MANATEE ELEMENT

September 12, 2011

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Introduction

The information in this section is taken from the Manatee Protection Plan Element of the *Citrus County Comprehensive Plan*, prepared by the Citrus County Planning Department. Any manatee protection plan developed or adopted by the City will be in coordination with the County plans already in effect.

Setting

The West Indian (Florida) Manatee (*Trichechus manatus latirostris*) is a year-round inhabitant of the coastal waters and rivers of Crystal River and Citrus County. During the winter months, a significant number of manatees seek out the water outflows of natural springs for warmth, food, and rest. As coastal waters begin to warm in the spring and summer months, the manatee population disperses throughout Big Bend Gulf coastal waters.

The City of Crystal River attracts many of its new residents and visitors because of the tremendous natural recreational resources provided by its coastal waters and rivers. The endangered manatee depends upon these same resources for its survival. Although the local manatee population has grown in recent years, there is still a need to protect manatees while allowing for enlightened recreational and commercial use of Citrus County's coastal rivers and waters.

Purpose

The purpose of this plan is to provide County-wide protection for the West Indian (Florida) manatee. To provide effective protection, this plan contains criteria for marina/boat facility siting, law enforcement, shoreline/submerged land development, educational programs, habitat protection, manatee-human interactions, and governmental coordination.

Objectives

The long range recovery goal for the Florida manatee, as required by the Marine Mammal Protection Act of 1972, is to maintain "the health and stability of the marine ecosystem" and their numbers at "optimum sustainable population" levels (U.S. Fish and Wildlife Service [USFWS] 1989). The County's goal is to assist in meeting the goals of the Marine Mammal Protection Act of 1972. An interim objective is to downlist Florida manatees from "endangered" and "threatened" pursuant to the provisions of the Endangered Species Act of 1973, as amended (USFWS, 1996). Programs, standards, criteria, objectives, and policies to achieve the County's objectives of reducing mortality and injury; ensuring the continued existence of suitable habitat and minimizing harassment are contained in this plan.

Inventory and Analysis

Prior to the development of this plan, the Crystal River and the other Citrus County coastal waters were the subject of a regional study and plan for the protection of manatees. That study, the Proposed Research/Management Plan for Crystal River Manatees (Packard, 1983) concludes that the following issues need to be analyzed and planned for in order to adequately protect the manatee:

- Manatee-Human Interaction (or Overlap);
- Land Development;
- Water Quality and Vegetation;
- Habitat Protection; and
- Warm Water Refugia.

To improve the Manatees' chances of a full recovery, these additional issues have also been analyzed and planned for:

- Education; and
- Governmental Coordination.

Manatee-Human Overlap

Human activities greatly impact manatees especially during the winter months when manatees congregate in warm-water refugia and during the warming period when manatees begin to disperse throughout Florida's Big Bend Coastal Region. Activities known to either harass, injure, or kill manatees include boating, fishing, swimming, snorkeling, diving, and water-related construction (Packard, 1983). Activities which disrupt the manatees' normal routines, prevent them from feeding or resting or cause them to move unnecessarily, may cause physiological stress (Buckingham, 1990).

Manatee-Human Interaction Study

A study of manatee-human interaction in Kings Bay has been conducted by USFWS staff from the Cooperative Research Unit and the Chassahowitzka National Wildlife Refuge Complex. The research was directed at determining the impacts of human activities in Kings Bay on manatees and forming a basis for eliminating incompatible manatee-human interaction.

The study shows that manatees come to Kings Bay, particularly the South Bay, in response to dropping air and water temperatures, regardless of the number of boats present. (One of the concerns that led to this study was the possibility that manatees were being driven out of the South Bay by the weekend crowds of people. The author believes this not to be the case). However, the study finds that manatees are continuing to use the South Bay, but they are spending a disproportionate amount of time in the sanctuaries in direct relationship to the number of boats present. The presence of large numbers of boats in the South Bay alters the way

manatees use this critical habitat by confining them to smaller areas. The study concludes that this situation constitutes harassment as defined by the Endangered Species Act because normal behavioral patterns have been significantly disrupted (Buckingham, 1990).

To remedy this situation, the study recommends several approaches to reduce harassment in the area: 1) limiting the number of boats on the South Bay during the coldest weather and closing the area to boats during the night and early morning when temperatures are the coldest; 2) creating new sanctuaries to protect foraging areas and expanding existing sanctuaries to accommodate the increasing number of manatees using the South Bay; 3) further study of the human impacts caused by divers and snorkelers; 4) restricting night diving; 5) coordinating Federal, State, and local agencies law enforcement efforts; and 6) expanding the winter idle speed zone in the South Bay (Buckingham, 1990).

USFWS has determined that the most enforceable and practical of the study's recommended actions were to expand the existing sanctuary system in Kings Bay to include new warm water and foraging areas. Four new sanctuaries were established in Kings Bay within or near the Crystal River National Wildlife Refuge and one existing sanctuary containing the King Spring was significantly enlarged.

Protective Designations

The designation of sanctuaries, refuges, critical habitats, essential habitat, and speed zones are aimed towards protecting the manatee from the impacts of human activity. Sanctuaries refuges and critical habitats are federal designations, under the authority of the Endangered Species Act. Essential habitat is a designation recently established by the State. Speed zones can be established and enforced by federal, state, and local governments.

Federal and State Designations

Sanctuaries, refuges, and critical habitats are designations established by the Endangered Species Act of 1973. Sanctuaries are areas in which human activities are prohibited so that manatees can breed, nurse, and rest free from human harassment. The seven existing sanctuaries in the County are all in Kings Bay. Manatee refuges are areas where interaction is allowed but where certain waterborne activities are restricted to prevent the disturbance and harassment of the manatees.

Critical habitat is a broader designation for areas which are essential to the conservation of the species and which require special management considerations or protection. The Crystal River and Kings Bay are currently the only Citrus County water bodies designated as a critical habitat for manatees. All County coastal waters are considered to be areas of manatee-human interactions.

Essential Habitat is used in this plan as criteria for determining areas where dock facilities should be limited. Essential Habitat is any land or water area constituting elements necessary to the survival and recovery of the manatee population from endangered status, which may require special management considerations and protective measures. The constituent elements include, but are not limited to: space for individual and population growth and for normal behavior; available food sources with adequate water depth and

quality; warm and fresh water sources; sites for breeding and rearing of offspring; and habitats protected from disturbances that are representative of the geographical and seasonal distribution of the species.

Existing Boat/Vessel Speed Zones

Speed zones are located in areas and corridors, which are frequently used by manatees. By requiring boat operators to travel at slower speeds, the high speed impacts, which are often fatal to the manatee, can be prevented. The existing speed zones illustrated in Figures MP -1 through MP -3 are a combination of zones regulated by the Federal, State, and local law enforcement agencies. The zones are in effect either seasonally or year-round depending upon when manatee/boat conflicts are most likely to occur in the corresponding area. Figures MP -1 through MP -3 indicate the specific duration of each regulation period for the existing zones.

Need for Additional Boat/Vessel Speed Zones

In some existing speed zones, where recreational use is heavy, there may be a need for further restrictions and in others, existing restrictions systems are too complex and may need to be simplified.

Crystal River and Kings Bay

Manatees use the Crystal River year-round because of the warmth of its water and its abundance of vegetation. While in the river, the manatees are most vulnerable to boat collision when they are in shallow water along the banks feeding on the vegetation. Manatees have shown the apparent ability to avoid boats by diving out of the way in deep water (Packard, 1983). The establishment of marked slow speed corridors along the banks of the river provides an enforceable restriction system that would accommodate boaters and enhance manatee safety. Boats can operate within the central corridor at cruising speeds providing a lower risk of collision with a manatee. Outside the central corridor where the water is shallow, boat traffic is required to maintain “slow speed” to allow time for manatees and boat operator to avoid one another.

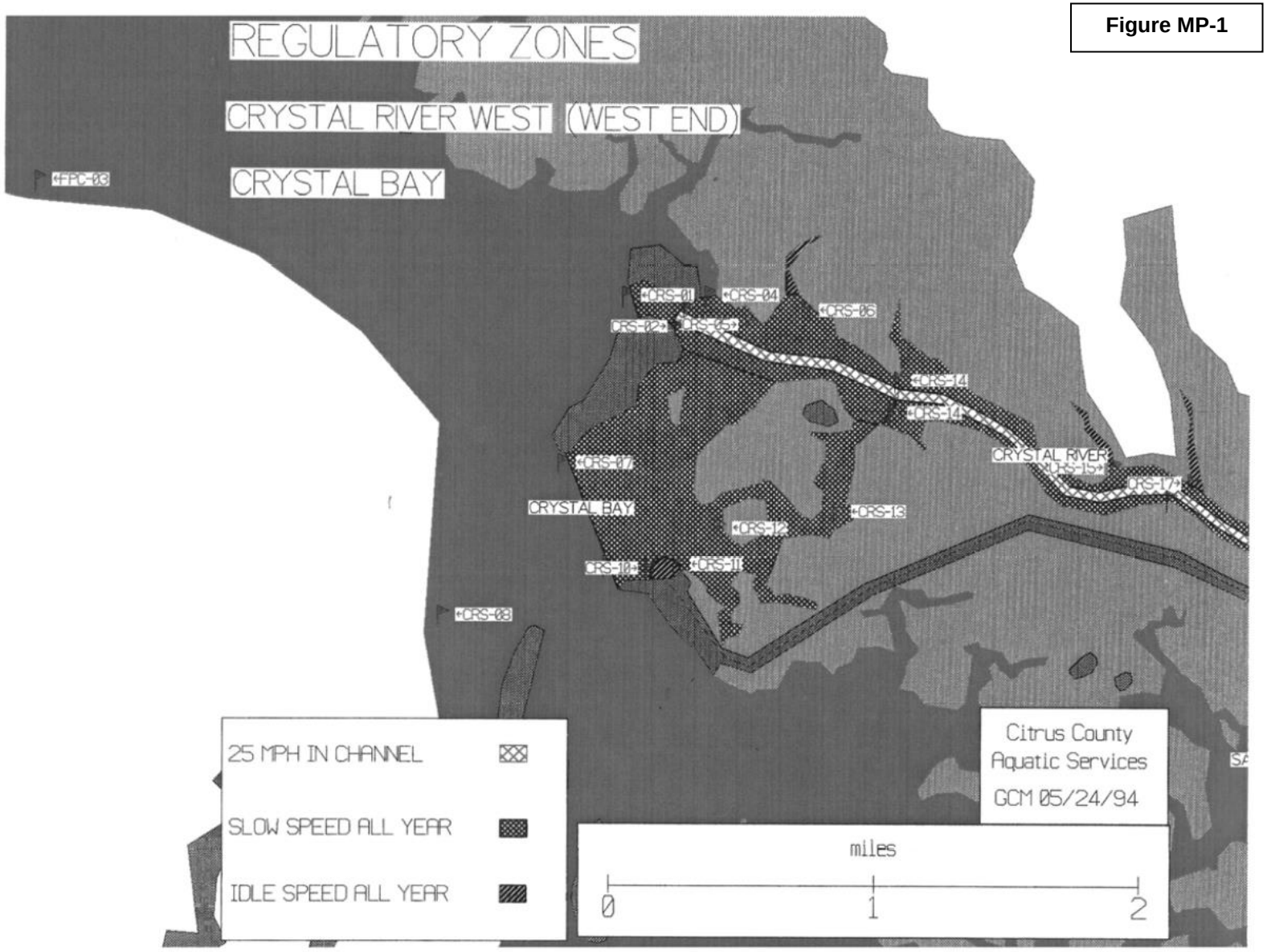
Kings Bay experiences the heaviest manatee use within the Crystal River system in addition to intense recreational use year-round. The bay has the highest level of human/manatee overlap in the County and therefore, the greatest need for an easily enforceable and understandable set of protective zones. However, confusion exists over the various speed zones and their effective dates on Kings Bay. Designation of the northern part of the Bay as a “Summer Watersport” zone during non-winter months allows the use of watercraft such as jet skis, water-bikes, and water skiing during the period when manatees use the bay the least. The establishment of this portion of the Bay as a “Winter Slow Speed” for the remainder of the year provides needed protection during the most intensive manatee-use period. Extension of the existing “Winter Idle Speed” to “Year-round Idle Speed” in the southern portion of Kings Bay eliminates confusion over the

effective dates of speed restrictions and provides greater protection for the manatees in one of their core activity centers.

Salt River

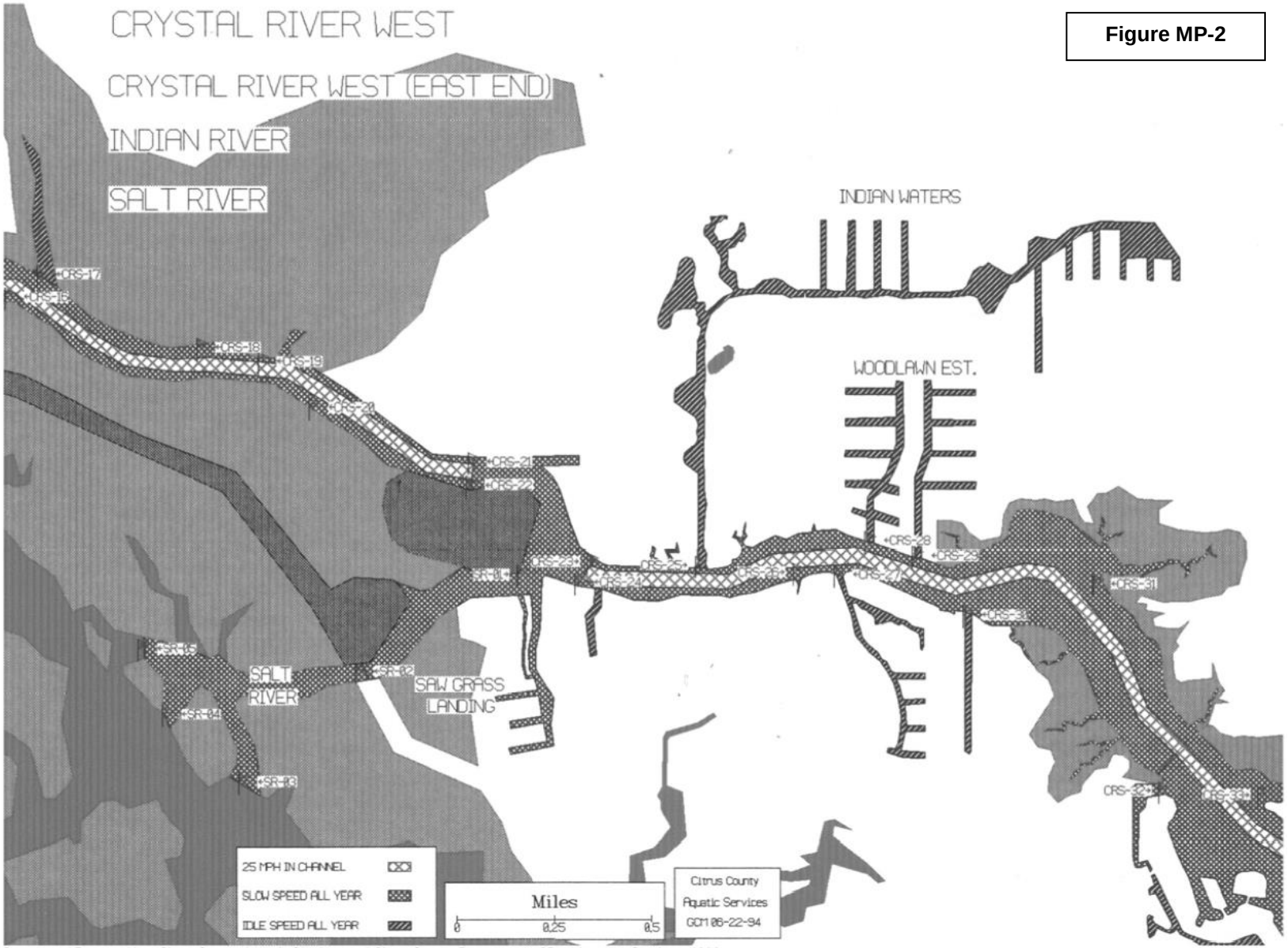
Manatees linger at the confluence of the Salt and Crystal Rivers while feeding and waiting for high tide (Beeler, 1988). A number of boat launching facilities are located near this confluence area, including a county boat ramp. This area has a "Year-round Slow Speed" designation due to the existing and future boat traffic levels and the importance of it as a manatee habitat.

Figure MP-1



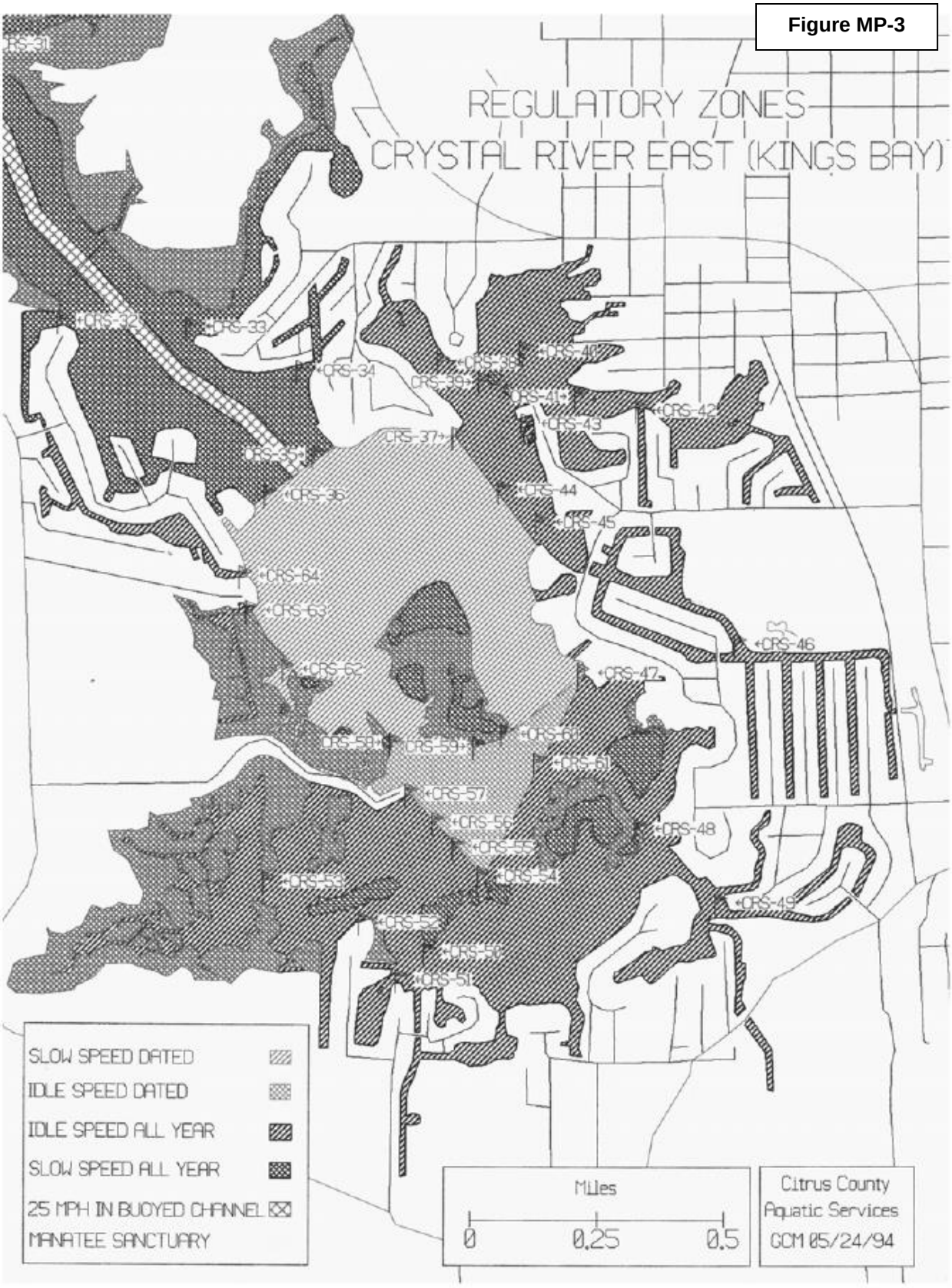
Source and Prepared by: Citrus County Aquatic Services and Citrus County Department of Development Services, 1996

Figure MP-2



Source and Prepared by: Citrus County Aquatic Services and Citrus County Department of Development Services, 1996

Figure MP-3



Source and Prepared by: Florida Fish and Wildlife Conservation Commission and Citrus County Department of Development Services, 2004

Speed Zone Signage

Existing speed zone signs were replaced under a uniform signage program by DEP in March 1992. Unfortunately, an intense winter storm in March 1993 has resulted in some signage damage and loss. In addition, the use of buoys to mark the central corridor of the Crystal River has not been successful due to buoy damage and movement. Citrus County has entered into an Interlocal Agreement with DEP to address long-term maintenance and is working with the Department to correct problems with signage. The buoys were replaced with fixed signage in 1996 through a Special Waterways grant.

Crystal River and Homosassa River Boating Study

A boating study was conducted in 1987-88 for the Crystal and Homosassa Rivers. This study, entitled "Manatee Protection Project: Boat Usage Patterns, November 1988", was prepared by Dr. J. Wesley Hutchinson, Associate Professor of Marketing, University of Florida. The study concludes that:

- The vast majority (approximately 75 percent) of the people who used boat ramps on the rivers did not reside in Citrus County.
- The average boat trip consisted of between three and four people in a boat 16 to 20 feet in length, staying on the water for 6 to 7 hours and more than half of that time was spent anchored.
- The average boater made 10 trips on the river during the winter and about 14 trips during the summer.
- Most boating activities took place within 10 miles of shore. Only 50 percent of the sample indicated that they entered the Gulf at all.
- While the percentage of boaters that entered the Gulf decreased in the winter, the percentage that traveled in the river and springs areas remained approximately the same.
- The distributions of boating activities on the two rivers and in the Gulf are, in general, quite similar to the distribution of manatee activity except in the immediate vicinity of the springs where the winter manatee population is greatest.
- The boat ramp closest to the Gulf on the Crystal River, Fort Island Beach, did not contribute to boat traffic in the springs area of Kings Bay.

A summarization of the boating study for the purposes of this plan reveals that boat usage patterns are directly related to the locations of launching or docking facilities, 72 percent of the boat ramp users were from outside Citrus County, and several boat ramps (Pete's Pier, Knox Bait House, Plantation Inn, and Crystal Lodge), within Kings Bay, contributed a significant portion of trips to the Gulf.

Manatee Mortality and Injury

Manatee mortality records for the Big Bend region of Florida, including Taylor, Lafayette, Dixie, Gilchrist, Levy, Citrus and Hernando Counties, consist primarily of deaths due to non-human related causes. From 1974 through June 30, 2005, 158 of the deaths occurred in Citrus County. Sixty seven of the dead manatees were dependent calves. Other causes of death included: 37 which died due to watercraft related incidences (Map MP -1); 25 manatees which died from undetermined causes (including animals verified dead but not recovered); 23 which died of natural causes; one which died in flood control structures; 9 which died of cold stress; and 5 which died due to another human cause (Table MP -1).

Injury and scarring are additional factors, which have not been analyzed. Data on the origin of the injury or scarring has not been recorded due to the difficulty of determining where and when nonfatal or non-acute injuries occur. Recent surveys of the Crystal and Homosassa Rivers have indicated that many of the manatees observed have scars on their backs, most likely the result of watercraft collisions.

Manatee Distribution

Manatee distribution throughout coastal Crystal River, Citrus County, and the region is concentrated during the winter months near warm water refugia and dispersed throughout the spring/summer months along the coastal fringes and near shore areas.

The following section is an excerpt from Distribution and Movement Patterns of Manatees (*Trichechus manatus*) in Northwestern Peninsular Florida (Rathbun, et. al., 1990, see Appendix S. Distribution of Manatee Sightings for totals of manatees counted on individual rivers).

This paper presents information on the distribution and movement patterns of manatees in northwestern peninsular Florida (defined herein as the western coast between the Suwannee and the Chassahowitzka Rivers). Data was obtained by aerial surveys conducted at least monthly from April 1981 through August 1985, radio-tracking studies from winter 1978-79 through winter 1985-86, and re-sightings of recognizable individual manatees from April 1981 through August 1985. The data from these three types of surveys show that manatees in northwestern Florida use primarily the headwaters of the Homosassa and Crystal Rivers as their winter, warm-water refuges.

Intensive 24-hour radio tracking of three individuals indicated that all three spent most of their daylight hours near these warm-water refuges, but on some nights they traveled downstream as far as 7 km (4.4 miles) to feed on *Ruppia maritima* and *Potomogeton pectinatus* in estuarine areas.

During the summer months, manatees were sighted in all of the major river systems of the southern Big Bend coast. Aerial surveys showed that Crystal River was used most heavily by manatees, followed by the Suwannee River, the Homosassa River, the Chassahowitzka River, the Withlacoochee River, the Progress Energy (PE) Crystal River power plant effluent canal, the Cross Florida Barge Canal (CFBC), and the Waccasassa River. Sightings outside these waterways were rare, and all were in or north of Waccasassa Bay. Survey paths were designed to monitor the distribution of manatees in and around the major waterways and were not expected

to detect manatees in the adjoining coastal waters unless they were found in conspicuously large numbers.

About 85 percent of the aerial-survey sightings of manatees in the Withlacoochee River were made in the lower portions of the river, including the mouth. Few manatees were seen in the freshwater part of the river, which extends from Yankeetown up to the spillway on the canal. The findings within the Withlacoochee River may be affected by the turbidity of this tannin-stained waterway. This condition makes aerial survey work difficult and may significantly affect the results. The Chassahowitzka National Wildlife Refuge Complex reports indicate many manatees are sighted by area residents up to and beyond the US-19 bridge including the Rainbow River and Lake Rousseau.

Thirty-two aerial-survey sightings were made at the CFBC and the isolated segment of the Withlacoochee River between the canal and the spillway at Lake Rousseau. The animals were distributed fairly evenly between the mouth of the canal, where Beauregard was located by satellite on several occasions, and the pool at the base of the spillway.

Sightings in the vicinity of the PE Crystal River power plant effluent canal were concentrated in the western end of the discharge canal; only one manatee was seen in the intake canal. The three animals (at two locations) in the shallow bay south of the power plant were probably associated with the Crystal River system.

Table MP-1
Citrus County Manatee Deaths by Year
January 1974 through February 2010

Year	Total	Watercraft	Canal Lock	Other (Human)	Dependent Calf	Other (Natural)	Cold Stress	Undetermined
1974	1	1						
1975	0							
1976	1							1
1977	4			1				3
1978	2	1			1			
1979	2				2			
1980	2				1	1		
1981	1				1			
1982	4				3	1		
1983	1				1			
1984	5	2			3			
1985	3	1			2			
1986	4	2	1		1			
1987	6				4	1		1
1988	7	2			4	1		
1989	5	2				1		2
1990	4	1			1	2		
1991	5				4	1		
1992	9	3			3	2		1
1993	7	1		1	2	1		2
1994	5	2				3		
1995	6				4	1		1
1996	6	2			3			1
1997	5	1		1	2			1
1998	4	2			1			1
1999	6	3			2	1		
2000	6	1		1	2			2
2001	9	1			6			2
2002	9	3		1	4	1		
2003	10	3			2		3	2
2004	7	1			1		3	2
2005	18	6			9			3
2006	10	2		1	2	1	1	3
2007	12	5			3	2		2
2008	22	8			6	5		3
2009	6	2			2	2		
2010YTD	3	1					2	
Total	**217**	**59**	**1**	**6**	**82**	**27**	**9**	**33**

Source: Florida Fish and Wildlife Conservation Commission
Prepared by: Withlacoochee Regional Planning Council, 2010

During summer surveys, manatee sightings were distributed fairly evenly along the length of Crystal River below Kings Bay. Over 70 percent of the total sightings were made in Kings Bay; comparatively few sightings were made in Crystal Bay and the Salt River. During winter surveys, over 90 percent of the sightings in Crystal River were in Kings Bay. Each segment downriver from the bay had progressively fewer sightings.

To determine the patterns of distribution within Kings Bay, aerial-survey results from January 1982 through October 1984 were plotted within 50x50-m (54.7 feet) grid-squares and summarized as the average number of sightings per flight during each of four "typical" months. January and July surveys were used to represent winter and summer distributions, respectively, and March and October surveys were used to represent spring and fall (periods of transition for manatees) distributions, respectively.

In January, manatees were sighted in nearly all of the grid-squares, with especially high averages recorded near sources of warm water (e.g., Main, Tarpon, and Magnolia Springs). During the March surveys, the use of Kings Bay decreased considerably as animals dispersed, although manatees still frequently used the warm-water areas. In July, the fewest number of manatees used the bay; most of the time they stayed near the mouth of the bay. Sightings made during October were similar to those made during March, but there were more sightings around the southern end of the bay. Sightings made during October were similar to those made during March, but there were more sightings around the southern end of the bay during October. The animals were not near the springs.

Almost 75 percent of the sightings in the Homosassa River during the summer surveys were concentrated in the upper third of the river, and nearly 33 percent were in the wide section below Buzzard Point. The confluences of the Salt River and Price Creek and the mouth of the Homosassa River combined, accounted for nearly 16 percent of the sightings. With the exception of Blue Water, manatees were rarely seen in the narrow portions of the Homosassa River. The distribution of sightings in the Homosassa River during the winter surveys was similar to that of Crystal River. Nearly 65 percent were seen in Blue Water. Each segment of the river towards the mouth accounted for progressively fewer sightings. The winter 1983-84 sightings in Blue Water were plotted on a large-scale map to determine distributional patterns. The animals showed some preference for the deeper areas, such as boat channels, and avoided narrow canals and shallow coves. Some of the distributional data indicated that the manatees formed loose aggregations in the upper, middle, and lower regions of Blue Water. The narrow, shallow channel below Blue Water was used mainly as a travel corridor.

Records of five manatees tracked in the Homosassa River from February through June 1985 were used to determine which segments of the river were most heavily used. The Blue Water segment accounted for 30 percent of the locations where the manatees were sighted, followed closely (nearly 30 percent) by the confluences of the Salt River and Price Creek. The wide portion of the river below Buzzard Point accounted for over 16 percent, and the rest of the segments accounted for 4.0 percent - 5.7 percent of the locations where the five manatees were sighted.

The lower portion of the Chassahowitzka River was divided into three segments. The middle and lower segments combined accounted for about 80 percent of that river's summer aerial-survey sightings; the rest of the sightings were made in the shallower, upper section of the river.

Data gathered from the three manatees that were intensively tracked in Crystal River in 1981 provide the first detailed information on movement patterns within the river. All three manatees depended on the artesian springs in Kings Bay for warm water and made foraging trips away from these sites. Most of these trips involved leaving warm-water sites in midmorning, slowly moving into central or northern Kings Bay by afternoon, and then swimming down-river at dusk. The animals often waited for high tide at the confluence of the Salt River; then they swam out Salt River to feed on the *Ruppis maritima* beds associated with the Salt River and Crystal Bay, or they swam down Crystal River to the *R. maritima* beds along the banks of the river, halfway to the mouth.

Movement Patterns

Aerial surveys are usually conducted on regularly scheduled days. Based on aerial-survey results, both Kings Bay and Blue Water were thought to be the most important habitats for manatees during the winter: 93 percent and 56 percent of aerial-survey sightings were in these two areas, respectively. However, radio-tracking studies have shown that these two areas are not as important as aerial-survey data alone indicate: 74 percent and 30 percent of loci from radio tagged animals were in these two areas, respectively. In both areas, downriver sites are much more important than previously thought.

Law Enforcement

Enforcement of boat speeds and manatee protection regulations within Citrus County is conducted through a multi-agency enforcement approach. These agencies include the Florida Marine Patrol of the DEP, U.S. Fish and Wildlife Service (USFWS), U.S. Coast Guard, Florida Game and Freshwater Fish Commission (FGFWFC), Citrus County Sheriff Department, and the Crystal River Police Department.

The most important aspect of improving law enforcement efficiency regarding the manatee has been to increase coordination between the various agencies and offices. Three identified means of accomplishing these tasks are: 1) developing working relationships between all law enforcement personnel and agencies; 2) increasing personnel; and 3) development of the Manatee Interpretive/Education center in Crystal River area.

Developing a working relationship between all enforcement agencies and personnel benefited enforcement activities by ensuring that the regulated areas and zones were monitored in such a way as to provide full and efficient coverage.

Increasing personnel would allow the agencies to monitor and enforce laws throughout the critical areas in the coastal waters.

Establishment of the Crystal River National Wildlife Refuge headquarters has given the USFWS a greater presence on Kings Bay and Crystal River. In addition, the construction of a Florida Marine Patrol (FMP) headquarters on the Cross Florida Barge Canal has increased the FMP presence in the region.

Land Development

Properly controlled land development is critical to manatee protection. Development activities occurring in a watershed or along shorelines ultimately affect the waterbody, thus affecting species survival in the aquatic environment. Shoreline and submerged land development activities which are harmful to the aquatic environment include the construction of artificial canal systems, dredging and filling, construction of structures which eliminate beneficial aquatic vegetation, placement of structures which can trap or crush manatees, and placement of bulkheads below the ordinary high waterline.

Marina/Boat Facility Siting

Marina/boat facility siting for the purposes of this plan is defined as the determination of a location for commercial marinas, commercial docking structures, and public/private boat launching facilities. Marinas, docks, and boat ramps may have a direct effect on manatees and their essential habitat by: 1) reducing aquatic vegetation in feeding areas, 2) obstructing manatee movements along shallow shorelines, 3) providing a source of contaminants, and 4) disrupting functions of wetlands through dredge and fill activities (Packard, 1983). It should also be noted that improperly sited facilities may increase the probability of boat collisions with manatees especially if the facilities increase boat traffic in manatee habitat areas.

The relationship between manatee habitat and boat traffic was analyzed in order to distinguish the vulnerability of specific areas to the development of docking and launching facilities. Sites suitable for the development of boating facilities should meet the following criteria: 1) minimize boat travel in areas where manatees are sighted; 2) do not cause destruction of aquatic vegetation eaten by manatees; and 3) meet design standards in wetlands (Packard, 1983).

Analysis for Siting Criteria

The following analysis of each waterway uses two criteria for identifying suitable sites for marina/boat facility siting:

- Minimizing disturbance of wetland; and
- Minimizing boat/manatee overlap (Figure MP-4).

Crystal River and Kings Bay

The Packard Plan analyzed suitable areas on the Crystal River/Kings Bay and found no suitable sites. Areas were identified which either minimize boat/manatee overlap or minimize the disturbance of wetlands. The only areas on the Crystal River and Kings Bay which are sites minimizing boat/manatee overlap are located downstream near the Gulf at two locations, one at Fort Island and one near the mouth of the river (Figure MP -4). However, it should be noted that both sites are located in the Coastal High Hazard Area (velocity zone; see Coastal, Lakes, and River Element of Comprehensive Plan) and would not be appropriate for marina/boat facilities development.

Residential Docking Facilities

Residential docking facilities are defined as docks and wet slips provided for the sole use of the residents of a residential land use adjacent to a waterbody. These docks should not be permitted to be used for commercial purposes or as rental facilities. All docks should be subject to construction standards, which will ensure that they are designed so that they will not entrap or injure manatees.

Residential docking facilities can be further classified as single family and multifamily docks.

Single Family Docks

Single family docks can be regulated differently than multifamily or multi-slip residential docks because, if constructed properly, they have a lesser impact on the aquatic environment.

Multifamily Docks

Waterfront multifamily areas have potentially greater impacts than single family areas of shoreline because they result in greater concentrations of boats. Therefore, more stringent siting criteria are needed. These criteria should not allow high intensity docking facilities adjacent to Sanctuaries, Warm Water Refuges, in Critical Habitats, or in any other area constituting essential habitat for the manatee.

With assistance from the Citrus County Community Development Division, the Manatee Plan Committee investigated potential build-out scenarios of multifamily and single family residential docks with maximum dock density standards for multifamily of 1) two slips per 100 feet of shoreline and 2) three slips per 100 feet (the standard for single family is one slip per 100 feet of owned-shoreline as required by the Citrus County Comprehensive Plan).

This brief study considered generalized future land use designations on coastal properties outside the Coastal High Hazard Area and the amount of developable or easily re-developable property with significant amounts of shoreline on rivers or canals, which would accommodate multifamily and/or single family docks (400 scale, aerial photos were used to determine if parcels, in applicable future land use categories, were vacant or underdeveloped and to eliminate canals which were too narrow or too short to accommodate multifamily dock). Because of the brevity of the study, developed, shoreline, single family lots without docks were not considered in the total build-out. It was assumed that those residents who wanted docks had already built them (these non-docked single family lots were sprinkled throughout the coastline and would not be large enough for or allowed to have multifamily development and would, therefore, only contribute to the base number of single family docks and not the multifamily scenarios).

The findings of the Committee were that, at three slips per 100 feet, the County's coastal shorelines would have approximately 385 new multifamily slips at buildout versus approximately 255 new multifamily slips at two slips per 100 feet. Added to the base of

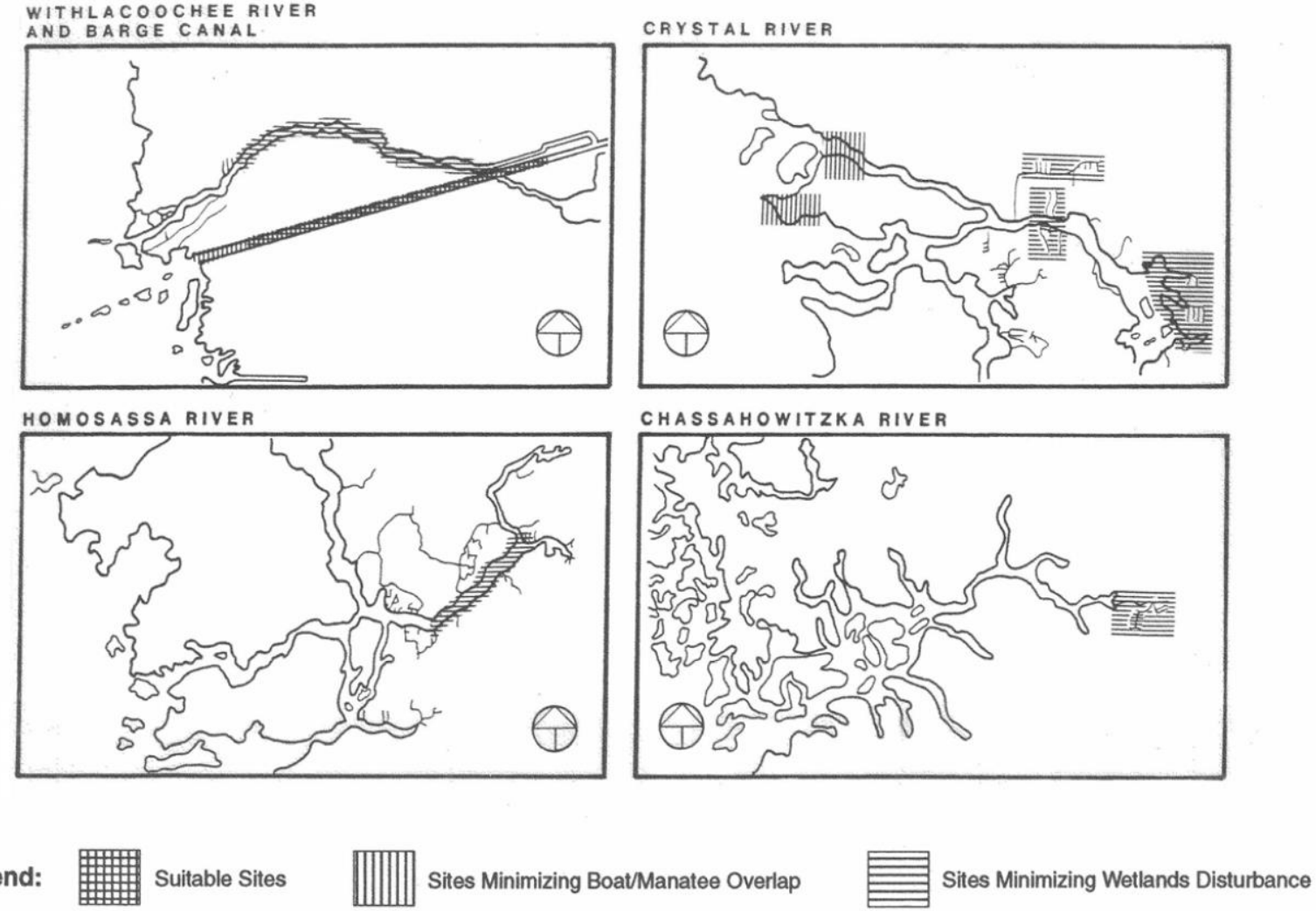
approximately 265 slips new single family slips, the three per 100 feet criteria yields 648 new slips versus the 520 slips yielded by the two per 100 feet criteria for the whole County coastline. Based on this information, the Committee chose to allow vested multifamily development develop docking facilities at two slips per 100 feet of shoreline and have all new multifamily and single family developments adhere to the one slip per 100 feet criteria.

Construction on Submerged Lands

The effects of upland and shoreline development on manatees are often indirect, whereas effects of submerged land development can be direct. Docks, piers, and other such structures designed and constructed without concern for compatibility with the environment can lead to disastrous results. Poorly planned and constructed submerged structures may reduce the quantity and quality of food resources for manatees, as well as increasing the probability of injury and entrapment. The construction and alteration of the shoreline and upland areas to increase the amount of waterfront lots in a development can destroy the natural functions of the shoreline and associated wetlands, and degrade water quality. The following issues regarding construction on shorelines and submerged land need to be addressed.

Figure MP-4

Sites Minimizing Impact of Future Boating Facilities on Manatees



Source: Packard, 1983.
Prepared by: Citrus County Department of Development Services, 1996.

Shoreline

Development standards for shoreline areas would address the maintenance of natural vegetation and the placement of non-water dependent structures above the ordinary high water line or the safe uplands line.

Conveyance Structures

Conveyance structures such as stormwater drainage pipes and culverts, which are large enough for manatees to stick their head into, should be covered by a grate or screen to prevent entrapment.

Submerged Lands

Development standards for submerged lands would address the preservation of submerged vegetation, placement of dredge and fill materials, and the capacity, size, and the design of structures below the ordinary high water line.

Water Quality and Vegetation

Manatees may be susceptible to a variety of water contaminants, including pesticides, herbicides, industrial by-products, and pathogens associated with human sewage (Packard, 1983). The objectives of this Plan must address the fact that water quality improvements and maintenance are essential for manatee survival. Two specific areas to be addressed include water quality and vegetation.

Water Quality

Water quality within the study area is characterized as good. However, degrading factors have been recorded for most waters which are frequented by manatees. The Conservation and Coastal, Lakes, and River Management (CLRM) Elements of the Citrus County Comprehensive Plan address water quality throughout the County. The Conservation and Coastal Management Elements of this Plan address water quality throughout the City of Crystal River. Specific criteria have been included in the Comprehensive Plan for managing, improving, and maintaining water quality. The Surface Water Improvement Management (SWIM) program operated by the SWFWMD has identified Crystal River/Kings Bay as a priority water body. A water quality improvement and management plan has been prepared by SWFWMD staff and the Crystal River SWIM Committee. A water quality study was conducted by Florida Land Design and Engineering, Inc. in 1988 on the Homosassa River. The study found that septic tanks appear to be significant contributors of bacteria to the river system especially around the headwaters. Other factors found to be contributing to low water quality included the sewage treatment plant

leachate, stormwater runoff, and effluent associated with the Homosassa Springs Wildlife State Park. The Park has since connected to the County's regional system.

Conservation Element and CLRM Element of the Citrus County Comprehensive Plan

These two elements of the Citrus County Comprehensive Plan have established framework for managing our surface waters. The Plan calls for the preparation, adoption, and implementation of water quality management plans for all water bodies throughout the County and the designation of Outstanding Florida Water classification for the Chassahowitzka River, Homosassa River, and Halls River. Also, the plan sets the framework for intergovernmental coordination with the Cities of Crystal River and Inverness pertaining to the management of coastal, lakes, and river resources.

Crystal River/Kings Bay SWIM Program

The Southwest Florida Water Management District (SWFWMD) and the Crystal River SWIM Committee have prepared a SWIM Plan for Crystal River and Kings Bay. The main goals of the SWIM Plan are to: 1) protect and enhance the identified areas of environmental quality; 2) reverse the environmental degradation; 3) optimize water quality and other habitat values; and 4) maintain a productive, balanced ecosystem.

The SWIM Plan will be implemented by the SWFWMD and will require the unified support and financial assistance of the County and the City of Crystal River.

Aquatic Plant Control

Because of an excess of nutrients and other factors, aquatic plant control must be conducted by the Citrus County Division of Aquatic Services to maintain navigational paths on the Crystal, Homosassa, and Chassahowitzka Rivers. On the Withlacoochee River, vegetation is controlled by the SWFWMD.

Since the Crystal and Homosassa Rivers are wintering habitats for manatees, special plant control methods are required to ensure manatees or their habitats are not harmed by these activities.

The agencies responsible for aquatic plant control and manatee protection in the Crystal and Homosassa Rivers established an inter-agency relationship in 1982. These agencies, which include the U.S. Fish and Wildlife Service, Army Corps of Engineers, Department of Environmental Protection, and Citrus County Department of Aquatic Services, meet on an annual basis to revise the Summer/Winter Treatment Plan.

Designated prime feeding and congregation areas used by wintering manatees do not receive any aquatic plant control. This inter-agency Plan also scrutinized the use of herbicides and prohibited the use of herbicides potentially harmful to manatees during the wintering months. Of the aquatic herbicides currently permitted in the state for use on submerged vegetation, only Aquathol-K (an

endothal salt compound) and SONAR are allowed in accordance with the Plan. Their use is restricted to certain areas used less frequently by manatees and then only during the non-winter months.

The Treatment Plan now provides for the inclusion of the Homosassa River with emphasis on mechanical harvesting in Kings Bay and Homosassa River. In many areas of Kings Bay and the Homosassa River, mechanical harvesting is an effective means to control aquatic vegetation. It permits vegetation levels to be maintained in areas that are used by manatees. Thus, specific amounts of vegetation can be removed to create a balance between too much vegetation, which might restrict human use of the river, and too little vegetation, which would endanger the manatee.

However, in some man-made canals, conditions are such that mechanical harvesting alone is not sufficient to keep weed growth under control to a level at which adequate navigation paths can be maintained.

Where the Treatment Plan allows for the use of DEP-approved herbicides, it is critical to facilitate their proper application by residents and contractors. It is also critical that citizens understand that it is illegal to apply aquatic herbicides without a permit. All citizen-initiated plant control activities must be coordinated through the Department of Environmental Protection, Aquatic Plant Management office in Floral City.

Residents must obtain permits, should use the services of professional applicators instead of applying herbicides themselves, and should organize to have whole canals treated at one time. Special efforts should also be made to discourage the use of hazardous chemicals such as copper sulfate, which may have an extremely negative impact on manatees and other desirable aquatic plant and animal life.

Female manatees seek out the quiet waters of canals to give birth. They may stay in these canals for extended periods while nursing their calves. The use of any herbicides may have a negative impact on nursing female manatees and their calves.

Consideration should be given to the over-effective use of herbicides on hydrilla. If all of the hydrilla is removed from an area, it may be replaced by an infestation of lyngbya. Lyngbya is an algae which grows on the bottom of the bay, and also forms large floating mats. These surface mats have several negative effects: they impair navigation and recreational uses of the water and the decay of the algae produces a foul, musty odor. Portions of these algal mats may wash up on banks and canals, further impairing the aesthetic quality of Kings Bay. Lyngbya also has no food value for manatees (Romie, 1990).

A study by Dr. Bruce Cowell, University of South Florida (Romie, 1990), has found that the presence of lyngbya is most strongly related to the absence of hydrilla. These two nuisance weeds rarely coexist. Bay waters and canals in which hydrilla is over-managed may be placed at risk of a lyngbya infestation.

The vigorous growth of hydrilla and lyngbya and other aquatic nuisance plants is believed to have a direct relationship to the general level of nutrients in the Kings Bay/Crystal River system. One of the factors controlling that nutrient level is the time it takes for water to be flushed out of the system.

The 1999 Crystal River/Kings Bay Surface Water Improvement and Management Plan contains the following text regarding the circulation and flushing within this water body:

Circulation and Flushing: In 1989, the District entered into an agreement with United States Geological Survey (USGS) to develop a computer model of Kings Bay. The purpose of the project, Water Motion and Retention Times in Kings Bay, is to determine how water movement in the bay is affected by tides, variation in spring discharge, and the physical configuration of the bay. Modeling analysis included water velocity, mixing, and retention times. To facilitate model development, an intensive data collection effort was conducted by the USGS on June 7-8, 1990. During this period, flow velocity and direction, and tidal stage data were collected at various points in the bay to be used in the computer model. While the final report has not yet been published by the USGS, preliminary results yield interesting insight into Kings Bay (K. Hammett, WWW.USGS.pers.com).

One interesting result of the study is that the data suggests that Kings Bay functions as two separate water bodies; a northern and a southern portion. The northern portion of Kings Bay, north of Buzzard Island, includes Cedar Cove and Hunter Spring. The southern portion of the bay is from Buzzard Island south. Because of the spring discharges and tides, these two water masses do not mix within Kings Bay but are flushed out of the bay into Crystal River. Figures 2-4 and 2-5 (not included) show a theoretical distribution of dye originating from the Cedar Cove area for high and low tide cycles. From these figures, it can be interpreted that on an incoming tide, water from the Cedar Cove area does not flow south of Buzzard Island. On an outgoing tide, this separation is even more pronounced. Additionally, based on the preliminary USGS information, average flushing times in Kings Bay range from slightly over two days to slightly more than four days depending upon spring discharge conditions (K. Hammett, WWW.USGS.pers.com). A shorter flushing time corresponds to typical spring discharge whereas a longer time corresponds to typical spring discharge whereas a longer time corresponds to lower spring discharge (drought conditions). As stated previously, average discharge from Crystal River is reported as 975 cubic feet per second (28 m3/s) (Yobbi and Knochenmus, 1989). During the period of data collection for this study, preliminary data or 75 percent of the long-term average and this decrease was probably due to low rainfall (K. Hammett, WWW.USGS.pers.com).

The flushing time of the bay can prove to be a very important characteristic of the system. A short flushing time (less than 2 or 3 days) may not be sufficient to allow microscopic algae to develop within the bay. Conversely, a longer flushing time may allow such a bloom causing a noticeable change in water clarity.

The revised SWIM report *Crystal River/Kings Bay Technical Summary (2005)* contains the following description regarding the bay's hydraulics:

> As a tidally influenced embayment, Kings Bay receives substantial fresh water inflows from spring discharge, but is affected daily by tidal inflows from Crystal River. The result is a complex interaction between springs flow exiting the bay and tidal fluctuations of incoming and outgoing tides. The average tidal range in Kings Bay stage is approximately three feet.
>
> Flushing and circulation characteristics modeled by Hammett et al. (1996) indicate that the open waters of the bay are flushed relatively quickly; mean residence times were reported as follows:
>
> Low inflow conditions – 59 hours;
>
> Typical inflow conditions – 50 hours; and

Low inflow with reduced friction – 56 hours.

For purposes of the two-dimensional hydrodynamic model, low and typical inflow conditions were determined to equal a net spring discharge of 735 cfs and 975 cfs, respectively. Low inflow conditions with reduced friction represented a simulation of decreased bottom roughness through reduced vegetative coverage (i.e. *Hydrilla*). Circulation patterns, identified by the hydrodynamic model, were almost identical between the three simulated hydrologic conditions listed above. Circulation patterns were similar for the three spring groups included in the computer model; each exiting the bay north of Buzzard Island. The combined discharge acts to separate waters north of Buzzard Island from the remainder of the bay. This reduced mixing between the two water masses likely diminished the effects of wastewater effluent from the City's municipal WWTP on water quality in southern Kings Bay.

In recent years, the occurrence of hydrilla has been dramatically reduced. This is due, in part, to more effective herbicides and treatment schedules, salinity impacts related to the March 1993 storm and other coastal flooding events, relocation of effluent disposal of the Crystal River Sewage Treatment Plant outside of the immediate watershed of Kings Bay and storm water retrofitting in the area.

This reduction has coincided with an increase in Lyngbya Biomass. This marked increase in lyngbya is identified as one of the major management issues for Kings Bay in the SWIM report. Studies of lyngbya conducted under the auspices of SWIM are summarized in this excerpt from the SWIM Report:

Unlike hydrilla, which is an exotic macrophyte, Lyngbya sp. is blue-green algae. It is a filamentous algae that develops as mats on the bay's bottom. Trapped gases often develop in and beneath these algal mats causing them to break free of the substrate and float to the surface. Once floating, these mats can move to other areas of Kings Bay by wind and water currents impeding navigation and impairing the recreational use of the water body. Upon decomposition, the cells of this algae release a compound (geosmin) that has a strong, musty odor which further impairs the aesthetic value of the water body (Romie, 1990).

Interestingly, Lyngbya sp. biomass appears to be increasing in a number of coastal spring systems within the Southwest Florida Water Management District. The project, entitled "An Evaluation of Factors Contributing to the Growth of Lyngbya sp. in Kings Bay/Crystal River, Florida", was initiated in March of 1989 and was initially funded by a grant from the USEPA. The purpose of the project was to identify the cause of the Lyngbya sp. infestation in Kings Bay. At the University of South Florida, Dr. Bruce Cowell (as cited by Romie, 1990) studied the factors affecting the growth of Lyngbya sp. in both field (Kings Bay) and laboratory settings.

Because the biomass of Lyngbya sp. in Crystal River was especially high in the Cedar Cove area, and because the effluent from the City of Crystal River Sewage Treatment Plant historically discharged into Cedar Cove, a relationship was suggested between the sewage plant effluent and biomasses of Lyngbya sp. This perceived linkage to the wastewater discharge was one of the reasons for Lyngbya sp. becoming a major issue in the Kings Bay system.

In the field investigations, Cowell (Romie, 1990) found specific conductivity and the abundance of hydrilla accounted for almost 62 percent of the variability in Lyngbya sp. biomass; no nutrient/ Lyngbya sp. relationship, follow up laboratory studies by Cowell (1991) funded through

the SWIM program suggested that Lyngbya sp. growth may increase with increasing nitrate and calcium concentrations. Studies with salinity indicated that Lyngbya sp. growth was negatively affected by increases in salinity (and conductivity).

Studies on Crystal River offer only some insight to the increased growth of Lyngbya sp. Unlike hydrilla, Lyngbya sp. is not a recently introduced exotic plant, and increases in this plant cannot be due simply to colonization of new habitats by an invading species. Because Lyngbya sp. is indigenous, it has probably been present in the Crystal River and other coastal spring systems for thousands of years. Why the sudden expansion of this plant? What has changed significantly in recent years to cause a preferential increase in this algal's biomass? Increases may be attributable to one or a combination of the following factors: increased nutrient loading from the Crystal River Waste Water Treatment Plant (which, until recently, discharged its treated effluent directly to the Kings Bay); use of aquatic herbicides (such as copper sulfate); and/or increases in hydrilla biomass. Although hydrilla biomass was negatively correlated with Lyngbya sp. biomass, it is conceivable that hydrilla causes increases in benthic mats because it shades the bottom of the river where Lyngbya sp. mats develop. Cowell (1991) and Speziale (1991) found that Lyngbya sp. favors low light intensities and perhaps hydrilla growth from above shades the bottom sufficiently for Lyngbya sp. to expand. Once Lyngbya sp. expands sufficiently, it becomes self-shading and may then out-compete hydrilla. Other explanations for the proliferation of Lyngbya sp. have been proposed.

Researchers at Clemson University have suggested that Lyngbya sp. may be a "stress tolerator" (Larry Dyck, Clemson University, Pers, com). In natural systems that had been severely stressed, Lyngbya sp. has apparently expanded. The stress on the system could be natural or anthropogenic. An example of an anthropogenic stress is a severe pollutant loading causing a major change to the system. A natural stress could include drought, or in the case on Kings Bay, flood. In 1985, Hurricane Elena reportedly caused saltwater to move into the Freshwater Kings Bay. Perhaps this stress to the naturally fresh water environment caused the start of the Lyngbya sp. infestation in Kings Bay. Unfortunately, there is not sufficient data available, given our present understanding, to determine what factor(s) are responsible for Lyngbya sp. increases. Cowell (Romie, 1990) did; however, make several recommendations regarding the management and restoration of Lyngbya sp.-infested areas. These include:

(1) Removal of bottom mats of lyngbya sp.

(2) Prevent movement of floating lyngbya sp. mats.

(3) Hydraulic dredging of sediments, and planting of new macrophytes.

The growth of hydrilla poses several challenges for the management of Kings Bay. Hydrilla was first introduced in Florida waters in 1960 at Crystal River and at a canal near Miami. Since that time it has spread through the state clogging drainage and residential canals, precluding boating access for fishing and other water-related recreation, impeding navigation, crowding out desirable native vegetation, and degrading water quality (Langeland, 1990). While hydrilla can impair recreational uses of the waters, it also supplies food for manatee.

More recent research of the Kings Bay aquatic plant communities is summarized within the *2005 SWFWMD Crystal River/Kings Bay Technical Summary*. The section regarding aquatic vegetation (without referenced figures) is provided below:

> Submersed aquatic plant communities support wildlife species, stabilize sediments and remove contaminants from the water column and sediments. These functions alone

substantiate the importance of healthy aquatic plant communities in a water body. Historical anecdotal evidence suggests that extensive Tapegrass or *Vallisneria americana* beds once dominated the vegetative community of Kings Bay. The introduction of nuisance species (Figure 15) such as *Hydrilla verticillata* (circa 1960), *Myriophyllum spicatum* (or Eurasion Water Milfoil) (circa 1960), and *Lyngbya spp.* (circa 1980) adversely altered the composition of submerged aquatic vegetation in the bay. Efforts to eradicate nuisance aquatic plants and filamentous algae have ranged from sulfuric acid treatments in 1965 (Phillippy 1966) to herbicide applications (circa 1960s-1970s), mechanical harvesting (circa 1980s) and skimming/grubbing (circa 1990s). In 1990, the University of South Florida completed a study analyzing factors affecting growth of *Lyngbya* sp. (Cowell 1990). Results revealed that specific conductivity (a surrogate of salinity) and abundance of *Hydrilla* together explained 61.8 percent of the variability in *Lyngbya* sp. biomass. Conversely, *Lyngbya* biomass and total phosphorus together explained 41 percent of the variability in *Hydrilla* biomass. Therefore, it was concluded that two factors impair the abundance of *Lyngbya* in Kings Bay; abundance of *Hydrilla verticillata* and increased salinity concentrations. Possibly, interspecific competition with other rooted aquatic plan species, beyond *Hydrilla*, might reduce abundance of *Lyngbya*.

Similarly, salinity was determined to affect presence of aquatic macrophytes in the Bishop and Canfield study (1995); designed to assess effects of the 1992 wastewater effluent removal on Kings Bay's aquatic plant communities. During the study period, tidal surges, associated with the "Storm of the Century" in March 1993, presumably increased salinity concentrations in Kings Bay. It was noted that both *Hydrilla verticillata* and *Lyngbya* sp. were absent from the fifteen stations monitored by the National Biological Service (as analyzed by Bishop and Canfield) following the "Storm of the Century". Although the reductions were short-lived (< 1 year), the data support the ability of salinity to alter the composition of aquatic vegetation in the bay. While *Hydrilla verticillata* and *Lyngbya* sp. were negatively affected by the storm, the native *Vallisneria Americana* and the exotic *Myriophyllum spicatum* were relatively undisturbed by the increased salinities. Bishop and Canfield concluded that increased salinities had greater impact on the composition of aquatic plants in Kings Bay than nutrient reductions effected by the diversion of wastewater effluent in 1992 (Figure 15). In areas of the bay periodically affected by increased salinities, *Vallisneria* and *Myriophyllum* could have a competitive advantage over *Hydrilla* and *Lyngbya*, a factor determining site-specific differences in aquatic plant composition in Kings Bay.

In 2001, the University of Florida monitored water clarity, water chemistry, and aquatic macrophyte abundance in Kings Bay to characterize the relationship between aquatic vegetation and water clarity (Hoyer et al., 2001). Historical LAKEWATCH data were used to augment data collected for the study. Results supported the substantive effects of aquatic plant abundance on water clarity in Kings Bay; primarily through the inverse relationship between abundance of rooted plants and algae suspended in the water column. Ten species of submersed aquatic plants and algae were identified as part of the study, of which the four predominant species were *Myriophyllum spicatum, Hydrilla verticillata, Lyngbya* sp., and *Vallisneria Americana.* Hoyer et al. substantiated the effects of salinity on the abundance and distribution of aquatic plants in Kings Bay. Greater occurrences of *Myriophyllum* and *Vallisneria*, over *Hydrilla verticillata* and *Lyngbya* sp., in locations with higher mean specific conductance were recorded during the study. Additionally, *Myriophyllum* and

Vallisneria displayed quicker recovery times following periods of highly elevated salinities (via storm surges) than either *Hydrilla verticillata* or *Lyngbya* sp. These data are consistent with the persistence of *Vallisneria* in systems of high specific conductance such as Salt Spring (noted by District staff during field reconnaissance). Water chemistry data for the study indicated Kings Bay is frequently a nitrogen-limited system, where total plant biomass is potentially more sensitive to increases in total nitrogen than total phosphorus.

An atlas depicting the coverage for eight of the documented plant and filamentous algal species was submitted with the Hoyer report (Frazer and Hale 2001). Overall, representatives of the native genera *Potamogeton, Najas, Ceratophyllum,* and *Chara* were typically reported to sparsely cover (5-25% coverage) upstream areas in the west-central and southern portions of Kings Bay. More substantial coverage (5-75% coverage) of the salt tolerant species *Vallisneria Americana* (Figure 16) and *Myriophyllum spicatum* (Figure 17) occurred in the central areas of the bay surrounding Buzzard Island, adjacent to the mouth of the Crystal River. Coverages of the exotic nuisance species *Hydrilla verticillata* (Figure 18) and *Lyngbya* sp. (Figure 19) were also substantial (5- greater than 75%) to extensive (greater than 75%) coverage by exotic species was much more frequent than that documented for native species.

In support of a more comprehensive effort by the University of Florida (Hauxwell et al. 2003), the District concluded a pilot study in 2001 investigating the potential of removing *Lyngbya* mats from five sites in Kings Bay and revegetating with *Vallisneria Americana.* In each instance, newly planted *Vallisneria Americana* were quickly consumed by manatees, regardless of size or density of the installed plants. Hauxwell et al. (2003) found that excluding manatees from newly planted *Vallisneria* beds increased survivability. However, abundance of the protected plants was then reduced through competition with other species, primarily *Myriophyllum spicatum.* Moreover, allowing the *Vallisneria* plants to establish, for an approximate 5-month period, did not increase survivability once protective fencing was removed (Figure 20). Results of both studies indicate that extensive restoration of *Vallisneria Americana*, through replanting activities, is not currently feasible in Kings Bay.

In 1982, agencies responsible for aquatic plant control and manatee protection in the Crystal and Homosassa Rivers formed an interagency relationship. These agencies, including the U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, Florida Department of Environmental Protection, and Citrus County Department of Aquatic Services, meet on an annual basis to revise an aquatic plant control plan (Citrus County, 1991). The dominant method of control in Kings Bay is mechanical harvesting.

Biological plant controls offer the most potential as a cost effective and environmentally sound method of treatment. Biological control agents include insects, fish, and diseases, which have evolved with and are able to naturally suppress aquatic weeds. Several agents are in use in small lakes and ponds in Florida. However, research is still being conducted on these agents to determine if they can be safely used in open waterways such as rivers and streams. Further, the increasing number of winter foraging manatees and their dependence on adequate supplies of hydrilla supports postponement of their use at this time.

Habitat Protection

Incorporation of essential manatee habitat into existing State and Federal systems of refuges, parks, reserves, preserves, etc. can provide an appropriate and valuable approach for protecting the integrity of coastal ecosystems while providing for human activities and uses that are compatible with protection of manatees and other wildlife (Packard, 1983). Programs such as Preservation 2000 and Florida Forever have led to agency acquisition of lands along the Citrus County coastline and the Crystal River. This section specifically addresses the alternatives to provide long-term habitat protection.

Conservation Lands and Protective Jurisdictions

Conservation lands and areas under special designation are an important part of providing adequate protection for manatees. These areas protect the necessary habitat and maintain the natural ecosystem functions. These areas within the manatee study area include:

Crystal River State Buffer Preserve, St. Martins Marsh Aquatic Preserve, Crystal River National Wildlife Refuge, Chassahowitzka National Wildlife Refuge, Lake Rousseau State Recreation Area, Homosassa Springs Wildlife State Park, and the Cross Florida Greenway (refer to the Conservation Element for illustrations and descriptions).

Management of these areas provides a valuable basis for protecting the integrity of the coastal ecosystem that supports the area's manatee population. However, the specially designated areas and conservation areas now being publicly maintained do not adequately protect the essential complement that makes up the manatee habitat. The full complement of a manatee habitat includes warm-water refugia; summer and winter feeding areas; sources of freshwater; protected resting and calving areas; and travel corridors.

The most important winter habitats for manatees are the Kings Bay and Homosassa Springs warm water refugia (Packard, 1983). In addition, since the Crystal and Homosassa Rivers are essential access corridors to these refugia, these two rivers are also considered particularly important winter habitat (Packard, 1983). The most important summer habitats are the lower portions of the Crystal, Homosassa, and Withlacoochee Rivers and the entire Salt River. The Chassahowitzka River and estuarine area are also an important warm weather habitat.

Alternative and Needed Actions

It was evident that habitat and adjacent supporting lands needed to be acquired and incorporated into special designations. Established priorities were based on geographic areas, the importance of manatee habitat, and on indications of potential manatee-human overlap. Therefore, expansion of the wildlife refuge in Crystal River and protection of the undeveloped wetlands adjacent to the Homosassa River and north of the Chassahowitzka National Wildlife Refuge were of high priority (Packard, 1983).

Habitat Acquisition

Both winter and summer habitat must be permanently protected to ensure the long-term survival of manatees in the region. Equally important, especially in the northern end of their habitable range, are continuous corridors of favorable habitat connecting summer feeding grounds with warm-water refugia. Not only do manatees need to range over large areas to feed, they also need to be able to return quickly and safely to warm-water refugia in case of sudden drops in temperature (Marine Mammal Commission, 1984).

This section summarizes the recommended methods of increasing protection of manatee habitats within Citrus County stated in the findings of the Marine Mammal Commission report entitled "Habitat Protection Needs for the Subpopulation of West Indian Manatees in the Crystal River Area of Northwest Florida". A subcategory in each section has been inserted to address actions taken to date to address these needs.

Crystal River and Kings Bay

The designation of Manatee Sanctuaries in a small portion of Kings Bay, the incorporation of the islands of Kings Bay into the National Wildlife Refuge System, and the local residents' support of protective measures has enhanced the protection of this area (Marine Mammal Commission, 1984). Priority has been established for acquiring undeveloped wetlands and adjacent uplands along the Crystal River, northern Salt River, and Crystal Bay. With respect to the Crystal River area, it has been recommended that the USFWS provide the Crystal River National Wildlife Refuge with staff and budget sufficient to carry out research, management, and interpretive activities necessary for protecting area manatees and manatee habitat; conduct a biological survey and prepare an Ascertainment Report assessing habitat protection needs for manatees; and based on the findings of this report and the Service's Ascertainment Report acquire additional wetland and uplands. Establishment of an interpretive center in the Crystal River area is also warranted.

Extensive acquisition of the coastal region of Crystal River has occurred. The current Crystal River Buffer State Park stands at 27,295 acres in addition to the existing 23,123 acres already contained in the St. Martin's Marsh Aquatic Preserve. The Crystal River National Wildlife Refuge has expanded to 45 acres in size and four new sanctuaries, and one of the three existing Sanctuaries was established by the Fish and Wildlife Service in Kings Bay within or near the Refuge. A Refuge Office has been established in Crystal River and an interpretive center is located at the US-19 Visitor Center to the Homosassa Springs Wildlife State Park.

Homosassa River and Homosassa Springs

The lower portion of the Homosassa River is composed mainly of undeveloped wetland areas and acquisition is recommended. The water areas are also recommended to be evaluated for designation as "Critical Habitat" for manatees.

Much of the undeveloped coastal lands in this region have been acquired and incorporated in the Crystal River Buffer State Park. The evaluation of these waters as Critical Habitat is routinely re-evaluated.

Withlacoochee River to Crystal River

Acquisition of the undeveloped coastal wetland fringe between the Withlacoochee and Crystal Rivers would increase protection for the large number of manatees that move between the Crystal River and the Withlacoochee River and other points north.

The majority of the coastal wetlands from the Crystal River north to the Withlacoochee River have been acquired by the State.

St. Martin's Marsh and Salt River

The majority of the St. Martin's Marsh and the Salt River are protected as part of the St. Martin's Marsh Aquatic Preserve. The Preserve has jurisdiction over all sovereign submerged lands within its boundary. Some of this area has been acquired and many other parts are proposed for acquisition through the State's Crystal River and St. Martin's River CARL acquisition projects. Protection could be increased by the designation of the Salt River as a "Critical Habitat".

A large portion of this area is now part of the Crystal River Buffer State Park.

Warm Water Refugia

In winter months, manatees respond to declining water temperatures by aggregating at constant temperature springs and warm water power plant or industrial effluents. Arrival at major aggregation sites usually begins in early October and ends in early March, but exact dates vary greatly with the location of the refugia and weather patterns. Crystal River/Kings Bay, Homosassa River, and Progress Energy's discharge canal are the major warm-water sites in Citrus County.

Although manatees are attracted to the warm water discharge of the power plant, it is not used consistently as warm water refugia. However, it should be noted that the warm water provides a layover during the spring and fall. Warm industrial discharges are not suitable alternatives to the

warm water refugia provided by natural springs because they usually lack the vegetation necessary to sustain the manatees.

Natural springs are the Crystal River manatees' essential refugia from cold winter waters. Crystal River is vital manatee habitat because the Floridian aquifer discharges relatively warm water through numerous springs. The manatees are able to move out of colder Gulf waters during the winter into this naturally warm water. The size of the area that is habitable to them depends on the rate of discharge and the resulting thermal gradient. Maintaining a sufficient flow of warm spring water is essential to the maintenance of warm water manatee habitat.

Progress Energy for safety and security concerns has restricted watercraft access to their discharge canals, thereby, greatly limiting vessel related interaction with manatees. The establishment of manatee sanctuaries within Kings Bay serves the same purpose around some of these natural warm water refugia.

Activities that Influence the Condition and Availability of Warm Water Refugia

Power plant overhauls and shutdowns, alterations of industrial and power plant cooling streams, water withdrawals from the aquifer, alteration of recharge areas, restriction of physical access to refugia, and capping of natural springs are some threat which could seriously impact manatees. Reduced flow volume of natural springs, for example, could influence water quality, which in turn would impact vegetative biomass and composition, particularly in such fresh water systems as Kings Bay and Crystal River.

Warm Water Refugia Needs

The quantity of water flowing from South Big Bends' springs needs to be maintained to insure the protection of essential warm water habitat for manatees. If water withdrawal from the aquifer that provides spring water exceeds recharge rates, the volume of water warmed by springs may drop, salinity of river waters may increase, and flow patterns could change or cease. Estuarine and even marine vegetation could be altered. The preservation of the natural flow of these springs should merit priority over other water uses, not only due to their importance for manatees, but also for fisheries and recreational values. The needs of manatees for warm water refugia in South Big Bend must be included in water use plans and the thermal effects of a reduction in spring discharge should be modeled.

The effects of different flow rates on the winter thermal characteristics of Kings Bay and Homosassa River could be modeled. This would provide the information needed to evaluate the minimum flow effect that is determined by SWFWMD to be necessary to maintain the estuarine ecology of the region.

The effect of springs on water temperature in Kings Bay and the headwaters of the Homosassa River needs to be determined. A model should be developed to predict the effects water withdrawal and alteration of recharge areas will have on the flow of springs in the Crystal and Homosassa Rivers. The SWFWMD through its Minimum Flows and Levels efforts will accomplish this task.

Behavior of manatees relative to temperature gradients in Kings Bay and Homosassa River needs to be investigated. This should be done in conjunction with the studies which investigate the effects of human behavior on manatees.

Sanctuaries

Sanctuaries have been established in Kings Bay and Homosassa. The sanctuaries were established to provide the manatees with areas to escape harassment and have uninterrupted access to the thermal protection of the spring discharge. An analysis of the need for sanctuary expansion has been conducted by the USFWS. The study recommended designating new sanctuaries to protect foraging areas and expanding existing sanctuaries to accommodate the increasing number of manatees using the South Bay (Buckingham, 1990). The expansion of existing sanctuaries and creation of four additional ones were completed in 1993.

Education and Awareness

With mortality attributable to human causes increasing throughout the state, it is imperative that emphasis be placed on educating the public on the plight of the manatee, improving public awareness, and improving the availability and distribution of educational information and literature. Within Citrus County, the School District, Save the Manatee Club, U.S. Fish and Wildlife Service, and the Florida Fish and Wildlife Conservation Commission Imperiled Species Management actively operate educational and awareness programs.

U. S. Fish and Wildlife Service (USFWS)

The USFWS, operating out of the Crystal River NWR Complex, maintains and distributes literature and instructive videos to dive shops, fish camps, etc., to facilitate education and awareness. An informational kiosk is maintained by the Service, which is anchored in Kings Bay between October 1 and March 31. The USFWS also operates an informational radio repeater station in Citrus County that provides manatee education and information. Additional signage and informational kiosks are planned in the future.

Florida Fish and Wildlife Conservation Commission (FWC)

The FWC invests in education and awareness programs through developing their own public information materials and cooperating with private organizations and groups. The agency's public information program includes posters, brochures, and boating guides which promote the theme, "Miss her now, or miss her forever". The FWC coordinates with the Save the Manatee Club, Progress Energy, and oceanaria including Sea World and Disney World. The FWC, in conjunction with USFWS, also operates the Homosassa Springs Wildlife State Park, which provides interpretive and educational opportunities to the Park's visitors, and is in the process of developing a Manatee Interpretive Center at their newly acquired entrance building on US-19.

Citrus County

Citrus County Ecotourism Committee

The Citrus County Ecotourism Committee, a committee under the Tourist Development Council and funded by tourist generated bed tax has developed a number of ecotourism brochures that incorporate manatee related information.

Citrus County School District

The Citrus County School District operates a two-tiered approach for manatee education at their Marine Science Station on the Salt River. Their education efforts are presented to both teachers and students. The 4th and 7th grade students in the County are educated through movies, slides, lectures, and a field trip to the springs in Kings Bay. Teachers throughout West Central Florida attend educational workshops at the Marine Science Station and are instructed in all aspects of manatee life history, protection efforts, and biological needs. Through this program, the teachers prepare lesson plans for incorporation into their classroom situations.

Non-Profit Organizations

Save the Manatee Club

The Save the Manatee Club (SMC) was established in 1981 by Governor Bob Graham and singer/songwriter Jimmy Buffet to promote public awareness and education about the endangered manatee. Through its Adopt a Manatee program, the SMC raised funds to augment state and federal research programs, to purchase manatee warning signs for waterways, to improve public awareness, to purchase critical manatee habitat, and to enlighten Florida's legislators to the plight of the manatee.

Florida Manatee Research and Educational Foundation

The Florida Manatee Research and Educational Foundation, created by the late Dr. Jessie White, conducts educational programs to improve awareness and understanding of the manatee among school children throughout the state. Dr. White's program focuses his education and awareness efforts on elementary and middle school children.

Educational Needs

An important element in expanding educational programs within Citrus County lies in the development of the Manatee Interpretive/Education Center. This facility, when complete, will support many educational programs and offer the community and persons visiting the center an excellent opportunity for learning about the manatee.

Awareness Needs

Awareness differs from education in that persons should be cognizant or conscious of manatees and their needs, as opposed to only having knowledge of manatees. Awareness plays an important role in waterborne activities and also in the decision making process for governing bodies. The three identified areas relating to awareness which need to be addressed are 1) the placement of informational signs at boat ramps, marinas, and all shoreline/water-use access sites; 2) the expansion of a traveler's information service; 3) the placement of information in rental boats; and 4) the establishment of a manatee interpretive center in the Crystal River area.

The increasing popularity of personal computers and the internet provides a new avenue for manatee education. Establishment of one or more web sites can help promote manatee awareness.

The placement of informational signs at all access sites can serve to make any user of the facility and passerby aware of important manatee safety information. The traveler's information service is a recorded AM radio broadcast maintained by USFWS, which is used to relay important manatee information, as well as other information similar to tides, weather, or related boating information. A Manatee Speed Zone map has been developed and distributed.

Local dive shops currently conduct scuba diving certification programs and rent boats to snorkelers and divers. These businesses are a critical link to increasing the manatee awareness of out-of-town users of Kings Bay and utilize a video tape developed by USFWS to acquaint divers with proper manatee interaction behaviors.

Governmental Coordination

Permit Procedures and Development Review

Permit and development review procedures for marina/boat facilities, docks, and general structures located on the shoreline or submerged land affecting manatees are conducted by many agencies. The facilities, which ultimately affect the manatee, are reviewed in part by Citrus County, City of Crystal River, Department of Environmental Protection (DEP) Florida Fish and Wildlife Conservation Commission (FWC), U.S. Army Corps of Engineers (ACOE), U.S. Fish and Wildlife Service (USFWS), Southwest Florida Water Management District (SWFWMD), and the U.S. Coast Guard (CG).

Permit and development review procedures for facilities affecting manatees are primarily conducted through the DEP and ACOE joint application for dredge and fill. The ACOE issues permits under Section 10 of the Rivers and Harbors Act of 1899 for projects located in navigable waters and structures that would alter or modify the condition, capacity, or channel of any navigable water. In addition, the ACOE issue permits under Section 404 of the Federal Water Pollution Control Act Amendments, which prohibits the discharge of dredged or fill materials into navigable waters without a permit.

The DEP also permits such activities pursuant to the Florida State Lands Act, which states that a permit may not be issued if it would interfere with the "conservation of fish, marine, and wildlife or other resources, to such an extent as to be contrary to the public interest" Section 253.123 (d), F.S. Both the ACOE and the DEP consult their paralleling agencies (USFWS and the FWC, respectively) for a determination of effects on habitat, wildlife, and other resource concerns.

The ACOE and other federal agencies are required to consult with the USFWS to ensure that its actions are not likely to result in the destruction or adverse modification of designated Critical Habitat and that its actions are not likely to jeopardize the continued existence of any endangered or threatened species. As a result, the ACOE consults the USFWS for wildlife impacts only when an "individual" permit is required.

The ACOE issues "general" permits authorizing the construction of small projects (including piers, docks, and bulkheads) without requiring an individual permit. An application for dredge and fill activities must be consistent with all the special conditions of a general permit. If not, the application is reviewed as an individual permit and the Corps consults with the USFWS prior to rendering a decision. The special conditions of a general permit are referred to as "Kick-out" clauses and are an important part of a general permit.

The DEP consults with the FWC through a similar process at the state level. This review procedure, required by the Henderson Wetlands Protection Act, is similar in that the FWC is required to consider adverse effect to endangered or threatened species of their habitats in its review of dredge and fill permit applications. The Department of Community Affairs and the Regional Planning Council are responsive to manatee issues through their regional and state review procedures.

Programs and Projects

The Manatee Advisory Committee of Citrus County is a multi-interest effort to unify and coordinate manatee protection programs and projects within Citrus County. This committee consists of various agencies responsible for manatee protection, local governments, and commercial and private interests.

Manatee Protection Plan Implementation

Manatee-Human Overlap

The overlap of the activities of humans and manatees has increased dramatically over the past 15 years. Popularity of coastal Citrus County as a recreational area has contributed to the added

pressures. The human pressures placed upon the manatee population include physical impact, harassment, disturbance of warm water refuges, and the general disruption of daily activities.

Measures to reduce impacts to the manatee can be implemented through speed restrictions, channel designation with slow speed exemptions, sanctuaries, law enforcement, the designation of Critical and Essential Habitats and, most importantly, public education and awareness.

Site Specific Recommendations

In summer 1989, the former Department of Natural Resources (DNR) was directed by the Governor and the Cabinet to address the increasing statewide manatee mortality. A portion of their assignment was to prepare a set of recommendations, which would reduce the manatee mortality trend.

After receiving this directive, the DEP prepared a set of recommendations. Following numerous public hearings, the DEP presented these recommendations to the Governor and the Cabinet. During this process, Citrus County was granted the ability to recommend and adopt protective measures prior to State action.

Combined with a directive from the Board of County Commissioners, the Manatee Plan Committee was to prepare the site specific recommendations, which led to the incorporation of these protective measures into this Plan. The outline below contains the existing and proposed speed zones for establishing the countywide specific protective measures.

Need for Markers on the Crystal River

To protect manatee traveling between the Gulf and Kings Bay, the Crystal River should be designated slow speed with central corridor for normal cruising speeds. To enforce this provision, it was necessary to mark the boundary between slow speed shoreline buffer and the central corridor. The Crystal River Surface Water Improvement and Management Plan (prepared by SWFWMD) addresses the placement of markers as a needed resource protection measure. The marking was coordinated between the County, the DEP, and the SWFWMD through the Crystal River/Kings Bay SWIM Plan. Joint funding from the DEP and SWFWMD were used to finance this project. Coordination with the County and the U.S. Coast Guard was sought during implementation of this recommendation.

Unfortunately, the use of buoys to mark the channel proved unsuccessful. The County, with a grant under the special Waterways Projects Program, replaced the buoys with fixed markers in 1996.

Design and Coordination of Signage

Signage within the Kings Bay/Crystal River, Homosassa River, and Withlacoochee River areas should be coordinated and redesigned to reduce confusion and to establish the DEP's uniform sign standards for Citrus County. This should be conducted between the County, DEP, USFWS, USACOE, and U.S. Coast Guard.

Increasing Enforcement Personnel

Law enforcement should be improved through the coordination of enforcement agencies and by increasing enforcement personnel. Programs have been established to increase coordination between the enforcement agencies. The FMP has established a regional substation on the Cross Florida Greenway immediately east of US-19 bridges. It is recommended that the County and the City of Crystal River work towards increasing enforcement personnel on area waters. Funding sources for such increases should be researched.

Fort Island Beach Boat Ramp

Based on the Boating Study conducted on the Kings Bay/ Crystal River, Fort Island Beach Boat Ramp is the only launching facility, which does not contribute to the boating traffic on Kings Bay and is primarily used for Gulf fishing. In an effort to divert traffic from the Bay, using Fort Island for a primary launching facility has the benefit of removing unneeded pressure from the Bay and placing it closer to the resource. Fort Island has been redeveloped in order to handle the diverted traffic. Improvements to the facility include additional parking, expanded/improved ramps, added docking facilities and additional security.

Sanctuary Expansion

A study of manatee-human interaction in Kings Bay has been conducted by USFWS staff from the Cooperative Research Unit and the Chassahowitzka National Wildlife Refuge Complex. The County supported the finding that the increasing population using Kings Bay created a need for additional sanctuary space. The County assisted USFWS and DEP in the evaluation of locations for new sanctuaries to protect foraging areas and expansion of existing sanctuaries to accommodate the increasing number of manatees using the South Bay. The county also supported the involvement of divers, sport fishing enthusiasts, conservationists, and the City of Crystal River in this evaluation process. After extensive public workshops, the sanctuaries were expanded and four additional sanctuaries established in 1993.

Opening Clogged Sinks and Springs

The potential to open closed sinks and springs within the Kings Bay area should be researched. This research should identify the potential costs, benefits, and impacts of opening springs and sinks. The intent of opening these areas is to reduce the existing pressures on a few diving and snorkeling areas. Reduction of these pressures can assist in the reduction of man-manatee interaction. The County in coordination with the City, SWFWMD and DEP obtained a Coastal Management Program grant and other funding to conduct sediment removal from Hunter, King, and adjacent springs. That project was completed in summer 1997.

Land Development

Land development within the County, as well as within the region, may impact the manatees in the Big Bend Region. For the purposes of this plan, only shoreline and submerged land development will be addressed. It should be noted that other development may impact manatees including storm water runoff, waste water discharge, and an increase in overall users of natural systems.

Siting Criteria

As identified in the Kings Bay/Crystal River Boating Study, the number of boats entering the system is greatly contributed by launching facilities. New marina/boat facilities and boat ramps in the coastal waters of Citrus County shall be located on sites which: 1) minimize manatee/boat overlap; and 2) minimize the disturbance of wetlands.

Sites which meet these criteria will be determined suitable for new facilities and are identified in Figure MP ~~13~~ 4 of this Plan. If a site minimizes boat/manatee overlap but does not minimize the disturbance of wetlands, then mitigation of wetlands and other actions will be required to protect natural resources as stated in this Plan. Any area which does not minimize boat/manatee overlap may not be developed for marina/boat facilities.

Since the lands adjacent to the Canal have been designated a Cross Florida Greenway under the auspices of DEP, a master plan for land uses has been developed. The County, DEP, FWC, USFWS, and other interested parties have agreed to review the establishment of speed zones and other controls on the canal to address manatee concerns.

Crystal River/Kings Bay

Exceptions to Siting Criteria

According to the siting criteria established (Packard, 1983), no new marinas or boat ramp facilities should be located on the Crystal River or in Kings Bay. However, within the Crystal River/Kings Bay system, there are some areas where boat traffic poses more of a threat to manatees than in others. Because of the concentration of manatees in Kings Bay and the upper Crystal River during the winter, boat traffic in this area during the colder months puts manatees at more risk of a collision. During winter aerial surveys, over 90 percent of the manatee sightings in Crystal River were in Kings Bay (Rathbun, et. al., 1990). If a new boat ramp is sited so that it will remove boat traffic from Kings Bay by providing access downriver, then that overriding benefit may be cause to allow for an exception to the criteria.

Fort Island Trail Park serves this function and is located near the confluence of the Salt River and Crystal River. Trailered-boat traffic launching from the proposed County-owned public boat ramp at Fort Island Trail Park avoids navigating approximately three miles of Critical Habitat waters, while destined for the Gulf.

The Hutchinson study on boat usage patterns (summarized in "Inventory and Analysis" section indicates that as much as 50 percent of boats launched at the Kings Bay/Crystal River boat ramps are destined to enter the Gulf of Mexico. The study also shows that, during winter weekends, anywhere from 50 to 200 boat trailers can be found at any one time at the six major publicly-used boat ramps on Kings Bay/Crystal River. The Fort Island Trail boat trailer parking lot accommodates approximately 50 trailers. This means that, with effective directional signage, 50 percent to all of the winter-time Gulf-destined trailered boats can be accommodated at the proposed facility.

The Packard study (1983) shows that the waters surrounding the new boat ramp facility are in an area of "low density manatee sightings". (Radio tracking data indicates that in the evening during the winter months, some manatees leave the warm water areas of Kings Bay and swim down the Crystal River to feed on the *Ruppia maritime* beds in the Salt River and the lower Crystal River [Rathbun, et. al., 1990]. See "Manatee Distribution" section for more complete discussion.) With slow speed designation at the Salt/Crystal Rivers confluence area and normal/slow speed corridor measures downstream on the Crystal River, the impacts of boat traffic on the manatees using Kings Bay and Crystal River can be reduced and boat traffic from the new facility can be provided with quick access to the open waters of the Gulf of Mexico.

Development of the Fort Island Trail Park occurred in 1991. In conjunction with the use of the new launch facilities, the following protective measures are in effect:

- Designation of a "Slow Speed" zone on the Crystal River from the east side of Fort Island Trail Park, including the confluence of the Salt River and Crystal River to the bend past the Yacht Club (on the Crystal River), and down to the CR-44 bridge (on the Salt River), and continuing down the Salt River, from the CR-44 bridge west to the second cut to the south (Little Coon Gap) and;

- Designation of "Slow Speed Shoreline Buffers" with a "Central Speed Corridor, Maximum 25 MPH" on the Crystal River; and
- Placement of information signs to direct Gulf-bound boaters to the Fort Island Trail and Gulf Beach Boat Ramps.

Incentive Launch Fee System

The Manatee Protection Project: Boat usage Patterns study (1988) showed that about half of the boats launched in Kings Bay were destined for the Gulf. If these boats were launched farther down-river or at the Gulf, the level of boat/manatee overlap in Kings Bay would be significantly reduced. To encourage Gulf-bound boaters to launch closer to the Gulf, an incentive launch fee system was suggested to be established where boat ramps near or in Kings Bay would have higher launch fees than those boat ramps down river or on the Gulf.

The boat ramps, which may be involved in this program, fall into several ownership categories: some are privately-owned and others publicly-owned; some charge a fee and others do not. The launch fee program was to be tailored to address the situation of each ramp so as to cause no undue burden to private boat ramp operators or create the necessity for full-time local government staff. In addition, the number of boats launching from Fort Island Trail and Beach boat ramps should be limited by the capacity of the boat ramp parking lot to accommodate trailered vehicles. Boat ramp activity should not interfere with other functions of the parks.

Concern over price fixing as defined within Chapter 125 F.S. and passage of Property Rights legislation in 1995 presents a serious obstacle to the incentive launch fee system. Governmental action such as an implementing ordinance would constitute new regulation that impacts existing private business thus setting the standing for legal action. As an alternative, the County has promoted the use of free public boat ramps located near the coast for Gulf bound boaters instead of fee charging private facilities upriver. This approach was used in the new manatee speed zone map developed by DEP and the County.

Residential Dock Density

The cumulative impact of single family and multi-slip residential dock facilities has an impact on manatees and their habitat. It is especially important that the density of submerged and shoreline structures, including residential docks, be limited in those areas that are essential to the survival of the manatee. Figure MP ~~13~~- 5 indicates the water bodies/shorelines that have been determined to be essential habitat for the manatee.

Within Essential Habitat Areas:

- Single Family Docks

Within essential habitat areas, single family residences shall be limited to one boat slip per residential unit. All new single family residential lots on coastal waters will have a lot width of not less than 100 feet at the shoreline.

- Multi-slip Residential Docks

  Residential land users/developments (single family or multifamily) within essential habitat areas may include multi-slip docking facilities; however, such facilities will not have a density of more than one boat slip per 100 feet of owned-shoreline. Any part of a development's shoreline which borders a single family lot shall not be attributable to the allowable number of multi-slip docks.

  Vested multifamily developments within essential habitat areas may include multi-slip docks having a density no greater than two boat slips per 100 feet of owned-shoreline.

  Locations on tributaries or canals, which are upstream or flow directly into a water body designated as an essential habitat area, shall be subject to the above-mentioned essential habitat standards.

  Outside Essential Habitat Areas:

- Single Family Docks

  Outside essential habitat areas, single family residences shall have the same criteria as those within essential habitats.

- Multi-slip Residential Docks

  Outside essential habitat areas, residential developments may include multi-slip docks having a density of no more than two boat slips per 100 feet of owned-shoreline. However, any part of a development's shoreline which borders a single family lot shall not be attributable to the allowable number of multi-slip docks.

- Multi-slip Docks

  Approval of multi-slip docks shall only be given to developments which have a SWFWMD approval drainage plan and which have shorelines, which include no vertical seawalls or are vested.

- All Residential Docks:

  In no case shall the number of slips exceed the number of residential units proposed or constructed. Any residential docking facility exceeding one slip per residential unit shall be required to meet the marina/boat facility siting criteria of this plan.

Construction on Submerged Lands

Poorly planned and constructed submerged structures may reduce the quantity and quality of food resources for manatees, as well as increasing the probability of injury and entrapment.

State and Federal agencies including USACOE, USFWS, FWC and DEP are involved in the review and regulation of construction on submerged lands, however, their regulations apply to the whole state or national shoreline and may not recognize local situations, such as manatee habitat and local water depth characteristics. County dock design regulations mirror the intent of state or federal regulations.

Dock design standards should be based on location specific criteria which recognize the levels of shoreline and aquatic vegetation, local water depths, and the manatee habitat importance of a given area. The County should monitor and regulate submerged land and shoreline construction in a manner which prevents negative impacts on manatees and the physical and biological resources on which they depend.

Water Quality and Vegetation

Water quality and vegetation issues in respect to meeting the goal of this plan are diverse. The areas which need to be addressed are water quality improvement, compatible aquatic plant control, water quantity protection, and sediment testing.

Water Quality and Vegetation

Areas which have been identified as needing the most attention are water quality improvement and sediment testing. These two problem areas have been noted in both Kings Bay/Crystal River and Homosassa River. The Surface Water Improvement and Management (SWIM) Plan for Kings Bay/Crystal River administered by the SWFWMD is addressing these aspects. However, it is not the sole responsibility of the SWFWMD to improve or preserve the system's water quality and the successful implementation of this SWIM plan is dependent upon the cooperation and unified support of the County and the City of Crystal River.

The Conservation Element contains criteria for the development of surface water management plans for all waterways in Citrus County. These plans will establish the County's direction for managing its surface waters.

Aquatic Plant Control

Since the Crystal and Homosassa Rivers are wintering habitats for manatees, special plant control methods are required to ensure manatees or their habitats are not harmed by these activities.

Citrus County Division of Aquatic Services (DAS) works in coordination with state and federal agencies (listed in "Inventory and Analysis" section) to implement the Summer/Winter Aquatic Weed Control Treatment Plan in Kings Bay and the Homosassa River. The Plan designates prime feeding and congregation areas used by wintering manatees. Aquatic plants in these designated areas do not receive any chemical controls. The Plan also prohibits the use of certain herbicides, which are potentially harmful to manatees during the wintering months.

Although mechanical harvesting is an effective means to control aquatic vegetation in many areas of Kings Bay and the Homosassa River, there may be times when it is uneconomical to keep weed growth under control on a level where adequate navigation paths can be maintained in man-made canals. During non-winter months (April through September), it may be advisable to use a combination of DEP-approved chemical controls and mechanical harvesting in these canals if there is no evidence that use of chemical controls will endanger manatees during these months.

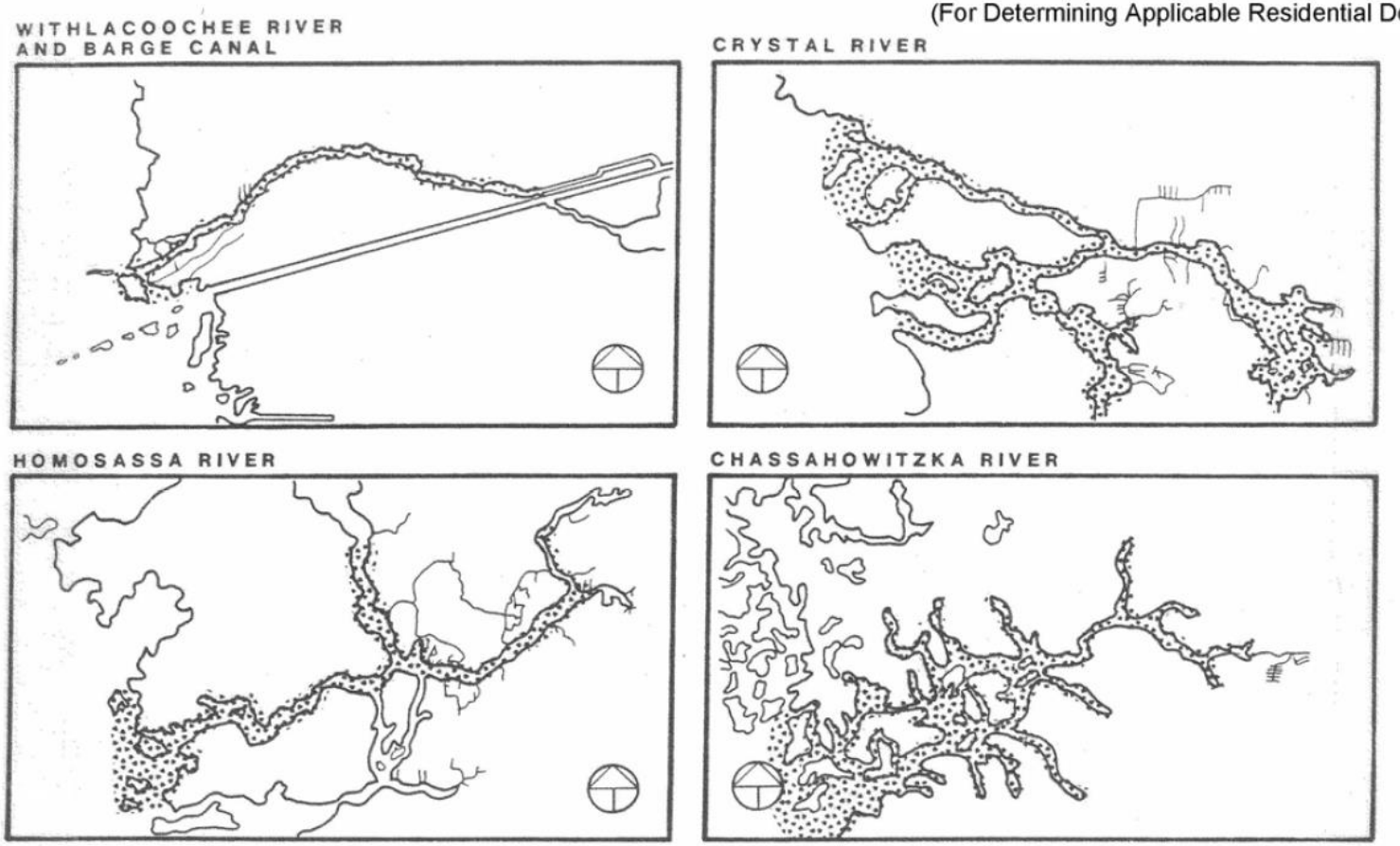
All citizen-initiated plant control activities should be coordinated through the County Aquatic Services Division in Lecanto and the Florida Department of Environmental Protection, Aquatic Plant Management office in Floral City. Residents must apply for permits, should use the services of professional applicators instead of applying herbicides themselves, and should organize and have whole canals treated at one time. Special efforts should also be made to discourage the use of hazardous chemicals such as copper sulfate, which may have an extremely negative impact on manatees and other desirable aquatic plant and animal life.

Biological plant controls offer the most potential as a cost effective and environmentally sound method of treatment. The County should support efforts to determine if they can be safely used in open waterways such as Kings Bay, Crystal River, and the Homosassa River.

Figure MP-5

Essential Habitat Areas

(For Determining Applicable Residential Dock Density)



ESSENTIAL HABITAT - Within these areas, single-family residences are limited to a denisty of one (1) boat slip per residence and vested existing multi-family projects may include multi-slip docks having up to (2) two boat slips per 100 feet of owned-shoreline. Outside essential habitat areas, residential projects may include multi-slip docks having up to two (2) boat slips per 100 feet of owned-shoreline. Locations on tributaries or canals which are upstream or flow directly into a water body designated as an essential habitat area are subject to essential habitat standards.

Source: State of Florida Department of Natural Resources, 1990.
Prepared by: Citrus County Department of Development Services, 1996.

Habitat Protection

Habitat protection offers long-term protection and has been successful in efforts to protect manatees. It is evident that habitat and adjacent lands need to be acquired or incorporated into areas with special designations. Priority should be placed on expanding the Crystal River National Wildlife Refuge and purchasing undeveloped wetland areas adjacent to the Crystal River, northern Salt River, Crystal Bay, Homosassa River, and areas north of the Chassahowitzka National Wildlife Refuge. Emphasis should also be placed on areas which are or may potentially be areas of manatee and boat overlap.

Methods for the County to assist in the habitat protection needs of the manatee are:

- Support the State and USFWS acquisitions in coastal Citrus County;
- Apply joint funding mechanisms to facilitate efficient acquisition of lands;
- Promote and assist in the designation of critical habitats in appropriate coastal waters;
- Evaluate the designation of the entire Crystal River as an Aquatic Preserve; and
- Evaluate the designation of Kings Bay/Crystal River and Homosassa Rivers as manatee refuges.

It is recommended that the Homosassa River, Salt River and Chassahowitzka River be evaluated for designation as "Critical Habitat" for manatees. Consideration should be given to acquiring the undeveloped coastal wetland fringe between the Withlacoochee and Homosassa Rivers.

The Manatee Plan Committee/Manatee Advisory Committee should review and assess the habitat recommendation needs for the manatee, as discussed above. The evaluation and recommendation needs should include at a minimum conservation acquisitions, critical habitat designation evaluations, and conservation easements.

This set of evaluations should be conducted on an annual basis.

Warm Water Refugia

Manatee sanctuaries are essential to ensuring manatees can use warm water refugia free from harassment. An analysis of the need for sanctuary expansion has been conducted by the USFWS. That agency's study recommends designating new sanctuaries to protect foraging areas and expanding existing sanctuaries to accommodate the increasing number of manatees using the South Bay (Buckingham, 1990). The County supports the finding that the increasing population using Kings Bay has created a need for additional sanctuary space and proposes to address the study in the manner described in the "Manatee-Human Interaction" section of this part of this Plan.

Criteria for artificial warm water refugia and the protection of manatees using such discharges is another area of need. The only artificial warm water source in Citrus County is the Progress Energy thermal discharge canal or effluent canal. Reporting requirements for power plant retirements, shutdowns and outages are handled through the NPDES permit process.

Education and Awareness

The development of an interpretive/education center is an essential part of expanding educational programs within Citrus County. This facility will be able to support many educational programs and offer the community and persons visiting the area an excellent opportunity to learn about the manatee. This facility is presently under development through the coordination of FWC, DEP and USFWS.

Other identified needs for improving awareness include the development of a traveler's information service and the placement of informational signs at all public and private shoreline and water-use access sites.

The County supports the development of an interpretive/education center in the Crystal River area, the expansion of the traveler's information service, the placement of information signs, and development of Internet sites.

Governmental Coordination

Manatee Advisory Committee of Citrus County

The Manatee Advisory Committee of Citrus County provides an ideal forum for governmental coordination related to manatee protection. Through this committee, the implementation and amendment of this Plan will be coordinated with other agencies.

Regulatory Authority

This Plan was adopted as the Manatee Protection Element of the Comprehensive Plan. The Plan was also adopted as County Ordinance 91-A13 and is utilized as a land development regulatory document.

Boat Traffic/Recreational Use Capacity Study

Kings Bay and the Crystal River have finite capacities for boat traffic and recreational use. The increasing number of boats on the water will eventually lead to decreasing levels of enjoyment and safety that one experiences while using these waters. A boat traffic study would enable the County to determine what that capacity is and to coordinate the implementation of protective programs to maintain the use below that capacity.

The importance of Kings Bay and the Crystal River as manatee habitat underscores the need for an understanding of what boat traffic and recreational use capacity is and its relationship to manatee safety.

A boat traffic and recreational use capacity study for the Kings Bay and the Crystal River could provide the following assistance:

- A determination of the intensity and nature of human use which can occur without unduly threatening recreational value, human safety, or manatee recovery.
- A decision-making system to aid policy-makers in the implementation of corrective programs if the level of service deteriorates.

Establishing and maintaining an acceptable level of use within the waters capacity would further the goals of a number of pro-manatee recovery organizations and agencies who may be able to assist with the funding of the study. Outside funding for this project should be pursued with SWFWMD, Save the Manatee Club, state agencies, and other organizations.

The County has pursued outside funding without success. Further, with the extensive ownership by the State of our coastal lands and the existing regulatory authority that exists over State waters, the need and benefits of this study is greatly diminished. The County believes that this study is more appropriate as a State activity and the County is better suited to a supporting role.

Manatee Protection Element
Goals, Objectives, and Policies

GOAL 1: To protect and enhance the recovery of the West Indian (Florida) manatee to a viable self-sustaining population.

Manatee – Human Overlap

OBJECTIVE 1.1: The City recognizes that human activities in the coastal waters of the city may conflict with manatee activities and that such conflicts can directly or indirectly results in manatee harassment, injury, or death. To prevent the occurrence of manatee/human interaction which results in manatee harassment, injury, or death, the City shall assist in the implementation of DEP/USFWS-approved site-specific protective measures.

Site Specific Protective Measures

POLICIES

A) Coordinate with local enforcement agencies to implement the Site Specific Protective Measures in waters within the City of Crystal River which have been approved by DEP/USFWS, and adopted by state rule or local ordinance.

B) The Manatee Plan Committee will evaluate the effectiveness of the Site Specific Protective Measures to prevent the occurrence of manatee harassment, injury, and death. *[Manatee Plan Committee is inactive at this time]*

C) Coordinate with Citrus County, USFWS, and other enforcement agencies to maintain the informational and regulatory signage necessary to enforce designated speed zones.

Harassment

D) In recognition of the increasing population of manatees using Kings Bay as warm water refugia, the City shall continue to monitor the sanctuary designation process and to participate as a member of the Manatee Plan Committee.

Law Enforcement

E) Concentrate enforcement activities seasonally as appropriate in City waters.

F) Participate in an annual meeting of the Sheriff's Department Marine Enforcement Unit, the Florida Marine Patrol, and USFWS enforcement personnel prior to the beginning of the manatee wintering season. These meetings shall address enforcement strategies and critical enforcement periods for each coastal water body.

G) The City shall continue to patrol areas of critical concern of the habitat of the manatee within the City limits through the local Sheriff's Department and encourage the Florida Marine Patrol and other agencies to do the same.

Land Development

Marina/Boat Facilities

OBJECTIVE 1.2. New marinas or ~~/~~boat facilities and boat ramps in the coastal waters of the City of Crystal River shall be located on sites which exhibit the following criteria:

1) Minimize manatee/boat overlap; and

2) Minimize the disturbance of wetlands.

Only two sites which meet both criteria 1 and 2 have been identified as suitable sites for new facilities on the Crystal River and Kings Bay: one at Fort Island and one near the mouth of the Crystal River (see MP 4). Neither location is within the City of Crystal River.

POLICIES

A. A new marina or boating facility or boat ramp may only be constructed if an existing boat ramp facility of similar capacity within an Essential Habitat area is permanently closed.

B. Nothing in this policy shall be construed to prohibit safety improvements to existing public boat ramps.

C. Utilize brochures, signage and other public relation tools to encourage boaters whose destination is the Gulf to use boat ramps which reduces their potential boat/manatee overlap to a minimum instead of unnecessarily navigating critical habitats or other coastal rivers in which manatees are known to congregate.

Residential Dock Density

OBJECTIVE 1.3. In an effort to limit the number of areas where boating activities and manatee activities overlap, new or expanded residential dock facilities in the coastal waters of Citrus County and the City of Crystal River shall be limited to a density of one boat slip per 100 feet of owned-shoreline when such water are located in Essential Habitat areas as defined by this Plan and depicted in Figure MP-4 of this Plan. Vested existing multifamily projects within essential habitat areas may include multi-slip docks having a density no greater than two boats per 100 feet of owned-shoreline. Outside essential habitat areas, residential projects may include multi-slip docks having a density of no more than two boat slips per 100 feet of owned-shoreline.

POLICIES

A) The residential docking facilities criteria in this Plan should not be interpreted to allow more boat slips than is prudent upon consideration of affected wetlands, navigability, depth of water, and other siting limitation as deemed appropriate by regulatory agencies.

B) Development of residential docks shall conform to all other comprehensive plan policies, City regulations and other agency regulations.

Residential Dock Design

OBJECTIVE 1.4. Docks, mooring pilings and other such structures proposed for location in the coastal waters of Crystal River and Citrus County shall be built in a manner which reduces or eliminates the impact of these structures on the manatee and the physical and biological resources on which it depends. This will be accomplished through the enforcement of construction standards which limit dock intrusion into waterways; eliminate dredge and fill related to residential dock construction; and require submerged structures to be designed in a manner which will prevent injury to manatees, as identified in this Plan.

POLICIES

A) Docks, mooring pilings or other such structures shall not extend within 100 feet of a federal navigation project channel as defined in subsection 253.03(10), F.S., or a channel marked by any governmental agency.

B) Docks, mooring pilings, or other such structures shall be placed in locations having adequate water depth. Docking facilities shall be located in waters having adequate depths for boat mooring, turning basin, access channels, and other such areas which will accommodate the proposed boat use in order to insure that a minimum of one foot clearance is provided between the deepest draft of a vessel and the bottom at mean low water.

C) No dock shall extend waterward of the mean or ordinary high water line more than 200 feet over sovereignty, submerged land or more than 25 percent of the width of the waterway at that particular location, whichever is less.

D) Docks, mooring piling, conveyance structures or other such structures shall be designed to prevent entrapment or injury to manatees (adult, juvenile, or calf).

E) No residential docking facility shall be approved which required either dredging or filling to provide access by canal, channel, road or any other means.

F) Single-family residential docks shall conform to the following criteria:

1. applicable state and federal regulations

2. the dock decking design and construction will insure maximum light penetration, with full consideration of safety and practicality;

G) Multi-slip residential docks shall conform to the following criteria:

1. applicable state and federal regulations

2. the dock decking design and construction will insure maximum light penetration, with full consideration of safety and practicality;

H) Because of the variety of types of shorelines in Crystal River and Citrus County, dock design standards should be based on location specific criteria which recognize the levels of shoreline and aquatic vegetation, local water depths, and the manatee habitat importance of a given area.

Water Quality and Vegetation

Water Quality Restoration

OBJECTIVE 1.5. Manatees are aquatic herbivores and may be susceptible to variety of water contaminants including pesticides, herbicides, industrial byproducts and pathogens associated with human sewage (Packard, 1983). Maintain or improve ambient water quality in the coastal waters, in coordination with the Crystal River/Kings Bay Surface Water Improvement and Management Plan, at or above levels which ensure that no manatee mortality can be attributed to surface or groundwater pollution.

POLICIES

A) Support and assist in the implementation of the Crystal River/Kings Bay Surface Water Improvement and Management Plan (SWIM) intended to improve water quality in Crystal River/Kings Bay by providing SWIM with local information and reviewing studies and proposals for research and water quality improvement projects.

B) Participate in the development and implementation of specific recommendations to improve and sustain surface water quality in the City of Crystal River.

C) Cooperate and coordinate with agency projects to investigate and establish criteria for maximum acceptable levels of water contaminants including pesticides, herbicides, industrial byproducts and pathogens associated with human sewage which have been shown to have a detrimental effect on manatees.

Aquatic Plant Control

OBJECTIVE 1.6: Food sources utilized by manatees may be directly affected by aquatic weed control (Packard, 1983). Continue to monitor and recommend techniques for aquatic weed control in the coastal waters which will reduce levels of toxicity in manatee food sources such that no manatee mortality can be attributed to toxicosis from weed control herbicides.

POLICIES

A) Aquatic vegetation shall be retained in essential manatee foraging areas through the use of mechanical harvesting and other alternate means. This policy shall be applied in accordance with the Summer/Winter Treatment Plan and local representatives from USFWS, ACOE, DEP, MTAC, and the Division of Aquatic Services (DAS)-Citrus County.

B) Continue to participate in ~~hold~~ annual meetings which include local representatives from USFWS, ACOE, DEP, MTAC, and DAS-Citrus County to evaluate the effectiveness of the Summer/Winter Treatment Plan for Citrus County coastal waters in preserving adequate food resources for manatees, any changes to the Treatment Plan between annual meetings should be reviewed by the aforementioned representatives.

C) All citizen-initiated aquatic plant control activities shall be channeled through the County Aquatic Services Division and the Florida Department of Environmental Protection, Aquatic Plant Management office in Floral City.

Habitat Protection

OBJECTIVE 1.7: In order to ensure that manatees can continue to use the physical and biological resources essential to keeping them free from harm and harassment, acquire or establish protective status for all areas of the habitat system in Crystal River which are essential to the survival and recovery of the manatee.

POLICIES

A) Maintain provisions in~~to~~ the land development code which provide for incentives for mitigation of disturbed habitat resources where redevelopment of coastal properties occurs.

B) Maintain provisions in~~to~~ the land development code which provide for conservation of habitat through fee simple donations and conservation easements.

C) Actively support and assist in the evaluation of Essential Habitats (State designation) of the Florida Manatee and Kings Bay/Crystal River as an Aquatic Preserve by submitting petitions, by initiation of commission resolutions, and by monitoring these federal and state designation processes.

D) Participate in initiatives select and purchase essential habitat coastal property on the Crystal River which will preserve manatee habitat resources, accommodate manatee education facilities, and provide passive recreation opportunities to Crystal River and Citrus County residents. Such initiatives shall include multiple agencies and shall not be the sole responsibility of the City of Crystal River.

E) The Manatee Plan Committee shall review and assess the habitat recommendation needs for the manatee. The evaluation and recommended needs shall include, at a minimum,

conservation acquisitions, critical habitat designation evaluations, conservation easements. This set of evaluations shall be conducted annually or as needed.

Warm Water Refugia

Volume and Salinity of Spring Water

OBJECTIVE 1.8: The quantity of salinity of water flowing from natural springs in Kings Bay may be altered by increased water withdrawals from the aquifer or the reduction of recharge areas. If the volume of water flowing from springs decreases, water temperature around springs may drop, increasing manatees' exposure to cold waters and its associated health risks (Packard, 1983). Changes in flow rates could also result in changes to the aquatic vegetative community composition and volume which could, in turn, impact manatee survival/use of the area. In coordination with SWFWMD, regulate and monitor consumptive water withdrawals which would result in a decrease of the average winter water temperature or an increase in the level of salinity in the springs that manatees depend upon for warm water habitat.

POLICIES

A) Require, by local ordinance, the monitoring of the water quality of all FSDWA public wells and consumptive water use of all major public well heads.

B) Support the establishment of a monitoring program for coastal spring water flow, warm water refugia and sanctuary water salinity by providing assistance with date collection to SWFWMD, DEP, and USFWS.

C) In coordination with SWIM, the County shall evaluate the potential for restoring historical flows from springs and sinks within the coastal river basins.

Artificial Refugia

OBJECTIVE 1.9: Reporting requirements for power plant retirements, shutdowns and outages shall be handled through the NPDES permit process.

Education and Awareness

OBJECTIVE 1.10: In an effort to eliminate harassment of an injury to manatees and to create additional public support for their protection and recovery, provide support to organizations and agencies sponsoring manatee education and awareness programs through the distribution of information, participation in activities, and the development of interpretive materials and signs, as identified in this Plan.

POLICIES

A) Distribute manatee-related documents and materials to all organization and individuals who request them.

B) Support the establishment of an additional USFWS/DEP Interpretive Education Center in the Crystal River area by aiding in the evaluation of prospective sites and assisting with planning documents. *[This is being met by the development of Three Sisters Springs site]*

C) Manatee protection/awareness information shall be posted at each public access to essential habitat waters and at private/commercial access points where permission of the owner is obtained. Other informational delivery stems such as radio broadcasts will also be used when adequate resources when possible.

D) Assist in the installation of interpretive signs/public notice boards throughout the coastal area, including all coastal area private and public shorelines and water-use access site. Include information describing what constitutes harassment of manatees and what the penalties for committing harassment are.

E) Provide manatee protection information and materials to the Chambers of Commerce and other groups and business which request it.

F) Provide waterfront residents with DEP literature on laws and penalties regarding unpermitted application of herbicides.

G) Support the development of manatee education sites on the Internet.

Governmental Coordination

OBJECTIVE 1.11: To ensure that the development-related policies of this plan are implemented, incorporate the provisions and references necessary to implement this plan into the appropriate administrative and substantive sections of the City's Land Development Code. This shall be accomplished through adoption of this plan as the Manatee Protection Element of the Comprehensive Plan and maintenance of land development regulations in compliance with this element.

POLICIES

A) Prior to the issuance of a local permit, assure that all proposed waterfront development has complies with the permitting procedures and standards with USACOE, DEP, USFWS, and SWFWMD.

B) The Manatee Plan Committee shall review proposed changes in the Manatee Protection Ordinance which are related to manatee protection.

C) Support a boat traffic and recreational use capacity study for Kings Bay and the Crystal River and determine whether the projected levels of recreational use of these waters will conflict with manatee recovery. The Manatee Plan Committee will use the findings of this study to determine if additional protection measures to assure manatee recovery is not inhibited or needed.

OBJECTIVE 1.12: Through the Manatee Advisory Committee provide a forum in which the implementation and amendment of this plan may be reviewed, monitored, and coordinated with other organizations and agencies involved in manatee protection and regulation.

POLICIES

A) Implementation of this plan shall be coordinated with the Manatee Plan Committee of Citrus County and the various regulatory agencies.

B) Participate in at least one meeting per year of the Manatee Plan Committee and/or Manatee Protection Plan at a time which allows for such recommendations to be completed before the deadline for the following Comprehensive Plan amendment process.

C) The Florida Manatee Recovery Plan is a document prepared for the USFWS by the multi-organization Florida Manatee Recovery Team which explains the actions necessary to permit the Florida Manatee population to build-up to a point of recovery. This Manatee Protection Plan reflects those elements of the Recovery Plan which the City believes it is capable of implementing. On an annual basis, or as needed, the Manatee Plan Committee shall review the Manatee Protection Plan and the City's implementation efforts to determine if they are consistent with the Florida Manatee Recovery Plan and recommend any actions necessary to achieve consistency.