc.
- 2) Work with counties, marina owners, etc. to have these signs placed in appropriate locations and maintained.

Potential Responsible Agencies & Organizations

Sea Grant Program

Florida Department Environmental Protection

County and Municipal Governments

Marine advisory committees

State wide and local boating and fishing organizations

Expected benefits

Reduce impacts to seagrass and oyster beds caused by boaters.

Monitoring Response

Long-term inventory of seagrass prop scarring damage.

Related Actions

FW-D, FW-E, FW-G, FW-H, FW-I, FW-J, FW-K, FW-M, FW-O, FW-T

4.12 FW-G

Action

Develop and distribute boater maps and stickers for the Charlotte Harbor NEP areas, including resources to avoid.

Background

The Charlotte Harbor NEP working groups felt that one of the methods which could be used to protect shallow water habitats would be to provide detailed information and mapping of local areas as guides to boaters.

- **Quantifiable Objective - FW-3**
- **Areas for Implementation - Coastal counties within the Charlotte Harbor NEP**

Strategy

- 1) Develop boater guides for each Charlotte Harbor NEP estuarine area emphasizing:
 - the importance of seagrass beds.
 - how to avoid damage to seagrasses.
 - local navigational channels and shallow areas to be avoided.
 - how to remove a boat from a seagrass bed.
 - manatee habitat and areas where they are known to frequent if different seasons.
- 2) Develop and implement a plan for the effective distribution of maps and stickers.
- 3) Identify areas of critical manatee habitat and specific locations where they are known to seasonally frequent. Highlight these areas on all developed materials.

Potential Responsible Agencies & Organizations

Potential distribution centers, such as: marine dealers, tackle shops, sporting good stores, and inclusion with boat registration packages

Sea Grant Program

Florida Department Environmental Protection

County and Municipal Governments

Marine advisory committees

State wide and local boating and fishing organizations

Expected benefits

Reduction in habitat damage caused by lack of specific local knowledge by the general boating public.

Monitoring Response

Long-term inventory of seagrass prop scarring damage.

Related Actions

FW-D, FW-E, FW-G, FW-H, FW-I, FW-J, FW-K, FW-M, FW-R

4.13 FW-H

Action

Develop and support a digital resource map system on the Internet for the public to use.

Background

This would provide an method of distributing detailed information and mapping of local areas to boaters. Such a format could easily be updated or modified on an as need basis as additional information is developed regarding shallow water habitats within the Charlotte Harbor NEP.

- **Quantifiable Objective - FW-3**
- **Areas for Implementation - Coastal counties within the Charlotte Harbor NEP**

Strategy

1) Develop Web Site with the following types of information:

- the importance of seagrass beds.
- how to avoid damage to seagrasses.
- how to remove a boat from a seagrass bed.
- within each of the major estuarine areas, develop maps specifically designed to show seagrass beds, oyster bars, major navigational channels, ramps and marinas, as well as areas to be avoided based on draft of boat and for given tidal stages.

Potential Responsible Agencies & Organizations

Sea Grant Program

Florida Marine Institute

Florida Department Environmental Protection

County and Municipal Governments

Marine advisory committees

State wide and local boating and fishing organizations

Expected benefits

Reduced amounts of habitat damage caused by lack of specific local knowledge by the general boating public.

Monitoring Response

Reduce amounts of habitat damage caused by lack of specific local knowledge by the general boating public and encourage environmental responsibility.

Related Actions

FW-D, FW-E, FW-F, FW-G, FW-I, FW-J, FW-K, FW-M, FW-O

4.14 FW-I

Action

Develop and install portable, semi-permanent displays with information on environmental responsibility that can be set up at shopping malls and other public locations.

Background

The Charlotte Harbor NEP working groups thought that such a display would provide an effective method of providing the public with information as to steps individuals can take to protect threatened fish and wildlife habitats within the study area.

- **Quantifiable Objective - FW-3**
- **Areas for Implementation - Coastal Charlotte Harbor NEP Counties**

Strategy

1) Develop displays with the following types of information:

- the importance of seagrass beds.
- how to avoid damage to seagrasses.
- how to remove a boat from a seagrass bed.
- maps specifically designed to show seagrass beds, oyster bars, major navigational channels, ramps and marinas, as well as areas to be avoided based on draft of boat and for given tidal stages.
- areas known to be seasonally frequented by numbers of manatees.

Potential Responsible Agencies & Organizations

Sea Grant Program

Florida Department Environmental Protection

County and Municipal Governments

Marine advisory committees

State wide and local boating and fishing organizations

Expected benefits

Increased public awareness.

Reduced amounts of habitat damage caused by lack of specific local knowledge by the general boating public.

Monitoring Response

Long-term surveys of prop damage to seagrass beds.

Related Actions

FW-D, FW-E, FW-F, FW-G, FW-H, FW-J, FW-K, FW-M, FW-O, FW-T

4.15 FW-J**Action**

Develop a shallow water resource marking program.

Background

Marking programs have effectively been used in other estuarine areas to alert boaters to the potential “hazard” of shallow and hard bottom areas. These programs have been successful in reducing boating damage and scarring of these important shallow water habitats.

- **Quantifiable Objective - FW-3**
- **Areas for Implementation - Coastal Charlotte Harbor NEP Counties**

Strategy

- 1) Identify areas in the Charlotte Harbor NEP region where hazard marking programs are needed and implement with the assistance of other partners.
- 2) Put together working groups comprised of local individuals with significant knowledge and on-the-water experience.
- 3) Determine where such hazard markings would be most appropriate.
- 4) Investigate hazard marking programs, such as the one in the Florida Keys, and gather information on how they can be implemented.
- 4) Install hazard markings.
- 5) Maintain markers.

Potential Responsible Agencies & Organizations

County and Municipal Governments

West Coast Inland Navigation District

Local power squadron and environmental organizations

U.S. Coast Guard

Fishing and Guide Associations

Expected benefits

Reduced habitat damage caused by unaware boaters entering shallow areas.

Monitoring Response

Evaluate any changes in the amount of prop damage in specific areas.

Related Actions

FW-D, FW-E, FW-F, FW-G, FW-H, FW-I, FW-K, FW-M, FW-O

4.16 FW-K**Action**

Establish "no motor zones" and "limited access zones" where appropriate based on Florida Marine Research Institute (FMRI) seagrass studies and bird rookeries.

Background

The Charlotte Harbor NEP working groups felt that the most feasible mechanism for providing adequate protection of expansive shallow areas and bird rookeries would be to establish, where appropriate, no motor zones or seasonally limited access areas. The working groups felt that support for the implementation of such areas would require close coordination between both the public and governmental agencies.

- **Quantifiable Objective - FW-3**
- **Areas for Implementation -** Estuarine areas of coastal counties within the Charlotte Harbor NEP

Strategy

- 1) Review other similar programs in other areas of Florida and evaluate potential problems.
- 2) Investigate severely scarred areas to determine their locations and boundaries.
- 3) Establish criteria for resource areas that need protection.
- 4) Establish working group to determine criteria for "no motor zones," such as:
 - areas of severely scarred seagrass beds.
 - areas often frequented by manatees.
 - waters surrounding significant bird rookeries.
- 5) Work with local government and public groups and organizations to implement programs.
- 6) Establish effective enforcement mechanisms.

Potential Responsible Agencies & Organizations

County and Municipal Governments

Florida Department of Environmental Protection

Florida Department of Game and Freshwater Fish

U.S. Fish and Wildlife Service

U.S. Environmental Protection Agency

U.S. Coast Guard

U.S. National Marine Service

Fishing and Guide Associations

Expected benefits

Reduced boating impacts to specific sensitive areas and habitats.

Monitoring Response

Determination of level of enforcement.

Related Actions

FW-D, FW-E, FW-F, FW-G, FW-H, FW-I, FW-J, FW-M, FW-O

4.17 FW-L**Action**

Provide additional support for environmental compliance and enforcement within the area of the Charlotte Harbor NEP.

Background

The Charlotte Harbor NEP working groups believed that existing laws provided a sound basis for habitat and wildlife protection. They, however, felt that the law enforcement agencies responsible for enforcement of these laws deserved increased support.

- **Quantifiable Objective - FW-3**
- **Areas for Implementation - Entire Charlotte Harbor NEP study area**

Strategy

- 1) Interact with judges, law enforcement officers, and state attorneys through a series of workshops on environmental issues and enforcement.
- 2) Review existing laws to determine whether civil fines would provide greater deterrents.
- 3) Evaluate and seek additional support for enforcement agents. Evaluate need for civil penalties for violations (criminal penalties changed to civil penalties through state statute). Recognize enforcement agencies and individuals (e.g., reward system) who are active in enforcement of environmental regulations.
- 4) Implement financial incentives (Wildlife Alert) for pro-active reporting and implementation of existing laws.
- 5) Increase public awareness regarding violations and impacts to resources.
- 6) Develop interagency task force to coordinate and reduce conflicts.

Potential Responsible Agencies & Organizations

Local and state law enforcement, including:

County Sheriffs

Florida Marine Patrol

Florida Game and Freshwater Fish Commission

U.S. Fish and Wildlife Service

Florida State's Attorney Office

U.S. Coast Guard

Expected benefits

Reduced violations of existing wildlife and habitat laws.

Monitoring Response

Track enforcement, citations and public awareness.

Related Actions

FW-Q

4.18 FW-M**Action**

Develop methods to enhance seagrass recovery from prop scarring.

Background

Often areas within seagrass beds which have been damaged by prop scarring are very slow to recover. Research has suggested that such slow growth can be shown to be attributable to changes in the characteristics of the sediments within which the seagrass rhizomes grow, which is in turn maintained by localized changes in current patterns and velocities. It is possible that methods can be developed which would reduce these stresses and promote a more rapid recovery of damaged seagrass areas.

- **Quantifiable Objective - FW-3**
- **Areas for Implementation - Coastal estuarine areas in the Charlotte Harbor NEP study area**

Strategy

Encourage research into methods to enhance the recovery of areas damaged by prop scarring.

Potential Responsible Agencies & Organizations

Water Management Districts

Florida Department of Environmental Protection

Public and private organizations (Universities and Research Centers)

Florida Marine Research Institute

Expected benefits

Enhanced recovery of damaged seagrass beds.

Monitoring Response

Determine if rates of recovery in experimental test areas are significantly different from natural processes.

Related Actions

FW-D, FW-E, FW-F, FW-G, FW-H, FW-I, FW-J, FW-K, FW-O

4.19 FW-N**Action**

Request local delegates to introduce state legislation to require a boater operator's license and support increased presence of enforcement officers on marine and fresh waters.

Background

Both the members of the Charlotte Harbor NEP Technical Advisory Committee (TAC) and the Citizens Advisory Committee (CAC) believed that the rapid increase in recreational boats and other forms of watercraft within the waters of the NEP has increased the potential for related impacts in important estuarine and riverine habitats. There was a consensus that a boater operator's license would provide an excellent opportunity for new operator's to become aware of potential dangers posed to these key resources, existing laws and regulations regarding natural resources, as well as ways to reduce significant damage to seagrass beds and shallow benthic habitats should they find themselves in shallow areas.

- **Quantifiable Objective - FW-3**
- **Areas for Implementation -Statewide**

Strategy

- 1) Investigate legislation from states that have small boat operators license programs.
- 2) Ask legislative delegations to implement boaters to obtain an operators license.
- 3) Require knowledge of rules and regulations pertaining to environmental protection as part of the program.

Potential Responsible Agencies & Organizations

State government

Expected benefits

Increased boater awareness of laws and rules regarding environmental protection and reduce impacts to critical habitats.

Monitoring Response

None.

Related Actions

None.

4.20 FW-O**Action**

Investigate and develop criteria for new and extensions of incomplete existing channels where they are needed to protect nearby resources.

Background

In a number of areas the channels leading from waterfront developments, marinas, launching ramps, and other high boating traffic areas do not end in water deep enough for many of the boats using these facilities. As a result, the shallow benthic habitats at the ends of these channels are often damaged by boaters trying to find ways to enter or exit these areas. It was suggested by the TAC/CAC working groups that where such areas are identified, permits be issued to extend existing channels to adequate depths to prevent damage to surrounding shallow water habitat.

- **Quantifiable Objective - FW-3**
- **Areas for Implementation -**Coastal counties in the Charlotte Harbor NEP study area

Strategy

- 1) Provide for a committee of appropriate agencies and public groups to coordinate programs.
- 2) Determine areas where enhancement of boating channels would be expected to reduce impacts to seagrass and other benthic communities.
- 3) Use interagency procedures to seek permits for such changes.
- 4) Construction.
- 5) Monitoring to determine effectiveness of permitted channel enhancements.

Potential Responsible Agencies & Organizations

West Coast Inland Navigation Districts

Florida Department of Environmental Protection

Florida Game and Freshwater Fish Commission

U.S. Fish and Wildlife Service

U.S. National Marine Fisheries Service

County and Municipal Governments

U.S. Army Corps of Engineers

Expected benefits

Reduced boating impacts to benthic habitats.

Monitoring Response

Programs to determine effectiveness of such programs.

Related Actions

FW-D, FW-E, FW-F, FW-G, FW-H, FW-I, FW-J, FW-K, FW-M

4.21 FW-P**Action**

Enhance fish and wildlife habitat along canals and artificial waterbodies containing vertical seawalls.

Background

In many areas of the Charlotte Harbor NEP, there are many extensive areas of constructed canal waterfront development. In the majority of these areas the new artificial shorelines have been hardened with vertical, low habitat value seawalls. The Charlotte Harbor NEP working groups felt that programs and incentives should be developed to encourage “softening” and increase the habitat structure of these modified areas. In addition, such procedures should become standard operation procedures for any future permitted shoreline alterations.

- **Quantifiable Objective - FW-2**
- **Areas for Implementation** -Charlotte Harbor NEP study area, especially saltwater/brackish canal systems

Strategy

- 1) Encourage the use of rip-rap and artificial reef structures under docks and along existing seawalls to enhance nursery and habitat value.
- 2) Encourage the planting of appropriate native vegetation along developed shorelines, and allow trimming and maintenance by property owners.
- 3) Develop and support incentive programs and agency permitting to enhance fish and wildlife habitat along seawalled canals.
- 4) Encourage the use of alternatives to vertical bulkheads through the permitting process to preserve existing habitat

Potential Responsible Agencies & Organizations

Property Owners

Artificial Reef Organizations

Florida Department of Environmental Protection

U.S. Army Corps of Engineers

Water Management Districts

County and Municipal Governments

Florida Game and Freshwater Fish Commission

U.S. Fish and Wildlife Service

U.S. National Marine Fisheries

Expected benefits

Improved diversity of structure and increase the habitat value of existing artificial water bodies and canal systems.

Monitoring Response

Studies to determine the effectiveness of such programs in increasing species densities and diversity in canal systems.

Related Actions

FW-B

4.22 FW-Q**Action**

Ensure uniform compliance and enforcement of environmental regulations and permitting criteria.

Background

The Charlotte Harbor NEP working groups believed that existing laws and permitting criteria provide a sound basis for habitat and wildlife protection. They however felt that the law enforcement agencies responsible for enforcement of these laws deserved increased support. In addition, they felt that enforcement of permitting and other environmental regulations should be uniform throughout the NEP.

- **Quantifiable Objective** - FW-2, FW-3, FW-4
- **Areas for Implementation** - Entire Charlotte Harbor NEP study area

Strategy

- 1) Identify areas of non-compliance with local, state, district and federal rules and regulations.
- 2) Work with regulator agencies in developing protocols in their development of annual reports which track the effectiveness of permit compliance within the Charlotte Harbor NEP.

Potential Responsible Agencies & Organizations

Florida Department of Environmental Protection

U.S. Army Corps of Engineers

Water Management Districts

County and Municipal Governments

Florida Game and Freshwater Fish Commission

U.S. Fish and Wildlife Service

U.S. National Marine Fisheries

Florida Marine Patrol

Expected benefits

Increased awareness of potential problems with compliance of existing regulations.

Enhanced preservation of fish and wildlife habitats under existing regulations.

Monitoring Response

Determine if existing regulations are effective and if post-permit compliance/enforcement is being adequately implemented as intended by current rules and regulations.

Related Actions

FW-L

4.23 FW-R

Action

Promote development and enhancement of plans and programs to improve fish and shellfish resources.

Background

There are a number of projects and plans currently being undertaken or under consideration by local, regional, state and federal agencies related to the maintenance and enhancement of fish and shellfish resources. The Charlotte Harbor NEP TAC/CAC believed that the effectiveness of these programs could be enhanced by closer coordination and joint support among all active parties.

- **Quantifiable Objective - FW-2**
- **Areas for Implementation** -primarily riverine, estuarine, and coastal waters within the Charlotte Harbor NEP study area

Strategy

- 1) Support scallop restoration programs.
- 2) Continue and expand critical independent fisheries monitoring programs.
- 3) Strengthen regulatory programs which protect vital fisheries habitats, including: submerged aquatic vegetation, shellfish beds, spawning areas, and critical juvenile fish habitats.
- 4) Encourage programs to restore wetlands and vital fisheries habitats.
- 5) Develop and implement management plans for the recovery of depleted commercial and recreational fishery stocks.
- 6) Encourage shellfish enhancement programs, including seeding programs to improve: fisheries, water quality (filtering), and habitat value.
- 7) Support increased regulation and enforcement of recreational fisheries.

Potential Responsible Agencies & Organizations

Florida Department of Environmental Protection

U.S. Army Corps of Engineers

Water Management Districts

County and Municipal Governments

Florida Marine Fisheries Commission

Florida Game and Freshwater Fish Commission

U.S. Fish and Wildlife Service

U.S. National Marine Fisheries

Expected benefits

Enhanced preservation of fish and wildlife habitats.

Maintenance of and/or increased fish and shellfish resources.

FW-R (continued)

Monitoring Response

Long-term seasonal studies of fish and shellfish populations to determine changes caused by natural variation and those associated with human influences.

Related Actions

FW-B, FW-F, FW-G, FW-K, FW-L

4.24 FW-S**Action**

Bring areas with the highest priority under protection through ownership and/or management, and expand conservation areas, reserves, and preserves.

Background

The Charlotte Harbor NEP Technical Advisory Committee and the Citizens Advisory Committee jointly felt that many important areas of existing natural habitat were currently threatened with substantial alteration due to the rapid rates of development which are occurring throughout many regions of the Charlotte Harbor NEP study area. It was proposed that the NEP process encourage, promote, and support efforts by governmental and private organizations, as well as private landowners to increase the protection of these habitats through expanded conservation, reserve, preserve, and stewardship programs.

- **Quantifiable Objective - FW-1**
- **Areas for Implementation - Entire Charlotte Harbor NEP study area**

Strategy

- 1) Identify key habitats in existing natural areas within each basin for protection.
- 2) Expand and enhance habitat inventory and monitoring programs.
- 3) Promote private stewardship of vital habitats through incentives and technical assistance to landowners, local governments, and other parties.

Potential Responsible Agencies & Organizations

Private Property Owners

Florida Department of Environmental Protection

Water Management Districts

County and Municipal Governments

Florida Game and Freshwater Fish Commission

U.S. Fish and Wildlife Service

Expected benefits

Maintained and preserved critical wildlife habitats.

Monitoring Response

Keep a running inventory of: 1) the existing acreages of each type of identified critical habitat within the Charlotte Harbor NEP; 2) that within conservation, reserves, or preserves; and 3) the annual amount of habitat converted to development.

Related Actions

FW-U

4.25 FW-T**Action**

Develop programs to improve public awareness of habitat and wildlife issues.

Background

The Charlotte Harbor NEP's joint Technical Advisory Committee/Citizens Advisory Committee working groups felt that the key to the protection of fish and wildlife habitat is public support for current and proposed programs. Without efforts to enhance the general public's awareness and/or involvement in these issues there may be a lack in the general perception as to the need for many of the NEP's important proposed actions.

- **Quantifiable Objective - FW-2**
- **Areas for Implementation - Entire Charlotte Harbor NEP study area**

Strategy

- 1) Increase programs and opportunities for citizens to communicate with members of environmental agencies and policy-making commissions.
- 2) Support development of comprehensive environmental science and education curriculum at all levels of education.
- 3) Increase conservation of buffer areas around mangroves to reduce pressures to cut and hedge mangroves.
- 4) Develop and implement information and education programs for developers, contractors, and builders on effective means of reducing habitat impacts.

Potential Responsible Agencies & Organizations

Florida Department of Environmental Protection

U.S. Army Corps of Engineers

Water Management Districts

County and Municipal Governments

Florida Game and Freshwater Fish Commission

U.S. Fish and Wildlife Service

U.S. National Marine Fisheries

Boards of Education

Expected benefits

Increased public awareness of habitat and wildlife issues, and increase support and participation.

Monitoring Response

None.

Related Actions

FW-D, FW-E, FW-F, FW-G, FW-I

4.26 FW-U

Action

Acquire environmentally sensitive lands currently privately held within large, undeveloped, platted areas.

Background

Within Sarasota, Charlotte and Lee counties there are extensive area of platted, undeveloped lands slated for future intense single family development. Many of these areas are the result of the projects by large land development companies which sold lots during the 1950s, 60s, 70s and 80s on long-term instalment sales to out-of-state customers. Many of these extensive areas are currently largely vacant having only a few scattered homes, and little developed infrastructure other than poorly maintained roads. Since many of these areas were sold prior to the implementation of most of the current environmental rules and regulations, many of these areas contain important natural habitats which are at risk of being cleared once individual landowners choose to develop their property.

- **Quantifiable Objective - FW-1**
- **Areas for Implementation** -Primarily extensive platted, undeveloped areas of Lee, Charlotte, and Sarasota Counties.

Strategy

- 1) Create a tax-exempt Land Trust for the establishment of wildlife habitat.
- 2) Inventory platted lands to identify areas of critical upland and wetland habitat.
- 3) Obtain the names and addresses of absentee property owners of targeted undeveloped lands from county tax offices.
- 4) Contact targeted property owners requesting:
 - land donation in exchange for income tax write-off.
 - exchange for equivalent land in non-targeted areas.
 - permanent wildlife easement.
 - sale of land to the trust.
- 5) Use acquired targeted properties for matching funds from:
 - the Trust for Public Lands
 - the National Audubon Society
 - the Nature Conservancy
 - Water Management Districts
 - Local, State and Federal Agencies
 - Private Business
- 6) The Trust can turn over large acquired tracts to appropriate government entities for management as permanent conservation areas.

FW-U (continued)

Potential Responsible Agencies & Organizations

Property Owners

County and Municipal Governments

Florida Department of Community Affairs

Regional Planning Councils

Water Management Districts

Private Organizations (Nature Conservancy, Audubon Society, Ducks Unlimited, etc.)

Expected benefits

Preserved existing critical upland and wetland habitats, that are currently platted for future development.

Reduce urban sprawl and need to provide services to areas outside current development.

Reduced future development in flood plain areas.

Monitoring Response

Develop a Geographic Information System (GIS) based inventory of undeveloped platted lands, critical upland, and wetland habitats, and an annual update of acquired lands.

Related Actions

FW-T

4.27 FW-V**Action**

Identify the potential living oyster bars for restoration within the estuarine waters of the Charlotte Harbor NEP study area. Identify the potential (recent and historic) dead oyster bar areas for recreation. Associate oyster enhancement with water quality, improved hydrology, and reassessed recreational harvest levels.

Background

- **Quantifiable Objective - FW2**
- **Areas for Implementation** -Estuarine waters within the Charlotte Harbor NEP study area

Based on the studies by Harris et. al. (1983), the total area of oyster bars within the waters of the Charlotte Harbor NEP was approximately 400 acres in 1982. This is in comparison to an estimated 800 acres in 1954. Much of this loss may be attributable to changes which have resulted from the large increase in the human population that have occurred around the Charlotte Harbor complex since the early 1950s. Presently, many of the remaining historic oyster bars within the waters of the NEP are in poor shape.

The South Florida Water Management District (SFWMD) is currently using oysters as part of a valued ecosystem component study to help determine how potential regulatory changes in the controlled discharges from the Caloosahatchee River may affect estuarine communities in San Carlos Bay and lower Pine Island Sound.

Habitat Restoration

The Florida Department of Environmental Protection's Shellfish section is very familiar with acceptable methods of recreating and restoring declining oyster bars. Management processes and their costs are well known for maintaining commercial bars in the panhandle and big bend regions of Florida. Such methods have been successfully been implemented in other southeastern and gulf coast estuarine areas.

Environmental Factors

Do decade-long, wetter than average years and drier than average years affect the distribution and abundance of oyster bars in the Charlotte Harbor complex? The answer is probably yes. Salinity variability above 20 parts per thousand (ppt) salinity or below 5 ppt is known to affect the presence and abundance of oysters. There is some limited evidence that there were die offs of some oyster bars near the mouth of the river in 1995 and 1998 due to unnaturally excessive freshwater discharges from the Caloosahatchee River.

In addition many well known, popular oyster bars have declined as a result of recreational harvesting. The primary reason for the declines in the size of these viable oyster bars is that, unlike natural mortality, no cultch is returned to the bars from such recreational harvesting.

Oyster bars have intrinsic value as complex hard bottom habitat for many species, foraging areas for some species, and as temporary night roosting areas for a number of bird species. Other human use of these bars as habitat include fishing and bird watching. In addition, oyster bars filter water and can have a positive effect on water quality.

FW-V (continued)**Strategy**

- 1) Develop a comprehensive inventory of existing oyster beds and determine the relative health of major bars.
- 2) Identify areas for restoration based both on historic and current bars.
- 3) Develop long-term plan for implementation of restoration plans, including funding sources.
- 4) Implement restoration.
- 5) Monitor effectiveness of restoration and, if necessary, make modifications based on the results.

Potential Responsible Agencies & Organizations

Florida Marine Fisheries Commission

Florida Department of Environmental Protection - Shellfish Section

Florida Marine Research Institute

U.S. Army Corps of Engineers

Water Management Districts

County and Municipal Governments

Florida Game and Freshwater Fish Commission

U.S. Fish and Wildlife Service

U.S. National Marine Fisheries

Expected benefits

The presence and abundance of oyster bars can be one of the primary indicators that more natural hydroperiods have been established for the Caloosahatchee River and other areas where there have been major hydrologic alterations of freshwater inflows. The increased opening of shell fishing areas can also serve as an indicator of an improvement in water quality within these estuarine areas. Increasing oyster bar habitat will also be beneficial to other fish and wildlife that use these areas, including many threatened wading bird species.

Monitoring Response

Aerial photography (past, present, and future) conducted by the Water Management Districts and the Florida Marine Research Institute can be used to identify oyster bar areas. Visual inspections can then be done to assess the relative health of identified major bars. In addition, the presence of oyster larvae in water samples can be identified for whether there is potential for re-establishing dead bars. Correlations between oyster bar elevations and tidal range should be determined and characterized.

Related Actions

FW-F, FW-G, FW-I, FW-L

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