

SECTION 5 PROBLEMS AND OPPORTUNITIES

Water resources projects are planned and implemented to solve problems, meet challenges, and seize opportunities. In the planning setting, a problem can be thought of as an undesirable condition, while an opportunity offers a chance for progress or improvement. The identification of problems and opportunities gives focus to the planning effort and aids in the development of planning objectives. Planning objectives are statements of what a plan is attempting to achieve; they communicate to others the intended purpose of the planning process. Problems and opportunities can also be viewed as local and regional resource conditions that could be modified in response to expressed public concerns. As the Water Preserve Areas Feasibility Study was formulated along with the Comprehensive Review Study, the same problems and opportunities that applied to the Comprehensive Plan also apply to the Water Preserve Areas. **Section 5** of the *Central and Southern Florida Comprehensive Review Study, Final Integrated Feasibility Report and Programmatic Environmental Impact Statement*, dated April 1999, presents a more in-depth view of the problems and opportunities of the ecosystem of the Central and Southern Florida region.

This section describes the problems and opportunities in the study area and the planning goals and objectives developed for the study.

5.1 PUBLIC CONCERNS

The concerns of the public that were polled in the Comprehensive Review Study have not changed. As a result of these prior efforts, the concerns of ecosystem health, uncontrolled growth, water quality, water supply, balance, flood control, recreation, economy, and social considerations are still prevalent.

As in the Comprehensive Review Study, one of the major steps in the planning process is the evaluation of the effects of alternative plans. Evaluation will reveal the plan's important effects, including effects that reflect progress toward meeting the objectives and constraints, as well as effects that are of interest for other reasons. Evaluation will cover the full range of effects on the human environment, including ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social and health effects, whether direct, indirect, or cumulative (Council on Environmental Quality, 1978). This information about the plans effects will provide interested members of the public and responsible decision makers with a basis for judging trade-offs within and among alternative plans; that is, for determining what they individually believe is a "balance" in view of likely

beneficial and adverse effects. In short, this study will provide information that people can use to make decisions about “balance”.

5.2 ECOLOGICAL PROBLEMS AND OPPORTUNITIES

Natural resource specialists agree that the remaining ecosystems in south Florida no longer maintain the functions and richness that defined the pre-drainage system, and that these measures of ecological health will continue to decline without preventative actions. Not only is it certain that these natural systems will not recover their defining attributes under current conditions, it is unlikely that even the current, unacceptable ecological conditions can be sustained into the future. For example, wading birds, key indicators of broad, regional patterns of aquatic production, continue to show declines in the total number of birds initiating breeding in south Florida colonies. Other examples are the declines in population levels of commercially and recreationally important fish species in the St. Lucie and Caloosahatchee Estuaries, and Biscayne and Florida Bays. High water levels in recent years in Lake Okeechobee have resulted in widespread losses of the emergent and submerged plant communities that provide habitat for economically important fish. If this trend continues, there may be substantial declines in the lake’s fisheries. Regulatory releases to the Caloosahatchee and St. Lucie Estuaries can have damaging effects on the plants and animals inhabiting these areas. Prolonged high volume releases from Lake Okeechobee are believed responsible for the defoliation of seagrasses, fish kills, and deformed fishes within the St. Lucie Estuary during 1998, for example.

Many of the defining characteristics of the pre-drainage ecosystem (spatial extent, habitat heterogeneity, and dynamic storage) have either been lost or substantially altered as a result of land use and water management practices during the past 100 years in south Florida. Loss in spatial extent of natural areas has been most severe in the past 50 years with the construction of the C&SF Project, including the construction of Herbert Hoover Dike around Lake Okeechobee. Nearly half of the original Everglades ecosystem has been converted to agricultural and urban uses. The ecological effects of this loss in spatial extent include:

- a substantial reduction in habitat options for fish and wildlife,
- reduction in the system-wide levels of primary and secondary production, changes in the proportions of community types within the remaining system, and
- increasing concentrations of pollutants in remaining natural system surface waters, sediments, and wetlands and degradation of water quality.

The hydrology of the remaining Everglades has become altered by the operation of the C&SF Project, which has generally:

- reduced average annual flows and surface water stages,
- lowered regional ground water,
- either increased or decreased annual hydroperiods, depending on location,
- geographically relocated long and short hydroperiod wetlands,
- reduced the extent of long hydroperiod refugia,
- altered the frequency, duration and magnitude of interannual wet and dry cycles, and
- altered salinity levels in estuaries.

Overall, the construction and operation of the C&SF Project and its subsequent modification of the natural system have:

- contributed to the substantial reduction in spatial extent and system resiliency,
 - provided a network of canals and levees which have accelerated the spread of polluted water, sediments, and exotic species,
 - greatly reduced the water storage capacity within the remaining natural system, and
 - created an unnatural mosaic of impounded, fragmented, and both over-inundated and over-drained marshes throughout the natural system.

Some level of ecological improvement is expected to occur as a result of the implementation of a number of projects such as: changes in the Lake Okeechobee regulation schedule, the addition of the stormwater treatment areas as part of the Everglades Construction Project, rainfall-based schedules for Water Conservation Areas 2 and 3, implementation of Minimum Flows and Levels for the Everglades and Lake Okeechobee, and the completion of the C-111 and Modified Water Deliveries projects. The effects of these projects on the regional system were modeled and analyzed. The magnitude of the cumulative, regional benefits from these improvements, relative to the level of ecological improvements required to recover a functional, Everglades-type system, is uncertain. The best professional opinion is that these projects will contribute less than 25 percent of the overall, improvement in hydrological patterns required for the recovery of a regionally integrated ecosystem, or to achieve the ecological targets that were contained in the performance measures used to define the restoration objectives. In general, these projects are expected to produce a higher level of improvement in the quality of water in the remnant natural system. Further discussion of water quality follows this section.

Translating these levels of improvement in hydrological patterns and water quality conditions into predictions of regional ecological health is risky business. A

large question in this evaluation is concerned with ecological thresholds, and whether modest improvements in hydrological patterns are sufficient to shift production and animal behavior patterns towards more Everglades-like patterns. The prevailing technical opinion is that these modest hydrological improvements are not expected to produce major, and in some cases, measurable, improvements in regional ecological conditions or in habitats critical to several species of endangered species. As mentioned above, relatively greater levels of improvement are expected for water quality conditions. Reduced inputs of excessive nutrients should slow the spread of cattails and other plants with high nutrient tolerances, and should produce a slow recovery of natural vegetation patterns in some nutrient-stressed parts of the system.

5.3 WATER QUALITY PROBLEMS AND OPPORTUNITIES

5.3.1 Regional Overview

Nutrient inflows into the Everglades, particularly phosphorus, have been responsible for many of the changes to the ecology of the Everglades. Total phosphorus concentration is used as an index criterion for water quality concerns in the Everglades as evidenced by the Everglades Forever Act. Therefore, reducing this “phosphorus enrichment” must be a primary goal of the Everglades restoration efforts. The Water Preserve Area (WPA) Feasibility Study also focuses on reducing phosphorus although dissolved oxygen is also considered in analyzing problems and presenting opportunities.

With a few exceptions, water quality during the 1990s was in compliance with existing state water quality criteria. The 2001 Everglades Consolidated Report prepared by the South Florida Water Management District indicated that, for at least one Everglades Protection Area region, dissolved oxygen, specific conductance, alkalinity, pH, un-ionized ammonia, iron, and total beryllium were placed in the most severe excursion category (Concern) based upon water year 1999 data. The pesticide diazinon was classified as a Concern for inflows to Water Conservation Area 2. Total phosphorus loads and median concentrations in the inflows to each Everglades Protection Area region during water year 1999 were within the ranges observed in the previous nine years. The parameter was identified in the Concern category in all regions except for Everglades National Park and interior marsh sites of the Loxahatchee National Wildlife Refuge. For the entire Everglades Protection Area, 87 per cent of total phosphorus measurements were below 50 ppb, and 45 per cent were at or below 10 ppb. Of all the parameters classified as Concerns, dissolved oxygen stands out as the most pervasive, being a Concern in every basin. The Class III criterion of 5.0 mg/l is troubling as the frequency of measurements falling below the criterion ranged from 42 to 92 per cent among the Everglades Protection Area regions. However, a majority of the

dissolved oxygen excursions are due to natural conditions within a marsh; therefore, do not necessarily constitute violations of state water quality standards. A similar statement can be made for dissolved oxygen levels in canals. A review of contributory factors reveals that the majority of pH and alkalinity excursions are also due to natural conditions.

From a regional perspective, within the three county WPA area, water quality impacts weigh most heavily on waters discharged to the Everglades Protection Area. While the water quality impacts in other receiving bodies may not receive the same level of attention as the Everglades, water quality is still a factor in the major canals leading to the estuaries and the estuaries themselves. The water quality criteria for these other water bodies differ as noted in the following paragraphs.

5.3.2 Everglades Protection Area Inflows

The Everglades Forever Act, Florida Statute 373.4592, directs that all water discharged into the Everglades Protection Area must meet an interim standard of 50 ppb total phosphorus concentration and either a default concentration of 10 ppb or a threshold concentration established by research findings by December 31, 2006. The threshold concentration must be set by December 31, 2003 or the default concentration becomes the standard.

Surface water runoff is discharged directly into the Everglades Protection Area in three locations within the WPA boundary. The Village of Wellington (Acme Improvement District) in Palm Beach County is divided into two sub-basins: Basin A flows via gravity discharge into the C-51 Canal and then into Stormwater Treatment Area 1 East as a part of the C-51 West Basin. On the other hand, Basin B runoff is pumped directly into the Loxahatchee National Wildlife Refuge (WCA-1) via Acme pump stations 1 and 2. The total phosphorus concentration identified from available data reflects an average concentration above 150 parts per billion (ppb) or 94 ppb on a flow proportional basis. The average annual flow volume discharged into the Water Conservation Area equals approximately 39,000 acre-feet.

The North Springs Improvement District discharges surface water runoff directly into Water Conservation Area (WCA) 2A via a 445 cfs pump station. A total volume of nearly 6,800 acre-feet of runoff is discharged into WCA-2A on an average annual basis. The total phosphorus concentration averages approximately 90 ppb or 39 ppb on a flow proportional basis.

The S-9 pump station on the C-11 Canal in western Broward County discharges approximately 215,000 acre-feet of runoff from the C-11 West Basin on an average annual basis. Total phosphorus concentration averages 34 ppb or 16 ppb on a flow proportional basis, although peak flows in the low 50s have been

reported. One reason for the low phosphorus concentration is the mixing of seepage from the WCA with surface water runoff.

5.3.3 Inflows into Major Canals

No state numeric criterion exists for phosphorus with the exception of the Everglades Protection Area. Runoff discharged into the major canal network within the Water Preserve Areas must meet the criteria established for a Class III water body or the Everglades Forever Act criterion if the canal discharges to the Everglades. As a consequence, in areas other than the Everglades, runoff must, as a minimum, be no worse than the background level of the constituent being measured. The major canals that serve as receiving water bodies for discharges from Water Preserve Area components include the C-51, Hillsboro, C-11, C-9, C-6, C-4 and C-2. With the exception of the C-51 and Hillsboro Canals, the total phosphorus level averages are in the 20 to 40 ppb range. The Hillsboro Canal averages from 50 to 120 ppb depending upon the location analyzed. The C-51 Canal downstream of the Acme Basin B possible discharge point has total phosphorus averages in excess of 60 ppb.

5.3.4 Flow into Estuaries (Discharge to Tide)

Canal discharge from the Water Preserve Areas flows into either the Lake Worth Lagoon, the Intracoastal Waterway or Biscayne Bay via the canals cited in section 5.3.3, above. A primary objective of the Comprehensive Everglades Restoration Plan and, therefore, of the Water Preserve Areas is to reduce discharges to tide while maintaining the proper salinity balance of the estuaries. In the case of Biscayne Bay, sufficient fresh water must be provided in an attempt to meet the historical flows into the bay. With the dearth of historical data, the necessary fresh water volume must be estimated with adaptive assessment being applied based upon observation and analyses of results. Water quality remains a concern.

5.4 ECONOMIC AND SOCIAL WELL-BEING PROBLEMS AND OPPORTUNITIES

The C&SF Project, by providing flood protection and water supply, has enabled the population of south Florida to grow from approximately 900,000 persons in 1950 to over 5.5 million in 1995. By 2050, population is projected to grow to 11.6 million. Increases in population growth intensify the competition for and stress upon regional water resources.

With the current C&SF Project, the availability of water from regional surface and ground water sources remains relatively constant. The growing demand for inexpensive, high quality water for agriculture, industry, and an

increasing population could exceed the limits of readily available sources. When factoring in the needs of the natural system, upon which a good part of the region's economy depends, conflicts among water users may become even more severe. In addition, the human community is fundamentally dependent on the project for public health, safety, and welfare.

In the south Florida region in general and the Lower East Coast in particular, per capita income levels are higher than in the rest of the state. There is a strong per capita income difference between the urbanized Lower East Coast and the agricultural areas surrounding Lake Okeechobee. Employment and income opportunities in the important industries of agriculture and tourism are heavily reliant on the benefits provided by the C&SF Project.

Agriculture and tourism were identified as "critical industries" by the Governor's Commission for a Sustainable South Florida. Agriculture depends upon the system for vital water supply and flood protection. The tourism industry is dependent upon the project in a myriad of ways. For example, a healthy ecosystem and its attendant tourism are the mainstays of the Monroe County economy, as reflected by the relative domination of economic activity there in the services, retail trade, and fisheries industries. The ability to sustain the region's economy and quality of life depend, to a great extent, on the success of the efforts to protect and better manage the region's water resources.

Predictions of water shortages in the future indicate serious – and probably unacceptable – levels of water supply cutbacks. Modeling shows that for the Lower East Coast, water supply cutbacks were predicted to occur in a range from 15 years in northern Palm Beach County and Miami-Dade County to 29 years in Broward County. The monetary losses incurred by these shortages are quantified in *Appendix E* of Central and Southern Florida Project Comprehensive Review Study, Final Integrated Feasibility Report and Programmatic Environmental Impact Statement, dated April 1999.

5.5 RECREATION AND PUBLIC ACCESS PROBLEMS AND OPPORTUNITIES

Public use has been an important consideration of the C&SF Project since it was first developed. The C&SF Project provides opportunities for a wide range of activities, including: fresh water and estuarine fishing, boating, hunting, camping, picnicking, nature watching and photography. The opportunity to pursue these activities is very important to the economy of south Florida and to the Native American Tribes.

Within the WPA, access to recreation is limited to canals and access through various locations adjacent to the water conservation areas. There is one campground located along Krome Ave in Miami-Dade County.

5.6 PLANNING GOALS AND OBJECTIVES

These goals, and the study objectives associated with them, are shown in *Table 5-1*.

TABLE 5-1 GOALS AND OBJECTIVES FOR THE C&SF COMPREHENSIVE REVIEW STUDY AND WATER PRESERVE AREAS

Goal: Enhance Ecologic Values
<ul style="list-style-type: none"> • Increase the total spatial extent of natural areas • Improve habitat and functional quality • Improve native plant and animal species abundance and diversity
Goal: Enhance Economic Values And Social Well Being
<ul style="list-style-type: none"> • Increase availability of fresh water (agricultural/municipal & industrial) • Reduce flood damages (agricultural/urban) • Provide recreational and navigation opportunities • Protect cultural and archeological resources and values

5.6.1 Enhance Ecologic Values

Healthy natural systems are integral to the sustainability of south Florida. These systems provide numerous functions such as:

- habitat for numerous plant and animal species,
- recreation and educational opportunities (photography, fishing, hunting, bird watching, etc.),
- water quality filtration including removal of nutrients and silt,
- ground water recharge,
- soil formation,
- hydrologic linkages,
- ground water quality protection,
- interception of airborne pollutants,
- shoreline stabilization, and
- protection against erosion.

Each natural area is uniquely important. Wetlands and lakes, in particular, retard floodwater and provide surface water storage. Mangroves and estuaries provide important feeding areas for manatees and breeding habitat for numerous finfish and

shellfish, including several of commercial interest. Upland natural systems function as noise buffers, urban green space, habitat for plants and animals (such as tree snails, deer, hundreds of species of birds, and the endangered panther and indigo snake), and travel corridors for these same animals. Thus, plant and animal habitat, although perhaps the most obvious benefit or function, is just one of many functions that natural systems provide. Collectively, these systems benefit the natural ecology and support agricultural, urban, and other human interests as well. The ecological health and hydrologic characteristics of Lake Okeechobee and south Florida's freshwater wetlands directly affect the quality of the receiving water bodies, including the St. Lucie and Caloosahatchee Estuaries, and Biscayne and Florida Bays.

Two documents are particularly important in framing the Comprehensive Review Study's goal for enhancing *ecological* values. These documents, which were prepared by many of the leading experts on Everglades ecology, are *The Science Sub-Group Report, Federal Objectives for the South Florida Restoration* (Science Sub-Group, 1993), and *Everglades, the Ecosystem and Its Restoration* (Davis and Ogden, 1994). Another earlier publication, *Ecosystems of Florida* (Myers and Ewel, 1990) also contributed substantial input into the Comprehensive Review Study.

5.6.1.1 Spatial Extent

5.6.1.1.1 Regional Overview

Scientists have identified the large spatial extent of the south Florida wetlands as one of the defining physical characteristics of the pre-drainage ecosystem. The size of the south Florida wetlands, in combination with the complex mosaic of habitats, enabled multiple populations of plants and animals to persist over time. The size of the pre-drainage area made it possible for the natural ecosystem to: 1) support genetically viable numbers and sub-populations of species with large feeding ranges and/or narrow habitat requirements, 2) provide the aquatic production to support large numbers of higher vertebrate animals in a naturally nutrient-poor environment, and 3) sustain habitat diversity despite natural disturbances. The ability of animal populations to recover from disturbances decreases as the available habitat area decreases since habitat diversity, the amount of seasonal refugia, and the number of dispersal options also decrease.

Roughly 50 percent of the pre-drainage wetland area and 90 percent of pinelands have been lost to development. Lake Okeechobee was much larger then it is at present with an extensive littoral/marsh system extending to the north, west, and south. The resulting loss of these natural areas has caused wading bird, snail kite, and panther populations, for example, to be stressed. Assuring adequate spatial extent for natural systems, necessary to support the mosaic of habitats characteristic of the pre-drainage ecosystem, will provide for genetically viable numbers and populations of native species and habitat diversity.

5.6.1.1.2 Water Preserve Areas

While the Comprehensive Review Study identified the need to assure adequate spatial extent for the natural systems, the remaining natural areas within the Water Preserve Areas are receiving pressure from development at an alarming rate. The need to protect the existing wetland systems like the wetlands in and around the Strazzulla tract, Pennsuco wetlands and remaining large tracts of undeveloped land is needed before this land disappears to the development of the urban areas of the lower east coast of Florida.

5.6.1.2 Habitat and Functional Quality

5.6.1.2.1 Regional Overview

Adverse changes in natural habitats, including sawgrass, mangroves, seagrass beds, and other native wetland habitats, as well as in many native fish and wildlife species, such as wading birds, alligators, shrimp, and lobsters, that depend on healthy habitats for survival have occurred in the south Florida ecosystems. The specific functions that wetlands or uplands perform are closely associated with their condition or quality. A reduction in the quality of these areas results in the loss of many or all of the functions that these areas historically performed. Improving the functional quality of the remaining natural areas is important to system-wide restoration given the loss of spatial extent and, thus, function of the historic wetlands and uplands.

South Florida natural habitats have been physically and hydrologically altered and manipulated. Consequently, these Florida ecosystems are now substantially less productive and diverse than the historic system. For example, although many of the historic short hydroperiod wetlands no longer exist, wetlands that were historically much wetter now have short hydroperiods. Another example is the alteration of wetlands in the Water Conservation Areas. These areas are managed as separate entities and are hydrologically different from historic conditions resulting in changed hydropatterns and quality of the wetlands and tree islands. Aquatic productivity has been reduced or highly altered throughout the marshes of the central Everglades and the estuaries. Reductions in aquatic productivity have affected the abundance of birds as well as fish. Changes in habitat, construction of deep canals, and abnormally extreme water levels impact the foraging ability of birds. Additionally, changes within interior and coastal wetlands have adversely influenced downstream commercial fish and other species in coastal ecosystems such as Florida Bay.

Invasive plant and animal species have also impacted the quality of the south Florida landscape. Invasive species include both native (i.e. cattails) and non-native species (e.g. *Melaleuca*, Brazilian pepper, and Australian pine). The increasing dominance of any community by a single species ultimately reduces the habitat variability necessary to sustain a healthy community of both plants and animals. Water management has encouraged the spread of these invasive species by creating

conditions under which they can out-compete the native habitat that existed under pre-drainage conditions. For example, high phosphorus loads and increased hydroperiods have contributed to cattails out-competing sawgrass; altered hydrologic regimes have increased the spread of *Melaleuca* and Brazilian pepper; and the construction of levees has contributed to the spread of Australian pine and Brazilian pepper. Eliminating the invasive and exotic species and the conditions that favor these species will contribute to restoration of native plants and animal species and a more natural ecosystem hydrology and function.

5.6.1.2.2 Water Preserve Areas

Adverse changes in wetland habitat, ranging from dehydration of freshwater marshes to infestation by invasive exotic vegetation, have occurred in South Florida as a result of developmental pressures, leading to a reduction in quality of the wetlands. A reduction in quality results in the loss of many or all of the functions that these areas historically provided, resulting in a threat to the survival of native fish, wading birds, alligators, crawfish, and other wetland species who depend on a healthy habitat for survival. Improving the functional quality of the remaining natural Water Preserve Areas is important to system-wide restoration.

Major natural areas considered in this study include the Strazzulla Tract, Everglades Buffer Strip, Pennsuco Wetlands, and Bird Drive Recharge Area. Landscapes associated with these areas include hydric pine flatwoods, wet prairie, cypress/hardwood swamp, freshwater marsh, and muhly grass prairie. These systems have been hydrologically altered as evidenced by changes in plant community composition, reduced productivity, and generally lower functional quality. Improvements to the quality, quantity, timing and distribution of water to these areas will protect and sustain wetland habitats resulting in functional recovery. This will benefit the extended system by increasing the spatial extent of productive habitat ranging from short hydroperiod (muhly grass prairie) to long hydroperiod (freshwater marsh) wetlands.

5.6.1.3 Species Abundance and Diversity

5.6.1.3.1 Regional Overview

The changes that have taken place in the natural system have led to decreases in native animal and plant populations. One of the most obvious indicators that the south Florida ecosystems have experienced ecologically significant reductions in productivity is the decline in wading bird populations. Several species are now so reduced in numbers that their long-term existence is jeopardized unless measures are taken to ensure their sustainability. Other species have a naturally restricted range; these species are also vulnerable to extinction if their specialized habitats are altered. In addition to considering these species, it is important to recognize that maintaining balanced communities of the more abundant species is also essential to a sustainable

ecosystem. It is also important to recognize that a balanced community is dynamic; population levels fluctuate widely from year to year as natural conditions fluctuate. Unnaturally small, isolated populations can be quickly extinguished by natural conditions.

Increasing spatial extent and improving habitat quality can provide a basis for improving species abundance and diversity. However, compartmentalization caused by construction of physical barriers such as dikes, canals, levees, and roads, or even hydrologic barriers (such as the Water Conservation Areas) has fragmented the system by creating a series of poorly connected natural areas. These barriers have restricted the movement of many fish and consequently reduced their range. Fragmented communities are more likely to lose species because the number of individuals in each fragment may be too small to persist. The smaller the fragment, the higher is the likelihood of losing species or favoring an imbalance in the species that do inhabit the areas. Moreover, fragmentation itself alters the landscape by breaking connections between the various habitat types that were distributed historically across the landscape. Therefore, improving the connectivity of habitats will improve the range of many animals and their prey-base and provide for a more natural balance of species within the system. The physical barriers that created the fragmented environment themselves affect species abundance. The introduction of deep canals which act to drain surrounding areas, affect the ability of wading birds to forage over large areas.

5.6.1.3.2 Water Preserve Areas

Drainage induced changes in the natural system have led to decreases in native animal and plant populations. Increasing spatial extent and improving habitat quality can provide a basis for improving species abundance and diversity. Improved habitat in Water Preserve Area wetlands will benefit native wading bird populations currently experiencing a drastic decline in numbers due to ecologically significant reductions in habitat productivity.

Invasive plant and species including *Melaleuca*, Brazilian Pepper, and Australian Pine have also impacted the quality of the natural areas in this study. Water management has encouraged the spread of these invasive species by creating conditions under which they can out-compete the native habitat that existed under pre-drainage conditions. The increasing dominance of any community by a single species ultimately reduces the habitat variability necessary to sustain a healthy habitat. Eliminating the invasive and exotic species and the conditions that favor these species will contribute to restoration of native plants and animals.

Water Preserve Area components designed for the purposes of water storage and seepage management must be configured to optimize these functions however, incorporation of fish and wildlife features into component design where applicable,

such as deep water refugia for fish, provides the opportunity to increase spatial extent of productive habitat.

5.6.2 Enhance Economic Values and Social Well Being

The C&SF Project provides economic benefits through regional water supply, flood damage reduction, navigation, and recreation. While most people recognize the need for a healthy ecosystem to support the region's economy and jobs, many people are concerned that restoration projects will displace farms and other businesses, limit development, reduce available water supply, and reduce job opportunities. By contrast, continued degradation of the south Florida ecosystem will adversely affect the tourism and recreational industry that are important to the regional economy.

5.6.2.1 Water Supply

5.6.2.1.1 Regional Overview

Drainage, water supply, and flood protection afforded by the C&SF Project have provided for the growth of south Florida's population, which by 1990 was 5.2 million. Local governments in south Florida are predicting that total population will reach 8 million by 2010 and will range from 12-15 million people by 2050. Approximately 88 percent of the region's current population are concentrated in the coastal urban counties of Miami-Dade, Broward, Palm Beach, Lee, and Collier; this distribution pattern is projected to continue. Urban water supply demands could increase from approximately one billion gallons of water per day today to two billion gallons of water per day by 2050. Lake Okeechobee is an important source of water to both natural and developed areas, particularly during low rainfall years. The growing demand for dependable water for agriculture, industry, and a burgeoning population at a reasonable cost could rapidly exceed the limits of readily accessible sources. If the needs of the region's natural systems are factored in, conflicts for water among users will become even more severe.

5.6.2.1.2 Water Preserve Areas

In the study area, surficial aquifers supply the majority of water for urban use. These aquifers are vulnerable to salt water intrusion. In the Lower East Coast area, salinity intrusion has resulted from two major events. The first is the lowering of the ground water table in the area due to drainage and reduced recharge as well as the increased withdrawal of water by pumping. The second reason is the construction of numerous drainage and navigation canals from inland areas to the coastal waters.

In order to prevent saltwater from entering the local surficial aquifer and contaminating nearby well fields, the water table in coastal areas should be maintained at the level needed to stabilize the fresh water - saltwater interface. Existing criteria to protect against saltwater intrusion requires maintenance of a one-

foot mound of fresh water between the withdrawal point and the saline interface. This is accomplished by maintaining canal levels high enough so that the hydraulic interconnection of the canals and the aquifer maintains a fresh water gradient that is adequate to prevent intrusion of saltwater into the fresh surficial aquifer.

5.6.2.2 Flood Damage Reduction

The C&SF Project was conceived and authorized to provide regional flood damage reduction for south Florida. The system of canals, levees, water control structures and pump stations conveys and confines flood waters to regional storage facilities such as Lake Okeechobee and the Water Conservation Areas, or to tidal receiving waters. Further, additional protection is afforded by the local systems operated by special taxing districts, private property owners, and local governments.

Throughout the C&SF Project area, there are varying levels of flood damage reduction. This is primarily due to variations in the original design goals and changes in land use that have occurred. Many areas that were expected to remain in agriculture have been developed, thereby changing the level of flood damage reduction offered by the project. However, the existing investment in flood damage reduction infrastructure was never intended to totally eliminate flooding in developed areas and flooding does occur periodically. In addition, natural areas have also suffered damage as a result of operating the flood control system to benefit the developed areas. For example, damaging releases to estuaries, unnaturally high water levels in the Water Conservation Areas, and backpumping to the Water Conservation Areas have occurred as a consequence of flood damage reduction.

Flood damage reduction needs have increased since the original flood control project was constructed. As agricultural and urban development continues, the volume, duration, and frequency of floodwaters may increase; the actual level of flood damage reduction may have declined in some areas. There is an opportunity to further reduce the extent of damages from flooding through operational and structural changes to the C&SF Project and local drainage systems.

Within the water preserve areas this could not be more prevalent. The existing project envisioned more agriculture within the lower east coast, but even that has been pushed as far west as possible up the water conservation areas due to urbanization. There is an opportunity to further reduce the extent of damages from flooding in this area by providing additional storage to the canals in flood events that would normally send these flows to tide.

5.6.2.3 Recreation and Navigation

Public use has been an important consideration of the C&SF Project since it was first developed. The C&SF Project provides opportunities for a wide range of outdoor activities, including: fresh water and estuarine fishing, boating, hunting,

camping, picnicking, nature watching, and photography. It also provides the public with access to areas where they can simply “get away from it all.” The opportunity to pursue these activities is very important to the economy of south Florida and to the people who make use of these opportunities, including residents, visitors, eco-tourists, and the Native American Tribes. Restoration and protection of the remaining Everglades system, the Keys, south Florida estuaries (including Florida Bay), and reef tracts are essential to the economic base provided by these recreational and traditional uses.

In as much as possible, recreational advantages within the water preserve areas are limited. Currently, the only recreation exists in the existing canals and at several locations along the Water Conservation Areas near the S-9 pump station and the Hillsboro Canal. There is one campground along Krome Avenue in Miami-Dade County.

5.6.2.4 Social and Cultural

Societal sustainability requires the preservation of the rich cultural diversity of the region, such as the Native American communities and the multi-generational culture of the agricultural communities. The rapidly growing population of south Florida is decreasingly dependent directly on the environment for its sustenance, with the exception of water needs. Yet that population is increasingly dependent indirectly on a restored and sustainable environment, such as for support for the economic base of tourism as well as the heightened awareness of the environmental ethic to preserve and sustain this unique natural environment for the future generations to experience and value.