Special Publication SJ 91-SP1

ECONLOCKHATCHEE RIVER BASIN NATURAL RESOURCES DEVELOPMENT AND PROTECTION PLAN

Final Report to
St. Johns River Water Management District

by

Mark T. Brown and Charles S. Luthin
Center for Wetlands
University of Florida

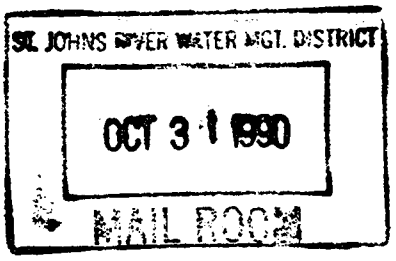
John Tucker and Richard Hamann
Center for Governmental Responsibility
University of Florida

Joseph Schaefer
Urban Wildlife Program
Department of Wildlife and Range Sciences
Institute of Food and Agricultural Sciences
University of Florida

Lucy Wayne and Martin Dickinson
SouthArc Inc.
Gainesville, Florida

St. Johns River Water Management District
Palatka, Florida

1990



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VOLUME I
RESOURCE INVENTORIES

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ACKNOWLEDGMENTS

We are grateful to Tom Ziegler and the staff of the St. Johns River Water Management District in Palatka, including John Hendrickson, Hal Wilkening, Lataine Donelin, and Librarian Judith Hunter, for unfailing attention to and friendly assistance on the project. We are particularly indebted to Colleen Logan (Seminole County Planning Department) and Sherry Hooper (Orange County Planning Department) for their special help in providing useful resource information for the Econlockhatchee River Basin Natural Resources Development and Protection Plan project.

We acknowledge the following individuals for sharing information and materials for preparation of this report:

Wes Biggs (Florida Audubon Society, Maitland)
Ken Bosserman (Friends of the Econ, Winter Park)
Jim Bradner (Department Environmental Regulation, Orlando)
Greg Brock (Florida Department of Natural Resources, Tallahassee)
Jim Crall (Orlando Utilities Commisision, Orlando)
Fred Cross (Florida Game and Fresh Water Fish Commission, Melbourne)
Jay Davoll (Florida Department of Transportation, Winter Park)
Michael Dennis (Breedlove, Dennis and Associates, Orlando)
Jim Farr (Department of Community Affairs, Tallahassee)
Richard Fowler (Florida Department of Transportation, Deland)
Chris Frye (Osceola County Planning Department)
Albert Gregory (Florida Department of Natural Resources, Tallahassee)
Michael Gilbrook and other staff, (East Central Florida Regional Planning Council, Winter Park)
Ellen Hemmert (East Central Florida Regional Planning Council, Winter Park)
Jim Hulbert (Florida Department of Environmental Regulation, Orlando)
Linda Jennings (Orange County Environmental Protection Department, Orlando)
Herb Kale (Florida Audubon Society, Maitland)
Dainne Kramer (Oviedo Planning Department)
David Kriz (USDA Soil Conservation Service, Orange County)
Roland Magyar (Orlando Planning and Development Department)
Bill Masi (Orange County Engineering Department, Orlando
Donald McIntosh (Donald W. McIntosh Associates, Inc., Orlando)
Rick Smith (Office of the Governor, Tallahassee)
Jack Stout (University of Central Florida, Orlando)
Henry Whittier (University of Central Florida, Orlando)

INTRODUCTION

Managing the Resources of the Econlockhatchee River Basin

This document is the first of three volumes of planning documents prepared for the St. Johns River Water Management District. It is a Phase I report in the two-phase program to develop a Basinwide Natural Resources Development and Protection Plan for the Econlockhatchee River. The three volumes are entitled as follows:

VOLUME I: Resource Inventories
VOLUME II: Economic and Regulatory Framework
VOLUME III: Synthesis: Critical Areas Management and Protection Plan

Volume I contains reports prepared by scientists and planners who studied the environment and resources of the Econ Basin. Their studies were intended to provide an inventory of and generalized management suggestions for the resources of the basin that form the basis for preparing a regulatory framework with which the special qualities and environmental resources of the Econ River Basin might receive protection.

Studies were undertaken to investigate three basic concerns related to environmental degradation. This volume presents an inventory and makes management suggestions addressing the following: (1) protection and enhancement of water quality; (2) protection of biological diversity and endangered species; and (3) protection of aesthetic, recreational, archaeological, scientific, or economic values. Each subsection in Volume I is organized to first present the issues surrounding each resource, review related literature, describe the resource, and finally, make management and regulatory suggestions to effectively manage and protect the resource. These management suggestions are general in nature and reflect the level of analysis in this first phase of the overall project. Volume II contains an analysis of the existing Regulatory Framework of the basin including land use regulations and planning policies, environmental regulations, and significant development, structures and activities. Volume III contains specific management and regulatory suggestions gleaned and sharpened from these Resource Inventories.

Chapter 1 discusses the water resources of the basin. There have been significant changes in water quality in the Little Econ River over the past several decades--first deteriorating, then showing marked improvement as state agencies worked to remove sewage outfalls from the river. Better stormwater management is still needed. The Big Econ River has altered little in quality over the period of record, but new development within the basin suggests this may soon change.

Chapter 2 is the resource management plan for terrestrial and wetland ecological systems. Major community types are discussed and the overall landscape scale organization of the basin is given as a means of developing a rationale for basinwide landscape management.

Chapter 3 discusses wildlife resources of the Econ Basin. Wildlife management should be approached from two perspectives: protection of habitat and maintenance of viable populations through landscape-scale wildlife management. This chapter provides the habitat values of the Econ Basin as well as suggestions for maintaining viable populations.

Chapter 4 presents the historical and archaeological resources of the Econ Basin with emphasis on the documented Indian sites. Additionally, suggested sites based on soil and elevations are provided with recommendations for a basinwide survey since this region of Florida has such a large number of potential sites and few systematic surveys have been completed to date.

While the organization of this report is divided along resource lines for the purposes of efficient research effort, the authors recognize that it is not a series of separate layers of resources, but an aggregate... a mosaic of historical resources and wetlands, wildlife, and water whose sum is far greater than its parts.

Background

In August 1989, the St. Johns River Water Management District contracted with the Center for Wetlands at the University of Florida to develop a basinwide management plan for the Econlockhatchee River. Often referred to as the "Econ" River, it is located in the eastern portions of Orange, Seminole, and Osceola counties in central Florida (see Figure 1) near the rapidly growing Orlando metropolitan area.

The overall program for development of a basinwide management plan was organized into two phases. The first phase was to be a five-month study to prepare a Critical Areas Management and Protection Plan (CAMP Plan) that would provide short-term suggestions for management, regulation, and acquisition as a first step in developing a long-term management strategy. The second phase will provide a more detailed look over a longer time period at the basin and its resources, fill gaps in the knowledge base, and develop a basinwide surface water improvement and management plan.

Concurrent to the work on Phase I, a citizen task force was appointed by the Water Management District to lend critical insight and public support to the process of developing a Basin Management Plan.

The Econlockhatchee River Basin

The Econlockhatchee River Basin is located in central Florida, in portions of eastern Seminole, Orange and Osceola counties (see Figure 1.1). The Big and Little Econlockhatchee rivers divide into

two sub-basins, converge in Seminole County, and flow eastward into the St. Johns River. The Big Econ River flows from south to north through a basin that is approximately 38 miles long and 25 miles wide; while the Little Econ River flows from western portion of the basin north and east to the confluence. Faced with concerns over urbanization of the Econlockhatchee River Basin, especially within the Big Econ Basin, a fresh look at its resources and its future are necessary. As one of the few intact river systems in central Florida, its water, wetlands, and wildlife have recently become the focus of intense scrutiny related to how best to protect its resources in the face of strong development pressure. Basinwide management that acknowledges the interrelationships between components of wild landscapes and developed land and that minimizes the impacts of human uses is required. To achieve a landscape that is simultaneously a place for humans and a wild habitat, and that maintains good water quality will require an approach to planning, designing, and engineering that is cognizant of the ecological communities and hydrology of the basin.

The Econ River: A Study in Juxtaposition

Water quality is a telltale sign of how well a landscape is managed. The Econlockhatchee River exhibits both good water quality and less-than-adequate water quality simultaneously. The Big Econ, flowing through a relatively undeveloped landscape from its origins in large headwater swamp, runs clear with few if any water quality problems. The Little Econ, for years impacted by sewage outfalls from 11 sewage plants, is channelized through much of its headwaters and receives stormwater runoff from a relatively urbanized watershed.

The challenge is to develop a management scheme that will improve the quality of the Little Econ and prevent water quality deterioration in the Big Econ. While stormwater management over the past several years has helped to improve water quality and offers significant protection, the fact still remains that it is not 100% effective. Better development patterns, better means of trapping and filtering stormwaters, and better engineering are needed if the Big Econ is to remain the high quality river it now is, and if the Little Econ is to ever flow clear again.

The Econ Basin: Vital Link in a Regional Wildlands Network

The Econlockhatchee River Basin is strategically located in eastern Orange, Osceola, and Seminole counties to become the focal point of a regionwide wildlands network and management program. To the east are the wildland resources of the St. Johns River floodplain, Tosohatchee State Wildlife Area, and the Orlando Wilderness Park. To the south are the lands of the Desseret Ranch containing large areas of wetlands; and to the north and east are the wildlands associated with the Wekiva River system. Because of its location, central to these important regional resources, the Econ River system is a critical link in a regional network of wildlands that preserve biotic diversity and ensure access to a wilderness experience for all central Floridians. On the other hand, it could easily resemble a stumbling block that, because of insensitive development, becomes a broken link in the chain

of wildlands which will someday be as widely known and regarded in the public perception of central Florida as the theme parks of western Orange County.

Unlike higher relief landscapes to the west, the Econ River Basin is extremely flat and "poorly" drained. As a result, the water resources of the Econ River are affected to a larger degree by alterations of surface water flow rates, and groundwater table elevations in the surrounding landscape. Because of the low relief there are large numbers and total acreage of wetlands that provide surface water storage. In addition the water table is very close to ground surface for much of each year. Changes, runoff rates, extent of surface water storage, and levels of groundwaters are possible with development. With such changes, changes in the quality and quantity of water in the river is likely.

It is the goal of this natural resource development and protection plan to establish a framework to ensure no net loss of water quality or wetland wildlife species. To achieve this goal, the resources are first inventoried, their sensitivities documented and management suggestions formulated.

The challenge of developing a basinwide management plan for the Econ Basin is to provide a framework within which both humanity and nature exist in a partnership relationship where both benefit from our experience and expertise.

Development Issues

The resource management issues surrounding development of the Econ Basin might be summarized as follows:

1) Development impacts on surface and groundwater quality and quantity,
2) Development impacts on terrestrial and wetland ecological communities,
3) Development impacts on wildlife, and
4) Development impacts on historical and archaeological resources.

Effective and vital development of the Econ Basin should establish a balance between full development on the one hand and full preservation of the environment on the other. The balance sought is one of compatible development at a scale and intensity, and with appropriate environmental safeguards, that will ensure the long-term viability of the terrestrial and water resources of the basin.

Ultimately, the affairs of humans, their economies and their social fabric depend on the surrounding environment. It is quite obvious that the tourism and the service economy it stimulates are dependent upon a healthy environment. Where environmental deterioration has occurred, and where environmental values are low, economies do not flourish. The greater the environmental values, the greater the potential for a flourishing economy. That is why it is of utmost importance that the environment, both the terrestrial and water resources of central Florida, are protected and their continued health become the concern of all citizens.

Sustaining a healthy terrestrial environment (that is, one which is productive, green, not prone to erosion, and does not pollute downstream aquatic environments) is an integral part of balancing development with environmental protection. Increased pollution and erosion of the terrestrial environment ultimately means increased pollution and sedimentation of the aquatic environment.

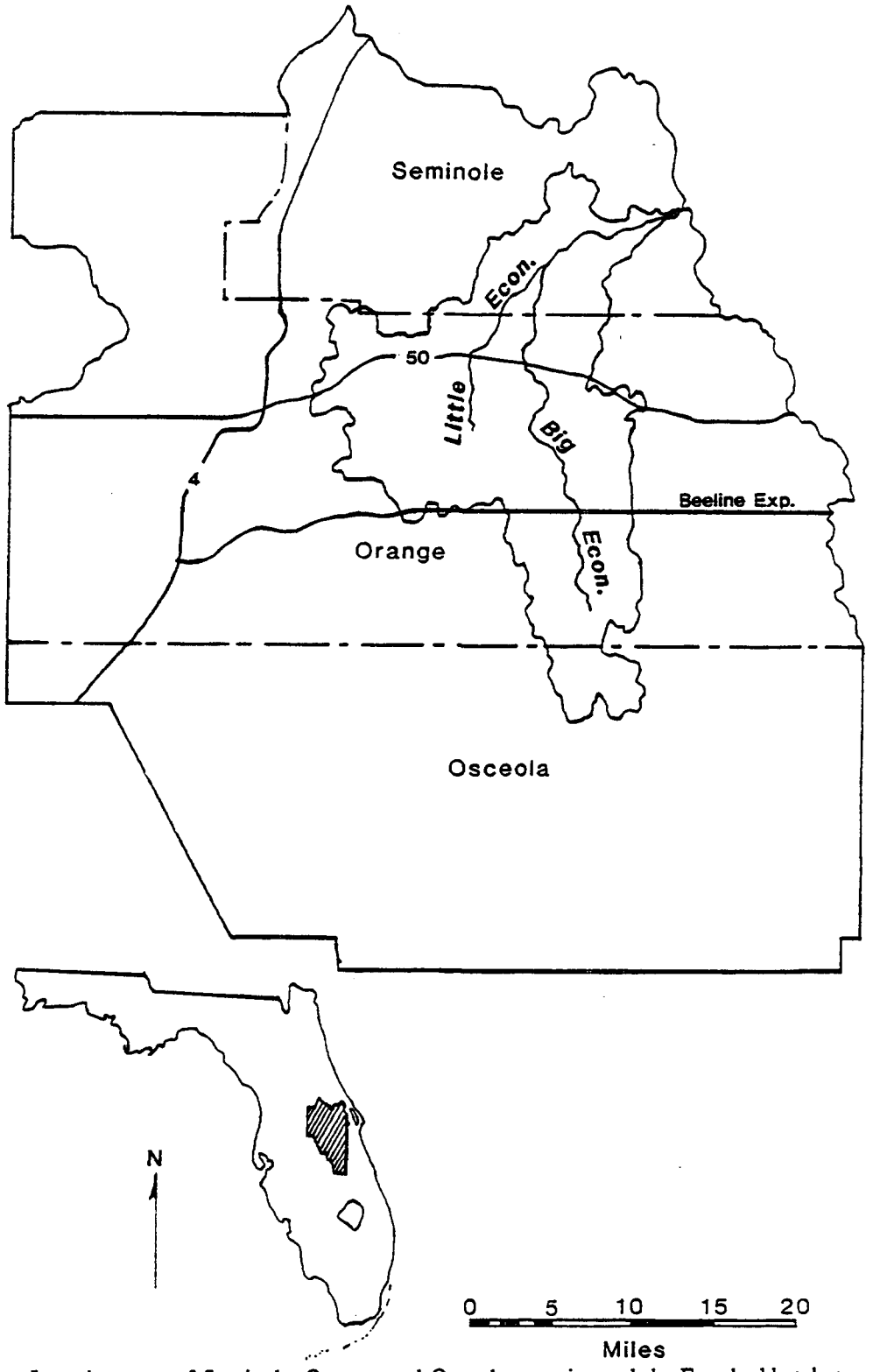

Figure 1. Location map of Seminole, Orange, and Osceola counties and the Econlockhatchee River Basin. The Econlockhatchee River has two main tributaries--the Little Econ and the Big Econ.

Scientists and planners associated with this project embarked on this first phase of this study of the social, cultural, physical, and biological environment of the Econ River Basin with these implications in mind. Our goals were to discover, study, and communicate the special qualities of the basin that are important to the economy and citizens of central Florida and to develop management strategies, plans, and a regulatory framework that would protect those special qualities. Taken one at a time, each of the Resource Inventories explores the issues, suggests sensitivities, and suggests management alternatives for individual aspects of the Econ Basin. Taken as a whole, and searching through each for common suggestions and a collective approach to landscape management, we have produced the CAMP Plan that is published as Volume III of this tripartite set of planning documents. The following summary is a synthesis of the most critical issues and collective suggestions from each of the Resource Plans and is intended as an overview from which an overall strategy for balancing development interests and environmental protection may be derived.

Summary and Recommendations

Issues and Management Suggestions

In this volume, each of the four issues listed above are discussed separately and management suggestions are summarized from the resource management plans that follow. The resource management plans give detailed discussions of the issues and recommendations for management from which the following have been summarized. Volume III gives not only management suggestions but also recommended regulatory actions.

ISSUE 1: Development impacts on surface and groundwater quality and quantity

The impacts of urbanization on surface water quality are well known. In general, as the result of increased runoff from impervious surfaces and other developed lands, stormwaters carry numerous pollutants and increased nutrient loads; the net result of which is a decrease in water quality in downstream receiving water bodies.

Groundwater quality is also affected, but probably of greater importance is the lowering of groundwater tables that results from construction of stormwater management systems. Lowered groundwater tables in the long run decrease base flows of streams and rivers, cause loss of hydroperiod in wetlands, and cause drought stress in terrestrial vegetation.

Management Suggestions:

1) Dechannelize streams, rivers, and tributaries of the basin.
2) Manage surface waters based on their nutrient status.
3) Avoid alteration of river and stream flow patterns.
4) Avoid alteration of natural vegetation in stream and river floodways and adjacent areas.

5) Design stormwater systems as networks of streams and wetlands and increase the use of wetland retention and detention basins and forested drainage swales.
6) Manage surface and groundwaters to minimize runoff.
7) Protect surficial aquifer levels.
8) Re-hydrate the landscape through recycling of wastewaters on the land in headwater areas and flatwoods/isolated wetland landscape associations to receive maximum treatment potential.
9) Maintain separate surface and deep aquifer groundwater systems.
10) Maintain "pre" development hydrology on all developed sites.

ISSUE 2: Developmental impacts on terrestrial wetland ecological communities

The loss of natural lands that may occur in the Econ Basin as developed lands increase will result from three different mechanisms. First, there will be the direct losses associated with clearing of vegetation and cuts and fills for building sites, roadways and miscellaneous facilities. Second, there will be secondary impacts caused by erosion and sedimentation from newly cleared lands and uncontrolled stormwater runoff. Third, there will be impacts associated with alteration of the landscape hydrologic regime. In all cases, the net result is increased fragmentation of the landscape, loss of ecologic functions, loss of visual amenities, and loss of wildlife habitat.

Management Suggestions:

1) Institute a controlled burning program and better controls on burning throughout the Econ Basin, but especially in the Big Econ Basin.
2) Develop performance standards for the design and construction of stormwater management systems as natural wetland sloughs and streams to minimize runoff, filter stormwaters, and maintain high water tables.
3) Begin a program of public education to reinforce the value of natural lands to wildlife and their scenic qualities in general and of the Big Econ in particular as a means of focusing public attention on management of the basin.
4) Cluster development whenever and wherever possible to minimize the aerial extent of clearing.
5) Areas of most intense development should be located at the greatest distance from surface water bodies and floodplains.
6) Seek protection of best examples of scrub forests, pine flatwoods, and other terrestrial communities.

ISSUE 3: Development impacts on wildlife

As development spreads across the Econ Basin, local extinctions of wildlife will result from several mechanisms. Natural habitats will become fragmented into sizes too small to provide adequate spatial requirements for some species. Genetic viability of wildlife populations in isolated habitat islands surrounded by development will diminish. Traditional wildlife travel lanes will be severed. Reductions in landscape diversity will eliminate essential wildlife nesting and feeding areas. The quality of habitats will decrease as the intensity of land use increases. Noise, cat predation and other factors

associated with encroaching development will penetrate into adjacent natural areas and adversely affect wildlife. The increase in recreational activities such as canoeing and hiking along the Econ will create greater disturbances for wildlife.

Management Suggestions:

1) Identify and delineate a contiguous Basin Preserve consisting of large diverse habitat areas connected by effective corridors.
2) Identify the best lands within the Basin Preserve and place them into public ownership.
3) Develop and implement standards for the Basin Preserve that are compatible with wildlife protection objectives.
4) Extend boundaries of the Basin Preserve where necessary outside the Econ Basin to include sites where listed species have been documented.
5) Apply buffers (development set-backs) to significant wetlands within the basin.
6) Design and implement an effective corridor that ecologically connects the southern part of the Econ Basin to the Tosohatchee State Preserve and Seminole Ranch.
7) Design and construct a system of underpasses for the major roads intersecting the Econ Basin that will provide for safe passage of wildlife.
8) Develop and implement standards for land uses that minimize impacts on wildlife.
9) Landscape with plants indigenous to communities in the basin and restrict the removal of understory vegetation so that developed areas will blend into the natural areas.
10) Develop stormwater control ponds that use native emergent vegetation, littoral zones, and native vegetation along the shore.
11) Develop educational programs and incentives to encourage pet owners to keep pets confined to their property.

ISSUE 4: Development impacts on historical and archaeological resources

The historical resources of the Econ Basin are poorly documented by comparison with other areas of the state. Only 17 sites have been recorded within the entire study area, and only four of these are significant sites. The major reason for this lack of information is the limited amount and level of surveying that has been completed within the basin. The majority of the recorded surveys consist primarily of surface inspections along roads, ditches, and streams. Little systematic subsurface testing has been completed. As a result of this lack of basic data and lack of data collected in a consistent manner, it is extremely difficult to make valid predictions of the potential losses of historical and archaeological resources within the basin that may result from development. With development of a predictive model, targeted areas could be systematically surveyed and other areas given only cursory attention. The protection of these resources is extremely important, for just like species extinction, loss of historical resources is forever.

Management Suggestions:

1) Future development projects within areas having high probability of historical resources should conduct systematic surveys including subsurface testing to locate cultural resources.
2) Implement a project to develop a predictive archaeological and historical location model for the basin.

In all, the issues and policy decisions facing the people of central Florida relating to development of the Econ River Basin are complex and will be difficult to make. The greatest concern and the toughest question is simply how to balance development interests and environmental protection. It is the same question faced by all developing regions and growing economies. The Resource Inventories that follow were researched and written in the hopes that the detailed information they contain will be of value to the Econ River Task Force, the St. Johns River Water Management District and the citizens of central Florida as they begin to make the difficult decisions necessary to ensure a robust economy and healthy environment. Each Resource Inventory contains detailed analysis and discussion of issues and more detailed regulatory and management suggestions than are summarized above.

ECONLOCKHATCHEE RIVER BASIN NATURAL RESOURCES DEVELOPMENT AND PROTECTION PLAN

Chapter 1

WATER RESOURCES OF THE ECONLOCKHATCHEE RIVER BASIN

Prepared for

St. Johns River Water Management District

October 1990

Chapter 1

WATER RESOURCES OF THE ECONLOCKHATCHEE RIVER BASIN

Charles S. Luthin & Mark T. Brown

INTRODUCTION

Importance of Water Resources

Along with sunlight and clean air, clean water is often taken for granted. This is especially true in Florida because of abundant rainfall, numerous spring-fed rivers, and seemingly unlimited supplies of pure, underground drinking water. The case for water conservation and proper water quality standards often seems counterproductive and a waste of time and energy. Nothing could be further from the truth. Water is the single most important driving energy of the landscape; both the affairs of humans and the processes of nature depend upon it.

In earlier times, when the numbers of humans and the spatial extent of their land uses were small, it was often assumed that "the solution to pollution was dilution." There is a limit, however, and throughout Florida (especially in central Florida), the limits are being realized. To reverse trends of the past, to begin the process of restoring good water quality, and to protect existing water quality requires cooperative efforts on the part of all agencies involved in development regulation and re-evaluation of old thought patterns. No longer can we assume the land and its resources are unlimited or that the affairs of humans are somehow apart from the cycles and processes of the landscape mosaic. The affairs of humans are part of the cycles of the landscape. To better understand how to fit the patterns of human affairs into a landscape dominated by water, we begin with the hydrologic cycle.

The Hydrologic Cycle

Rainfall powers the hydrologic cycle, recharging the land and surface waterways, and eventually the deep artesian aquifers. Much of what falls as precipitation is lost to the atmosphere due to evaporation from land and water surfaces and transpiration by vegetation. That portion which runs off the landscape

(about 25% on the average) develops a network of lakes, streams and rivers that carry valuable nutrients and organic matter ultimately to the sea.

Human activities that alter this delicate and dynamic cycle at any stage result in impacts throughout the system. Often the kind and magnitude of these impacts are unknown. Water extracted from one area results in reduced water quantities elsewhere. Water which is contaminated is eventually carried downstream or recharged to the Floridan Aquifer, the primary source of much of Florida's drinking water. The draining of surficial groundwater by ditches and canals lowers the water table for a considerable distance from the waterway, resulting in the eventual desiccation of adjoining wetlands and other ecological communities.

The loss of wetlands with their inherent ability to slow flood waters, filter and clean surface runoff, and maintain hydrologic homeostasis in the local environment further contributes to problems of rapid runoff, water contamination, soil erosion and reduced base flow of rivers. This is in essence "desertification," often read about in relation to the "Third World" but seldom considered a problem in Florida.

Contaminants

Potential contaminants of surface waters are many. These include inorganic and organic substances, both naturally occurring and man-made. The variety and quantity of environmental contaminants have increased in the past several decades as new agricultural and industrial chemicals have been introduced into the environment. Some of these pollutants are by-products of industrial and/or technological activities, including complex organic compounds and heavy metals.

The primary nutrients associated with eutrophication of water bodies are phosphorus and nitrogen, as they are required nutrients for plant growth. Both elements can occur in organic and inorganic form, but for general purposes in this report reference is made to "Total Phosphorus" (TP) and "Total Nitrogen" (TN) by combining all forms of these nutrients. Whereas small quantities of these nutrients are necessary for a healthy aquatic environment, surplus nitrogen and phosphorus can lead to degradation of water quality due to accelerated plant growth, thereby "choking out" the waterway with vegetation.

Many diverse organic compounds in water are degraded through biological or chemical processes requiring (or "demanding") oxygen. One parameter in establishing water quality criteria is Biological Oxygen Demand (BOD), or the oxygen demand for degradation/decomposition of dissolved or suspended substances (Brown et al. 1987). A high BOD is an indication of large quantities of organic compounds in the water; their source may be natural (e.g., wetlands associated with the waterway) or unnatural (industry, agriculture, urbanization).

In converse, Dissolved Oxygen (DO) is an indication of a healthy river or lake; the higher DO the better the water quality in supporting higher biological diversity and activity. DO is another parameter frequently monitored in waterways. DO may be naturally low in blackwater systems.

Various metals are known contaminants of waterways, as they can impair normal biological processes in numerous species of organisms. These substances usually originate in urban or industrial

areas, and can be extremely toxic in even minute quantities in water systems. Examples include lead, copper, cadmium, mercury, and many others.

Point and Non-point Source Pollution

Most attention on sources of pollutants in waterways in general, and in the Econ River specifically, has focused on point sources. Point sources include site-specific discharges from sewage treatment plants, agricultural drainage canals and ditches, industrial waste discharge points, and channelized runoff from impervious surfaces. The amount of contamination coming from a point source is relatively easy to determine, as samples can be taken directly from the area of discharge, and monitored at known distances from source. Most studies of water quality use a point source (e.g., sewage treatment plant) as a point of reference for comparisons of nutrient loadings further downstream (e.g., Alt et al. 1974).

As suggested by the name, non-point sources have no single defined site of discharge. Rather, the origin of non-point pollutants may be over large areas, such as agricultural fields, construction sites, parking lots, or other surfaces. These pollutants may eventually be concentrated via channelized runoff or drainage ditches prior to discharge into a stream or river, or may enter a waterway through diffuse means.

Izzo (1975) uses the EPA definition of non-point source pollution: "A pollutant which enters a water body from diffuse origins on the watershed and does not result from discernible, confined, or discrete conveyances." Major agricultural non-point sources of contamination for the Southeast United States include soil erosion and sedimentation, and seepage of agricultural wastes and man-made chemicals into the waterways. These can be conveyed to water surfaces by direct runoff, by infiltration to subsurface water, or by wind (Izzo 1975).

Construction activities near waterways can contribute considerable non-point source contaminants to the water system. Impacts from construction are most detectable during and immediately following construction activities. Brown et al. (1987) list three broad classes of construction impacts:

1) Impacts associated with erosion of loose soils and their subsequent deposition in downslope wetlands (and waterways);
2) Suspended sediment increases in surface waters, resulting in increased turbidity; and
3) Introduction of unusual levels of chemical compounds that may have negative effects on resident fish and wildlife populations.

The sediments which spill into a water body from construction sites will result in direct negative biological impacts on the waterway due to increased turbidity, more suspended solids, and sedimentation. The final water quality effect during the construction phase is related to the release of chemicals, the levels of which may be harmful to downstream fish and wildlife or negatively affect ecosystem function. When areas are cleared, runoff increases, carrying with it increased volumes of soil and sediment (Brown et al. 1987).

Water Quality Criteria

Federal and state regulatory agencies (e.g., U.S. Environmental Protection Agency, Florida Department of Environmental Regulation) establish standards for nitrogen, phosphorus and BOD levels in waterways, as well as for numerous other contaminants, for different "classes" of water (Fernald and Patton 1984, Hand et al. 1988).

A waterway is assigned an overall water quality index (WQI) that represents an average of six water quality index categories (clarity, dissolved oxygen, oxygen demand, nutrients, bacteria, and biological diversity) which, in turn, are averages of the component parameter index values taken from a table of fixed values. The WQI is a percent value; low WQIs have the best quality, and high WQIs have the worst quality (Hand et al. 1988). Reference is made to WQIs for the several parameters discussed in this volume.

For the purposes of this report, we have selected three parameters commonly used for water quality analysis: Total Nitrogen (TN), Total Phosphorus (TP) and Biological Oxygen Demand (BOD). Both point and non-point sources contribute to loading of these three nutrients. State criteria for Florida streams for these three parameters are listed in Table 1.1.

Water Quantity

The Econ River Basin receives on average 50-52 inches of rainfall per year. This rainfall occurs during a relatively short season; more than 60% falls between June and October (COE 1973). This short-season rainfall coupled with a relative lack of topography and slightly notched rivers make the Econ Basin prone to occasional natural floods.

Flood conditions are dependent upon numerous interconnected factors: existing water table level, level of soil saturation, period and intensity of rainfall, amount of vegetated surface adjacent to the waterway, and degree of human impact on the natural flow of waters (channelization, dams, urban and agricultural runoff, point discharges, etc.). Flooding in the Econ Basin is not uncommon at 10-25 year intervals.

> Floods of large magnitude occur due to an unusual combination of meteorologic and hydrologic phenomena. However, man-made alterations in river basin hydrologic characteristics can also contribute to increased flooding. For instance, urbanization and associated floodplain encroachment, if not accompanied by proper design, can increase the rate and volume of runoff produced during a storm event. (Rao 1986) [emphasis ours]

Drainage and channelization of the Econ River Basin, particularly in the Orlando metropolitan area and more recently in rapidly developing areas further east and north, could potentially contribute to increased impacts from major storm events. Large impervious surfaces (parking lots, highways, buildings, etc.) deflect water during storms. These waters, if not properly diverted and retained elsewhere, can result in flooding of the natural waterways. Furthermore, removal of vegetation from the

Table 1.1 Florida Stream Water Quality Index Criteria (Percentile Distribution of STORET Data)

		GOOD			FAIR					POOR
		Best Quality			Median Quality					Worst Quality
Parameter*	Unit	10%	20%	30%	40%	50%	60%	70%	80%	90%
OXYGEN DEMAND										
BOD	mg/l	0.80	1.10	1.10	1.30	1.50	1.90	2.30	3.30	5.10
NUTRIENTS										
TN	mg/l	0.55	0.75	0.90	1.00	1.20	1.40	1.60	2.00	2.70
TP	mg/l	0.02	0.03	0.05	0.07	0.09	0.16	0.24	0.46	0.89
METALS										
CD	ug/l	2	4	8	12	17	20	--	--	40
CU	ug/l	12.5	25	50	75	100	125	--	--	250
PB	ug/l	50	100	150	200	250	300	--	--	1000

Parameters*

BOD = Biological Oxygen Demand
TN = Total Nitrogen
TP = Total Phosphorus
CD = Cadmium
PB = Lead

Sources: Hand et al. 1986, Hand et al. 1988

soil during construction phases of urban or industrial development will accelerate runoff, thereby increasing short-period water flow following a period of rainfall.

Ironically, a contrasting problem in the Econ Basin is a significant drying trend throughout the region. Water drawdown of the surficial water table occurs through pumping (e.g., for agricultural and urban use), drainage via ditches, and loss of surface storage in wetlands. The huge water needs of the Orange-Seminole urban area are met by pumping water from the Floridan Aquifer; since this is ultimately recharged by the surficial waters, a lowering of the Floridan water level causes a drawdown in the surficial water table. Disruptions of the normal hydrologic balance are most noticeable in the eastern portion of the Orlando metropolitan area. The rapid urban development of the Orlando area "will require extensive drainage since a significant portion of the watershed consists of marginal lands containing a very large number of small swamps" (ECFRPC 1978a). Expanding drainage will result in further impacts on the natural hydrologic balance. Lowered water tables will result in reduced flow in the rivers. Reductions in the water table will stress water-dependent vegetation, and may result in its eventual death. Loss of wetlands will further result in reduced water levels and accelerated runoff during heavy storms. Finally, a reduction in base flow in the rivers will tend to concentrate contaminants, thereby accelerating eutrophication of the waterways and degrading water quality. Steward (1984) states:

> Among the natural factors affecting water quality in the southern Middle St. Johns River, water quantity is most significant. It directly influences water quality through dilution and indirectly through hydraulic residence times.

With a predicted doubling of population in 20 years, the unnatural stress on the hydrologic patterns in the Econ Basin due to human perturbations will increase. This will result in greater extremes in water excesses and shortages. Only through carefully controlled growth and wise resource use can the water balance in the region be maintained.

Additional summaries are included for three metals: lead (PB), copper (CU), and cadmium (CD). These three metals are indicators of non-point source pollution, usually from urban areas. Criteria are listed in Table 1.1.

To avoid losses of water quality and subsequent loss of overall environmental quality, the following list of principles of good water management are offered as components of a wise water management program.

Principles of Good Water Management Strategy

* Keep deep groundwater and surface waters separate.
* Plan activities and developments within, not around, the limitations and capabilities of existing water resources and cycles.
* Conserve water resources at all stages, from consumption to disposition of waste waters.
* Allow the water table to maintain its normal fluctuation.
* Eliminate sources of contamination in and near sources of water.

* Manage surface waters based on their natural nutrient status.
* Avoid alteration of river and stream flow patterns.
* Avoid alteration of natural vegetation in stream and river floodways and adjacent areas.
* Design stormwater systems as networks of streams and wetlands.

Rationale

The Econlockhatchee River Basin is composed of two major subbasins: the Big Econ, which flows from its origins in a huge, intact headwaters swamp through a relatively undeveloped landscape of pine flatwoods and wetland sloughs; and the Little Econ, whose headwaters and channelway have been urbanized for several decades (Map 1.1). In essence, the two tributaries could not be more different. Much of the Little Econ has been ditched and channelized, and in the past was the receptacle of treated wastewaters. The Big Econ remains one of the few unchannelized and "pristine" rivers in central Florida. In these differences there are lessons to be learned. There is still much potential to reverse trends of the past by restoring the urbanized Little Econ River and protecting the future of the Big Econ.

For years, the Little Econ River has been a waterway of special concern because it once carried some of the most contaminated waters in the St. Johns River Basin. Eleven years ago the Little Econ was ranked first of 17 waterways for levels of point source pollution and overall third in priority for cleanup within the St. Johns River watershed (ECFRPC 1978c). Although the quality of water in the Little Econ has improved within the past six years as the result of removal of wastewater discharges (Hulbert 1988) non-point pollution continues to be a major concern within the watershed.

Non-point source pollution from urban stormwater run-off and agricultural drainage is now one of the most significant water quality concerns within the Econ Basin (FRSC 1985). The problem is especially acute in the Orlando metropolitan area which constitutes a major portion of the headwaters of the Little Econ.

In contrast to the Little Econ, the Big Econ has consistently been noted for its clean waters and pristine condition. In the same study cited above (ECFRPC 1978c), the Big Econ was the lowest ranked river of concern of 17 within the St. Johns watershed; that is, it was the cleanest of all rivers in the basin with the least threat of reduced water quality.

Until several years ago, the Big Econ was subject to extremely low pressure from urban development. Presently, however, there are no less than 10 major residential and industrial developments within its watershed (Map 1.2). These combined developments constitute a major threat to both water quality and quantity within the river resulting from increased stormwater runoff and loss of natural filtration due to soil and vegetation disturbance.

Stormwater management regulations within the Big Econ Basin, while requiring reductions of 80% of pollutant loadings in surface waters leaving developed lands, will still allow increased cumulative loading of the river. Without a non-point pollutant loading allocation for specific reaches on the entire

basin, the cumulative impacts resulting from the 20% of pollutant loadings allowed could cause significant declines in water quality.

Scope of the Study

This volume summarizes the water resources of the Econ River watershed, which includes the Big and Little Econ Rivers and several smaller tributaries and lakes in a three-county area: Osceola, Orange and Seminole. This information was taken from historic and recent studies of these resources. The regional climate, hydrological characteristics of the waterways and adjacent areas, flood data, water quality, and the impacts of recent and future development are discussed.

A special emphasis of this volume is on water quality, as this has been the primary focus of numerous studies and management activities by state and county agencies, particularly in Orange County. A significant amount of water quality data over many years exists for the Econ River; these data are presented in graphic form and summarized to illustrate recent water quality trends and to highlight historic and potential threats. Several parameters, including Total Nitrogen (TN), Total Phosphorus (TP), Biological Oxygen Demand (BOD) and several metals (cadmium, copper, lead) will be discussed for both the Little and Big Econ rivers. Although data exist for numerous other water quality parameters, these will be analyzed in Phase II of this study.

Very few studies have addressed water quantity in the region, other than its relationship to flood conditions. Significant drainage has occurred in much of the Little Econ and parts of the Big Econ (e.g., Ranger Drainage District). This has reduced water table levels in the vicinity, lowered base flow rates for the river, and resulted in the desiccation and destabilization of wetland areas. Waters of the Econ Rivers are prone to flooding at frequent intervals, various studies have been undertaken to delineate floodway, flood prone areas, and floodplains of the rivers (U.S. Army Corps of Engineers 1973 and ongoing, FEMA 1987); other studies have investigated flood frequency, stage maxima, and ways to alleviate damage due to flooding within the floodplain (Ghioto et al. 1985, Rao 1985 and 1986). Water quantity issues are of importance in developing a regional water management plan.

Definition of Terms

Acronyms Used in this Chapter

COE	=	U.S. Army Corps of Engineers
DER	=	Florida Department of Environmental Regulation
DNR	=	Florida Department of Natural Resource
ECFRPC	=	East Central Florida Regional Planning Council
EPA	=	Environmental Protection Agency
FRSC	=	Florida Rivers Study Committee
SJRWMD	=	St. Johns River Water Management District
USGS	=	United States Geological Survey

Terms Used in this Chapter

(Definitions from Snell and Anderson 1970, Fernald and Patton 1984)

Aquaclude -- A layer impervious to the flow of water, for example, the thick confining beds between the surficial and Floridan aquifers.

Aquifer -- A formation or group of formations that is water-bearing. Often called "ground-water reservoir."

Artesian water -- Water under hydrostatic pressure confined in an aquifer by relatively impervious materials, which rises in a well above the top of the aquifer.

Drainage basin -- An area in which surface runoff collects and from which it is carried by a stream and its tributaries.

Eutrophic -- Rich in nutrients. When used to describe a body of water, a eutrophic condition often is accompanied with seasonal deficiencies in dissolved oxygen.

Eutrophication -- The natural aging process which results in the total sedimentation of a water body. Nutrient enrichment results from eutrophication.

Floodplain -- Relatively level valley floor built of material transported by a stream and deposited beyond the stream channel during floods.

Groundwater -- Water beneath the land surface in zones of saturation.

Nonartesian water -- Water in the surficial aquifer which is not artesian.

Non-point source pollution -- Pollution that is generated over a relatively wide area (such as a city or cropland) rather than at a specific site, and that is discharged into receiving waters at irregular intervals as a consequence of storm runoff.

Oligotrophic -- Deficient in nutrients. When used to describe a body of water, a oligotrophic condition often is accompanied with abundant dissolved oxygen with no marked stratification.

Piezometric level -- (See potentiometric level.)

Point source pollution -- Contamination from a single source, for example sewage plant discharge or industrial waste pipeline, discharged into receiving waters generally at a continuous rate.

Potentiometric level -- The level to which water will rise in tightly cased wells that penetrate aquifers.

Potentiometric surface -- The cumulative levels to which water will rise in an infinite series of imaginary wells that penetrate the same confined aquifer.

Recharge -- Water added to an aquifer by infiltration of precipitation into the soil or rock, by seepage through the soil or sinkholes, by seepage from streams and other surface water bodies, by flow from one aquifer to another, and by artificial introduction into recharge wells.

Runoff -- The part of precipitation that appears in surface streams after having reached the stream channel either by surface or subsurface routes.

Surface-water discharge -- The rate of flow of streams, expressed in cubic feet per second (cfs).

Surficial aquifer -- (See Water Table.)

Water table -- The surface of an unconfined aquifer, defined by the level at which water stands in wells that penetrate the water body far enough to hold standing water.

Physical Characteristics of Econlockhatchee River System

The Econlockhatchee (Econ) River Basin is comprised of the Big and Little Econ Rivers and 83 small to large lakes (Map 1.1). The Big Econ River, a typical blackwater system, originates in an extensive flat lowland in northern Osceola County, the Econlockhatchee Swamp. The Big Econ, intermittent south of SR 50, flows northward 35.8 miles through eastern Orange County into southeastern Seminole County, then eastward into the St. Johns River, south of Lake Harney. The Little Econ originates in the relative highlands of central Orange County on the eastern edge of the Orlando metropolitan area. The Little Econ is 14.8 miles long and drains an area of 71 square miles (18,389 hectares or 45,420 acres) (Lichtler et al. 1968 and Gerry 1983).

The total watershed covers approximately 260 (Snell and Anderson 1970) to 280 sq. mi. (72,520 ha or 179,000 acres) (Alt et al. 1974, ECFRPC 1978a), and is the second largest tributary of the Upper St. Johns River Basin. (The Econ River is considered by some as the southern limit of the Middle St. Johns River Basin, e.g., FRSC 1985.)

The headwater elevation of the Big Econ is 68 feet above mean sea level (msl). Much of the Big Econ drains a region of coastal lowlands called the Osceola Plain. This broad, flat plain reaches its highest elevation (90 feet msl) at the western edge of the Big Econ watershed and its lowest elevation in the Econ River Valley (30 feet msl). This north-south aligned ridge of slightly rolling hills forms a divide between the Big and Little Econ watersheds. The Osceola Plain is characterized by nearly level topography, very poorly drained soils (Manatee, Delray, Leon, Rutledge, Plummer), and scattered swamps with limited flow (Alt et al. 1974, Knockenmus 1975, ECFRPC 1978a). The average fall gradient for the Big Econ is 1.8 ft./mi. (Gerry 1983).

The headwaters of the Little Econ near Conway Manor and Azalea Park drain eastern Orlando. The southern reaches of the Little Econ are underlain with somewhat poorly drained soils (Leon, Immokalee, Pomello, and St. Johns), whereas the northern portion occurs on moderately drained soils. These latter soil types (Lakeland, Eustis, Blanton, and Orlando) constitute recharge soils (ECFRPC 1978a). The Little Econ is a typical blackwater system, as it has traditionally drained swampland.

Little remains of the original stream channels at the headwaters, as the Little Econ is now a series of box-cut drainage ditches in much of Orange County (Fitzgerald et al. 1988). Elevations range from 50 to 90 feet msl, and fall gradient is 3.5 ft./mile. Elevation at the confluence of the Little Econ with the Big Econ at State Road 419 in Seminole County is 25 feet msl (Gerry 1983).

Several miles past the community of Oviedo the Econ River makes an abrupt eastward turn south of the Geneva Hill, at which point the river channel changes from a broad, flat valley to a valley with steep narrow walls. The river cuts through the escarpment dividing the Osceola Plain and the Eastern Valley and debouches into the St. Johns River (White 1970, Knockenmus 1975). The elevation at the confluence with St. Johns is 5 feet msl (U.S. Army COE 1986).

Climate of the Econlockhatchee River and Vicinity

Climatic and rainfall data for the St. Johns River Basin, which includes the Econ River system, have been gathered and summarized by the St. Johns River Water Management District and published as several technical publications: Rao et al. (1984), Rao and Clapp (1986), Jenab et al. (1986), and Rao et al. (1989). Ghioto et al. (1985) summarizes rainfall data in relation to flood conditions.

The climate of this region is characterized as subtropical; the average annual temperature is 22°C (71°F) (Knockenmus 1975). Average rainfall was between 50.04 inches (Orlando area) and 52.41 inches (Bithlo) for a 38-year period 1947-84. The eastern region of the watershed receives slightly more rainfall than in the west. The majority of this rainfall occurs during a four-month period, June through September. Using the 1947-84 data for rainfall at Bithlo and Orlando, an average of 28.99 inches (57%) was recorded for these months (Jenab et al. 1986). The months of November through May are considered the dry season (Rao et al. 1989). These rainfall patterns have an important influence on the flow rates of the Econ River, which may fluctuate widely over a 12-month period.

The region is susceptible to occasional brief periods of extremely high rainfall, which may result in varying degrees of flooding. Twenty-four hour, high rainfall events have reached 12.05 inches (Bithlo 1961) and 11.86 inches (Orlando 1951) in the past 40 years. Ten-day highs in rainfall were 15.36 inches and 18.62 inches for Bithlo and Orlando, respectively (Rao and Clapp 1986).

Water Resources of the Econlockhatchee River Basin

White (1970) describes the geomorphology of the Florida Peninsula. Original hydrologic studies that encompassed the Econlockhatchee River Basin were prepared by Snell and Anderson (1970) for Northeast Florida, by Joyner et al. (1968), Lichtler et al. (1968) and Tibbals and Crain (1971) for Orange County, and by Stubbs (1938), Heath and Barraclough (1954), Barraclough (1962) and Tibbals (1976) for Seminole County. Additional hydrologic studies that have covered the Econ Basin include Anderson and Hughes (1975), Knockenmus (1975), Foose (1983), Rao et al. (1984), Phelps (1984), Phelps and Rohrer (1987) and Skipp (1988).

The Econlockhatchee River Basin is underlain by two distinct aquifer systems, the uppermost surficial (nonartesian) aquifer and the deeper Floridan (artesian) Aquifer. The surficial aquifer is 40-100 feet thick and is composed of fine quartz sands (late and post-Miocene sediments) which become finer with depth, eventually dominated by low-permeability clays. Generally, below 20 feet this aquifer contains a zone composed partially or entirely of shells with considerable permeability (Tibbals and Crain 1971, Knockenmus 1975).

A confining layer 10-150 feet thick composed of clay often mixed with sand and shells lies below the surficial aquifer. This is the Hawthorn Formation of Miocene age (Stubbs 1938, Barraclough 1962). This relatively impermeable layer separates waters from the surficial and Floridan aquifers (Joyner et al. 1968).

The Floridan Aquifer is from 100 to 350 feet below the surface, and is composed of dolomitic limestone of Eocene age. This layer ranges from 1300 to 2000 feet thick, and supplies the majority of

drinking water in Seminole and Orange counties (Joyner et al. 1968, Lichtler et al. 1968, Tibbals and Crain 1971).

Surficial Water

The surficial water table is usually within 0-20 feet of the surface over much of the Econ Basin, although it may be slightly lower in areas of highest elevation (Knockenmus 1975, Phelps and Rohrer 1987). In much of the basin, where pine flatwoods predominate, the water table is at or near the surface for much of the year (Tibbals 1976).

The surficial aquifer is recharged primarily by local rainfall. Water leaves the aquifer by evapotranspiration (as much as 70% of total rainfall) from open water surfaces and vegetation, seepage to lakes and rivers and by human extraction from wells or drainage ditches (Joyner et al. 1968). The water table has been lowered by drainage ditches in many urban and agricultural areas (Tibbals 1976).

Downward leakage of water into the Floridan Aquifer is negligible in many parts of the basin due to limited permeability of the confining layer (Lichtler et al. 1968, Knockenmus 1975). However, certain regions of the Econ Basin have a thinner and/or more permeable confining layer between surficial and Floridan aquifers. In these areas, and where the potentiometric surface is below the water table, there is recharge to the Floridan Aquifer from the surficial aquifer. The areas of highest recharge to the Floridan Aquifer within the Econ Basin are eastern Orlando south to Lake Conway (Orange County) and the Geneva Hill (Seminole County) (Phelps 1984, Phelps and Rohrer 1987). The majority of the Upper Econ Watershed contains areas of low to moderate recharge, and the Lower Econ below the confluence of the Little and Big Econ rivers has virtually no recharge to the Floridan (Phelps 1984).

Floridan Aquifer

The Floridan Aquifer is the major source of fresh drinking water throughout much of central and north Florida. Because this water is under pressure due to the impermeable aquaclude above it, water will rise above the top of the aquifer when penetrated by a well. The level to which water rises under such conditions is called the piezometric or potentiometric level. If the potentiometric level is above the surface of the land, water tends to flow freely from a well at that point. Many Florida springs are artesian flow of water from the Floridan Aquifer through thin, permeable or noncontinuous confining sediments.

In the Econ River, the potentiometric surface ranges from 60 feet below the land surface in areas of high relief (e.g., eastern Orlando) to several feet above the land surface near the St. Johns River (Joyner et al. 1968, Lichtler et al. 1968).

The Floridan Aquifer is not recharged by waters from as far away as Georgia as is commonly believed, but rather almost entirely by rainfall within the region. Recharge occurs when the Floridan Aquifer is relatively close to the surface, when the confining beds are thin or permeable, and when the water table is higher than the potentiometric surface creating a "downhill" gradient. Recharge potential

within the Econ Basin varies from good in western portions of the Little Econ Basin to poor in most of the Big Econ River (Phelps 1984).

Big Econ River

Until recent years, the Big Econ has remained in relatively pristine condition with limited impacts due to development. The majority of activities in the Upper Big Econ up to the 1970s had been grazing and some agricultural use (citrus groves).

The Ranger Drainage District, a major drainage project encompassing more than 6,000 acres east of the Big Econ in Orange County (Alt et al. 1974), was constructed in the early 1970s. Secondary and tertiary canals form a drainage network throughout the area; these empty into straight canals which lead directly into the Big Econ or smaller tributaries (SJRWMD 1980b).

Little Econ River

The water quality of the Little Econ, has received considerable attention throughout the past three decades. Reports include: Smith et al. (1954), Goolsby and McPherson (1970), Kaleel (1972), Alt (1974), Izzo (1975), Auth (1976), ECFRPC (1978a, 1978b, 1978c), SJRWMD (1979, 1980), Seminole County (1982), Hand and Jackman (1982), Gerry (1983), Hand and Jackman (1984a, 1984b), Steward (1984), ECFRPC (1985), Fall (1985), Hand et al. (1986), U.S. Army COE (1986), Fitzgerald et al. (1988), Hand et al. (1988), and Hulbert (1988).

In direct contrast to the Big Econ, the Little Econ has been one of the most heavily impacted waterways within the SJRWMD. Many miles of the original watercourse have been channelized, essentially creating a network of drainage ditches carrying surplus waters from the Orlando metropolitan area into the Econ system and ultimately to the St. Johns River.

For many years, the Little Econ received much treated sewage effluent from the Orlando metropolitan area. Prior to 1978, no less than 12 Sewage Treatment Plants (STPs) in eastern Orlando were delivering a total of nearly 8 million gallons per day (MGD) of secondarily treated wastewater directly to the Little Econ. The total existing capacity at the time was 13.4 MGD with an additional 4.8 MGD proposed. At the time that was the highest domestic wastewater load for the entire St. Johns River Basin (ECFRPC 1978a).

Aggravating the problem of sewage effluent in the Little Econ was urban runoff carrying surface pollutants from the Orlando area into the Econ Basin. Since the river is channelized in much of its headwater zone and the original vegetation cover was altered, the normal filtering "service" of natural wetlands adjacent to the river was lost and the runoff discharged directly into the river and washed downstream. This has contributed a significant load of contaminants to the already overtaxed waterway (Seminole County 1982, Gerry 1983, Steward 1984).

Numerous reports have detailed the historic conditions of the Little Econ River. Its pollutant loading has been so great that, despite considerable dilution by the Big Econ at the confluence with the

Little Econ near Oviedo, the Econ waters have had detrimental impact on Lake Harney in the St. Johns River system 20 miles downstream (Goolsby and McPherson 1970, Alt et al. 1974, Auth 1976, ECFRPC 1978a, SJRWMD 1979 & 1980, Seminole County 1982, Hand and Jackman 1982 & 1984b, Gerry 1983, COE 1986). The Florida Game and Fresh Water Fish Commission considered the Econ River the single most disruptive influence on the Upper Basin [of the St. Johns River]; a massive fish kill (ca. 10 million) in 1980 below Lake Harney was attributed to the nutrient loading in the Econ River (Gerry 1983).

Considerable improvement in average water quality was observed following the completion of Orlando's 24 MGD capacity Orlando Easterly Advanced Water Treatment (AWT) Sewage Treatment Plant (STP) in 1977 (ECFRPC 1978c), and the 24 MGD Iron Bridge Regional Wastewater Treatment Plant in January 1982 which began tertiary treatment of 12 MGD of sewage originally treated at the Bennett Road STP. Additional lines from other STPs to Iron Bridge were completed in the subsequent year or two (Gerry 1983, Hand et al. 1986). As a result, the quality of water in the Econ River has improved considerably compared to the previous two decades.

St. Johns River

The Econ River is a major tributary of the Upper (Middle) St. Johns River. Many of the studies of water quality in the St. Johns River, therefore, have included specific information about the Econ. The highly eutrophic conditions in Lake Harney, which originates shortly below the mouth of the Econ River, have been directly related to significant nutrient loading from the Econ River for decades (Goolsby and McPherson 1970, ECFRPC 1978b, Gerry 1983).

Whereas "the area from Lake Washington Dam [on the St. Johns River] to the confluence with the Econ River is generally in fair condition," Hulbert (1988) continues,

> This [Econ] drainage system, in the past, has been a source of nutrients from urban runoff and effluents from sewage treatment plants to downstream Lake Harney. Lake Harney has experienced accelerated eutrophication consisting of massive algal blooms causing pea-soup green water, especially during the summer.

Furthermore, the Florida Rivers Study Committee (1985) appointed by the Governor stated that Lake Harney has been, "plagued with intermittent destabilizing events associated with eutrophication (algae blooms, highly fluctuating D.O. [dissolved oxygen] levels, and fish kills)."

In its Draft Upper St. Johns River Basin Surface Water Management Plan, the SJRWMD (1978b) reports that:

> The high levels of phosphorus at SR 46 appear to be due to the influence of the Econlockhatchee River, which had an average total phosphorus concentration of 1.5 mg/l (milligrams per liter). This is nearly 17 times higher than the average for the basin (0.09 mg/l). [emphasis ours]

In discussing water quality on the Middle St. Johns River during the 1980-81 drought, Steward (1984) states, "...the Little Econ River contributed significantly to nutrient levels in the St. Johns downstream from its confluence, particularly during low flows." Although total phosphorus levels

decreased in Lake Harney between 1975 and 1979, they increased two- to threefold during the 1980-81 drought. Total nitrogen, rising since 1974 in Lake Harney, doubled the 1974-75 level during the same drought. Steward (1984) concludes:

> During low flow months the Econ has its greatest impact on Lake Harney as a result of lowered dilution of nutrient loads from treated sewage effluent.

RESOURCE DESCRIPTIONS

Water Quality

One of the greatest issues facing the Econ River Basin is related to restoration and maintenance of water quality. Many aspects of human activity in the region are dependent upon this single resource. Clean water is required for individual use and consumption, for use in industry and agriculture, for recreation, and for the maintenance of ecological function. Water use and consumption inevitably results in the production of waste waters, which must be properly disposed of if negative impacts to the clean water supply are to be avoided. Termed point sources of pollution, waste waters result from industrial processes, human waste treatment plants, and some agricultural operations such as feedlots.

Development of lands within a river's watershed can affect both the quantity and quality of surface waters that drain into the water course. Referred to as non-point source pollution, stormwater runoff from developed lands carries with it many constituents that can degrade water quality if present in sufficient quantities. The data suggest that the Big Econ is relatively unimpacted by non-point source pollution. Its watershed, especially its headwaters, have until recently remained undeveloped. Current development trends, however, suggest that changes in its "pristine" character are in the offing. On the other hand, water quality in the Little Econ is significantly below that of the Big Econ despite considerable improvement in the past five years.

As the discussion which follows demonstrates, water quality in and downstream from the Econ River has historically been degraded. Although some positive changes have taken place in recent years, considerable threats to the future regional water quality and supply exist.

Water Quality Analysis

Water quality data for the Econ River System have been recorded for many years by state and county agencies. Summaries of these data have appeared in numerous reports (e.g., Alt et al. 1974, Seminole County 1982, Gerry 1983, Steward 1984, Fall 1985, Hulbert 1988). This report summarizes recent water quality data from 1972 to 1988 for the Econ River, taken from 14 sample sites: six sites along the Big Econ upstream from the confluence with the Little Econ, six sites along the Little Econ, one site at the confluence, and one site below the confluence. These sample sites are described in Table 1.2 and located on Map 1.1.

The data are stored in EPA's "STORET," a nationwide data base of water samples that include those of Florida state and county agencies. The STORET identification codes for the sites used in this report are included in Table 1.2. The data were analyzed and plotted by the St. Johns River Water Management District. Raw data for Figures 1.1 to 1.6 exist in tabular form in Appendix A-1.

Table 1.2 Econlockhatchee River Water Quality Sample Site Descriptions (See Map 1.1 for locations.)

BIG ECONLOCKHATCHEE RIVER

Sample Site #	Storet Primary Station # (Agency Code)	Location and Description
1	BEH (FLORAN) SOR58010 (FLWQA)	Big Econ R. at Weewahootee Rd., Orange Co.
2	BEA (FLORAN) SOR58020 (FLWQA)	Big Econ R. at Beeline (528), Orange Co.
3	BEG (FLORAN)	Big Econ R. at powerline rt-of-way, below Ranger D.D., Orange Co.
4	BEF (FLORAN) SOR58030 (FLWQA)	Big Econ R. at "Old Cheney", SR 50, near Bithlo, Orange Co.
5	BEB (FLORAN) SOR58040 (FLWQA)	Big Econ R. at SR 420, Orange Co.
6	BEC (FLORAN) SOR58050 (FLWQA)	Big Econ R. above confluence with L. Econ R., Seminole Co.
7	BED (FLORAN) SOR58120 (FLWQA)	Big Econ R. confluence with L. Econ R. at bridge, SR 419, Seminole Co.
8	BEE (FLORAN) SOR58130 (FLWQA) ECH (21FLSJWM)	Econ. R. at Snowhill Rd., Chuluota, Seminole Co.
A	LEE (FLORAN)	Little Econ R. at North-South Canal, SWD 2, Orange Co.
B	LET (FLORAN) SOR58060 (FLWQA)	Little Econ R. at gauging station, Berry-Deese Rd., SWD 6, Orange Co.
C	LEH (FLORAN) SOR58080 (WQA)	Little Econ. R. at SR 50, above Orlando STP, Orange Co.
D	LEP (FLORAN)	Little Econ R. at Econlockhatchee Trail, below STP, Orange Co.
E	SOR58100 (FLWQA)	Little Econ R. upstream from Iron Bridge STP, Seminole Co.
F	LEZI (FLORAN) SOR58110 (FLWQA)	Little Econ R. 100 yds below Iron Bridge STP, Seminole Co.

For the purposes of this report, three parameters commonly used for water quality analysis: Total Nitrogen (TN), Total Phosphorus (TP) and Biochemical Oxygen Demand (BOD). Both point and non-point sources contribute to loading of these three nutrients. State criteria for Florida streams for these parameters are listed in Table 1.1 Additional summaries are included for three metals, lead (PB), copper (CU) and cadmium (CD). These three metals are indicators of non-point source pollution, usually from urban areas. Water quality criteria are also listed in Table 1.1 for these metals.

Figures 1.1 to 1.6 illustrate trends in TN, TP, and BOD for the Econ River prior to and after 1984. Between 1982 and 1984, the 24 MGD Iron Bridge Regional Advanced Water Treatment Sewage Treatment Facility came into operation, diverting wastewaters from Orlando-area secondary treatment plants for tertiary treatment. The secondary STPs have since gone off-line. Conversion to advanced wastewater treatment was a turning point in water quality in the Econ River. The figures represent data averaged from 1972-83 ("pre-1984"), prior to Iron Bridge, and averaged during 1984-88 ("post-1984").

A Median Water Quality Index (WQI) value of 50% ("fair" water quality) is shown on several graphs as a standard of reference for the various parameters discussed. These values are taken from Florida Water Quality Index Criteria listed in Table 1.1.

There are obvious differences in water quality between the Little Econ and the Big Econ for all three parameters prior to 1984 (Figures 1.1, 1.3, 1.5). Water samples at each site along the Little Econ were in excess of the median value for TN, TP and BOD. These same parameters were within median values for the entire Big Econ upstream from the confluence with the Little Econ, suggesting a river in excellent condition during the period 1972-1983.

Although the levels of all three contaminants dropped after 1984, the median values are still exceeded in the Little Econ and Lower Econ (downstream from the confluence). Discussions of each parameter for both sample periods follow.

Nitrogen. Total Nitrogen Concentrations along the Little Econ were above the 80% WQI value (poor), and four of the six were above the 90% value, or "worst quality" before 1984. A large increase in nitrogen levels between sites C and D undoubtedly reflects the discharge from the Orlando STP (which has subsequently been phased out).

Before Iron Bridge came on-line, there was so much nitrogen loading upstream from the confluence of the Big Econ that even after the rivers met and waters mixed, TN levels were still in the "worst quality" category (Figures 1.1 and 1.2). These high nitrogen levels have been implicated in eutrophication of Lake Harney many miles downstream (Hulbert 1988). In the past two years that nitrogen levels downstream from the confluence of the two rivers have begun to compare with TN levels of the Big Econ upstream from the Little Econ (Figure 1.2).

Figure 1.2 shows a doubling of TN concentration in 1981 compared to the previous year for the Little Econ River. The period 1980-81 was a period of drought which resulted in reduced flow rates in the Upper St. Johns River system, including the Econ River (Steward 1984). Annual rainfall in Orlando for 1980 was 41.2 inches, almost 10 inches below normal (50.85 inches). Furthermore, rainfall in 1981 was more than 3 inches below the mean (Rao et al. 1989). A similar doubling of TN in Lake Harney on the St. Johns below the Econ River was observed during the drought years 1980-81, probably reflecting water quality conditions in the Econ. Whereas the total nitrogen loading likely remained

much the same or increased slightly in 1980-81 compared to previous years, the increase in apparent TN concentration may be a result of flow rate reductions and reduced dilution of nutrients. The Little Econ seems to be particularly prone to low flow that may be the result of loss of wetlands in its headwaters, channelization which has increased the efficiency of drainage, and increased wet season runoff.

Total nitrogen in the Big Econ prior to 1984 consistently hovered near the median value (Figures 1.1 and 1.2); these slightly high values probably reflect a natural nitrogen level in the blackwater system, although there may have been some loading due to grazing by cattle or other agricultural activities in the basin. Interestingly, the Big Econ did not experience any significant changes in TN concentration during the 1980-81 drought as did the Little Econ. This is further indication of a healthy river experiencing little supplemental nutrient input.

Nitrogen levels decreased in the Little Econ after 1984 (Figure 1.1). Only at sample sites E and F (above and below the Iron Bridge STP) were the nitrogen levels excessively high, above the 90% WQI value ("worst" quality). These high nitrogen levels remained above the WQI at the confluence with the Big Econ. Figure 1.2 indicates that there may be a recent reduction in nitrogen loading in the Little Econ.

Nitrogen levels in the Big Econ remained near the standard median value during the post-1984 period, rising above the median only after the confluence. This has further improved in the past two years (Figure 1.2).

Phosphorus. Total phosphorus in the Little Econ prior to 1984 exceeded the "worst quality" value at four of six sample sites (Figure 1.3). During the same time period, phosphorus in the Big Econ remained at a relatively stable level near the median value. Phosphorus levels below the confluence were well above the 80% WQI prior to 1982 (Figure 1.4). Total phosphorus more than tripled below the confluence of the Little and Big Econ during the drought period 1980-81, compared to the previous year (Figure 1.4).

During the post-1984 period, phosphorus levels dropped considerably in the Little Econ (Figure 1.3). The point source loading between sites A and B and between C and D prior to 1984 were subsequently eliminated, and phosphorus levels decreased at these sites. The relatively high values for phosphorus are consistently in the "poor" category for these WQI values.

The reduction of distinct peaks in Figure 1.3 (post 1984) in the Little Econ suggests that point source pollution has been curtailed; the remainder of phosphorus likely comes from non-point sources from the urban areas drained by that portion of the Little Econ. The phosphorus levels in the Big Econ during the post-1984 period were almost identical to those prior to 1984 (Figures 1.3 and 1.4), indicating that land use has probably changed little during the past two decades. Figure 1.4 shows a general reduction in overall phosphorus levels in the Lower Econ River with time.

BOD. BOD levels in the Little Econ before 1984 varied from site to site, but were extremely high along its entire course to the Big Econ (Figure 1.5). A surge in BOD between sites C and D is related to discharge from a former STP. All six sites had WQI values above 80% ("poor") and three above 90% ("worst" quality). BOD at the confluence of the Big and Little Econ Rivers was also in the poor category during this period. BOD, as with TN and TP, increased three-to fourfold in the Econ River

during the drought years 1980-81 (Figure 1.6). Again, a reduction in flow in the river likely resulted in higher concentrations.

Median concentrations of BOD in the Big Econ appear somewhat higher than the median WQI value prior to 1984 (Figure 1.5). The peak during drought year 1981 has undoubtedly skewed the average BOD value for the Big Econ during the pre-1984 period, suggesting a higher BOD loading than what may have actually occurred. BOD levels were slightly higher at the headwaters of the Big Econ (Figure 1.5) compared to downstream, reflecting the naturally high biological activity in the river. The BOD levels decreased slightly further downstream until the confluence with the Little Econ.

Post-1984 BOD levels are rather high for both the Little and Big Econ rivers. The BOD levels in the Little Econ and downstream from the confluence are still considered "poor." Variations in seasonal rainfall and subsequent runoff may influence levels of BOD and the other nutrients; drought years tend to result in higher BOD loading in the river.

Metals. Figures 1.7, 1.8, and 1.9 illustrate the percent of time that cadmium (CD), copper (CU) and lead (PB) levels exceeded the standards set for these parameters in samples from the same sites along the Little and Big Econ rivers. Specific values are not plotted, but are listed in Appendix A-2. The data do not suggest any clear differences with respect to tributary in CD and CU concentrations. Lead, a common contaminant of urban and industrial zones, shows progressively increasing exceedences from upstream to downstream along the Little Econ River. These values are consistently higher than from the Big Econ. Lead is one trace metal so ubiquitous in urban surroundings that this is a good indicator of specific land use activities; the same is not true for copper and cadmium.

Point vs Non-point Source Pollution in the Econ Basin

Most discussions of, present and future water quality problems in the Econ River Basin suggest non-point source pollution originating primarily from urban sources in rapidly developing areas as the primary problem. The following are a selection of comments supporting this concern.

> "...better technology, increased efficiency, and increasing regulations will soon minimize their [point source] effect on the environment. ...non-point source pollution appears to be the prime cause of water quality degradation. Stormwater run-off, agricultural drainage, and the many waterfront lots contribute the majority of pollutants to [Seminole] County waters." (Seminole County 1982) [emphasis ours]

> "Much of the nutrient loading into the southern Middle St. Johns River [including the Econ River] is of non-point origin.... Despite efforts toward reducing point source discharges, net increases in phosphorus and BOD_5 loadings are expected as urban development in the basin continues, ...primarily through non-point source urban runoff." (Steward 1984) [emphasis ours]

"Land use intensification, particularly the urban expansion in Seminole County and in the Econ River basin (Orlando metroplex) is the most important factor deleteriously affecting water quality." (Steward 1984)

"Nutrient and coliform levels have improved in the Econ in recent years, probably due to improvements in sewage treatment plants. However, increases in non-point source pollutant loadings are expected to offset reductions in point source loadings as urbanization continues." (Fall 1985) [emphasis ours]

"Studies have concluded that mitigation of point sources alone is not sufficient. Non-point sources from urban, agricultural, and silvicultural activities are significant and may dominate the total nutrient input." (Governor's Florida Rivers Study Committee 1985) [emphasis ours]

"... untreated urban stormwater and cattle grazing in the area [Econ River above Lake Harney] continue to pose a problem." (Hand et al. 1988)

Steward (1984) states that "urban-related annual loadings for total nitrogen (TN), total phosphorus (TP) and biological oxygen demand (BOD_5) are expected to nearly double by the year 2000;" this parallels the projected doubling of the human population in the basin within 20-30 years.

The greatest potential immediate non-point source pollution loading may come from the large number of extensive developments, some considered "Developments of Regional Impact" (DRIs), both for residential and industrial expansion, which are either under construction or are planned for the Econ River basin south of Oviedo (Seminole County) to the Beeline (Orange County). These will contribute non-point source pollutant loading from construction activities and stormwater runoff as a result of increased impervious surfaces (roads, parking areas, buildings), loss of natural vegetation, and disturbed soil conditions.

The Econ River is classified as a "Class III" waterway by the Florida Department of Environmental Regulation. A Class III waterway should meet water quality standards for "recreation, fish and wildlife" (Fernald and Patton 1984). Class I (potable water) and Class II (shellfish) have criteria more stringent than Class III, whereas Class IV (agriculture) and Class V (industry) criteria are less stringent (Hand and Jackman 1984).

With the removal of wastewater discharges from the Little Econ, there has been marked improvement in water quality, yet it has also revealed how much is left to be done. Without wastewater to overshadow the poor water quality, it becomes apparent that stormwater runoff impacts are still to be dealt with. Removal of the waste treatment plant discharges was direct and significant. The management of stormwater is much more difficult and requires more concerted effort to maintain high water quality.

The impacts of urbanization on surface water quality are well known. In general, as the result of increased runoff from impervious surfaces and other developed lands, stormwaters carry numerous pollutants and increased nutrient loads; the net result of which is a decrease in water quality in downstream receiving water bodies.

Groundwater quality is also affected, but probably of greater importance is the lowering of groundwater tables that results from construction of stormwater management systems. Lowered groundwater tables in the long run decrease base flows of streams and rivers, cause loss of hydroperiod in wetlands, and cause drought stress in terrestrial vegetation.

As we see it, there are three main goals to achieve in this Management and Protection Plan that will ensure high quality and a sufficient quantity of water resources in the Econlockhatchee River Basin:

1) Restore water quality where it has been degraded.
2) Prevent any declines in water quality in the rest of the basin.
3) Manage water tables at their historic levels.

To achieve these goals we offer the following management suggestions.

Management Suggestions

Dechannelize Streams, Rivers, and Tributaries of the Basin

Dechannelization is not easy to do, and is not recommended lightly. The net effect of dechannelization of the Little Econ and other ditches and tributaries is an increase in water table levels, an increase in residence time of stormwaters within the systems, and most assuredly an increase in flooding. It will take serious and creative "ecological engineering" to achieve a natural drainage network given the levels of urbanization that now exist in much of the basin. If the basin were brought up to current stormwater standards, much of the need for channelization would be eliminated.

The benefits of dechannelization would be threefold:

1) improved water quality,
2) decreased flooding in downstream areas, and
3) a rehydrated landscape having higher water tables.

Likewise, existing constructed drainage ditches are good candidates for dechannelization. There are numerous ditches throughout the basin that traverse miles without so much as a one degree bend. Their effect is to lower water tables, increase storm peak flows, and degrade surface water quality. They should be re-engineered as first- and second-order forested streams.

A regional approach to non-point source treatment where large wetland detention basins are constructed for stormwater treatment in conjunction with dechannelization may offer both treatment and storage protection from flooding.

Avoid Alteration of River and Stream Flow Patterns

Not only should existing channelized portions of the River Basin be restored, but it goes without saying that further channelization should be avoided. Where road crossings have constricted flows, additional bridging and culverts should be installed to reduce velocities and the potential for downstream scouring.

Manage Surface Waters Based on their Nutrient Status

High nutrients and sunlight combine to produce high biomass. Where surface waters are high in nutrients, there is always sufficient sunlight (unless of course the water body is a forested stream) to drive large gross productions and thus standing stocks of biomass. If nutrients are not used (that is, stored in plant tissue or dead organic matter) they are passed through the system.

When eutrophic surface water bodies are managed as if they should be oligotrophic (for instance, when vegetation is prevented from growing) the net result is shunting the problem downstream to another portion of the system. Nutrients should be treated as close to their origin as possible. Once eutrophic, keeping a water body free of vegetation is not only extremely difficult but may be undesirable water and ecological management. Most often it requires herbicides or other chemicals which have many side effects on organisms other than the target. Additionally, the dead plants most often sink in place, adding to water quality problems as they decompose. We strongly suggest that state agencies rethink their current policies of maintaining appearances of oligotrophic lakes and streams when if allowed to vegetate, waters farther downstream would have lower nutrient concentrations and higher quality.

Avoid Alteration of Natural Vegetation in Stream and River Floodways and Adjacent Areas

Vegetated water courses have better water quality and are better protected against erosion and sedimentation. Vegetation acts to increase friction over the surface of the landscape, slowing down runoff water and stream velocities. Often in the belief that vegetation "clogs" stream channels and causes flooding, channels and ditches are maintenance dredged to improve their drainage capacity. The net effect of such management activities is to reduce treatment capacity of the channelway and to increase water velocities.

Design Stormwater Systems as Networks of Streams and Wetlands

Current stormwater networks only superficially resemble natural drainage networks. In appearance they are composed of straight ditches, swales, and lakes that most often have to be maintained to keep them open water bodies rather than vegetated wetlands. The average watershed size for a first-order stream in lands like those of much of the Econ Basin is one square mile. Its slope is roughly 1.3 feet per mile and sinuosity is about 1.3 (i.e., for every mile of distance as the crow flies, the stream channel is 1.3 miles long). It starts as a wetland slough with no definable stream channel. At its mouth, it has a storm channel measuring approximately 5 m and a base flow channel of less than 1 m, and a 10-year floodplain measuring about 70 m wide on the average.

In most first-order Florida watersheds the majority of wetlands are associated with the headwaters, not the outfall. Storage is accomplished where runoff occurs and not at the bottom of the system. Wetland storage is first in isolated wetlands, then through slight depressions (swales) where it may coalesce into sloughs (elongated wetlands with imperceptible flows) and finally into the headwaters of the stream.

Designed in this manner, stormwater management systems would minimize runoff, maintain higher water table elevations, have higher quality runoff, and incorporate wildlife habitat into development plans. Most importantly, post-development hydrology would more closely approximate to predevelopment conditions.

Manage Surface and Groundwaters to Minimize Runoff

Current stormwater management regulations more or less are designed to ensure that the quantity of water leaving a site, following a rainfall event, does not cause a decline in receiving bodies. However, there is little in current regulations that suggests that runoff should be minimized. There is no emphasis of storage and recharge, or maintenance of desirable water table elevations. Rules should emphasize the goal matching post-development runoff with predevelopment conditions.

Protect Surficial Aquifer Levels

In the process of stormwater management, often the net result is lowered groundwater tables. Reversing these trends requires that roadway and building elevations may need to be raised to accommodate some flooding during extreme events. Now that the lands with higher topographic relief have been mostly developed, the trend is to use less and less suitable lands. The application of more and more engineering while possibly solving the short-term problem, can only lead to gross losses of environmental quality as the landscape undergoes desiccation.

Increase the Use of Wetland Retention Basins, and Forested Drainage Swales

To protect water quality and still provide for stormwater management, systems should be designed purposely as vegetated stream channels and wetland storage systems instead of ditches and detention/retention ponds. The added treatment, friction and aesthetics, not to mention wildlife benefits are important contributions to a regionwide water quality program.

Re-hydrate the Landscape through Recycling of Wastewaters on the Land in Headwaters Areas and Flatwoods/isolated Wetland Landscape Associations to Receive Maximum Treatment Potential

It has now become more and more acceptable to recycle wastewater through wetland systems as integral parts of our development patterns. These trends need be encouraged. Smaller treatment facilities scattered throughout the landscape make recycling easier to accomplish because sewage is not concentrated, more wetlands are available, and wetland sizes can be smaller. In view of our past experiences with treatment plants discharging directly to surface water bodies, and lacking the many improvements in technology that present day plants have, small plants have acquired a bad reputation. Large regional plants are encouraged and landscape recycling made extremely difficult and costly.

These trends need be reversed so that sewage does not have to be pumped from one location to others many miles away in zones of favorable percolation rates or sites for constructed wetlands.

Maintain Separate Surface and Deep Aquifer Groundwater Systems

Until recently, surface waters and groundwaters were more or less separated by intervening layers of sands, clays, shells, and so forth. Now as a means of stormwater management, surface waters are shunted directly into underground aquifers where they might mingle with drinking water. Numerous deep "recharge" wells in Orange Co. directly carry surface water into the Floridan Aquifer. These waters are frequently contaminated with urban, agricultural or industrial wastes, thereby contaminating our drinking water. Where these conditions exist and as a means of protecting groundwater quality, wetland filters sufficient in size to have treatment potential should be used to provide some filtering action prior to release, and every effort should be made to eliminate "recharge" wells.

SUMMARY AND RECOMMENDATIONS

Management procedures for the water resources of the Econlockhatchee River Basin offer the opportunity and challenge to design and ecologically engineer better systems for both humans and nature; but to do so, we must be willing to work toward that common goal.

Admittedly, the management suggestions given above are quite general in their tone. We believe that they can be used to set guidelines and policy for attainment of good water quality throughout the basin, and can act as a catalyst for research that will be necessary if good design and sound ecological engineering is the end point we seek to achieve.

In this report, we have tried to describe the resource and its past and present condition, and then lay the groundwork for further detailed studies of the basin, potential re-engineering of its parts, and adoption of a regulatory framework for administering a management program. Obviously, the detailed studies that will follow need time to come to fruition; unfortunately, development of the basin does not seem to be slowing down. Might it be appropriate to consider slowing the speed at which things are changing within the basin long enough to determine how best to manage it?

Drawing from this inventory of the water resources and knowledge of potential future problems associated with further development of the basin, Volume III, the Critical Areas Management and Protection Plan, provides short-term management and regulatory suggestions to achieve the desired goal of no net determination of water quality within the basin.

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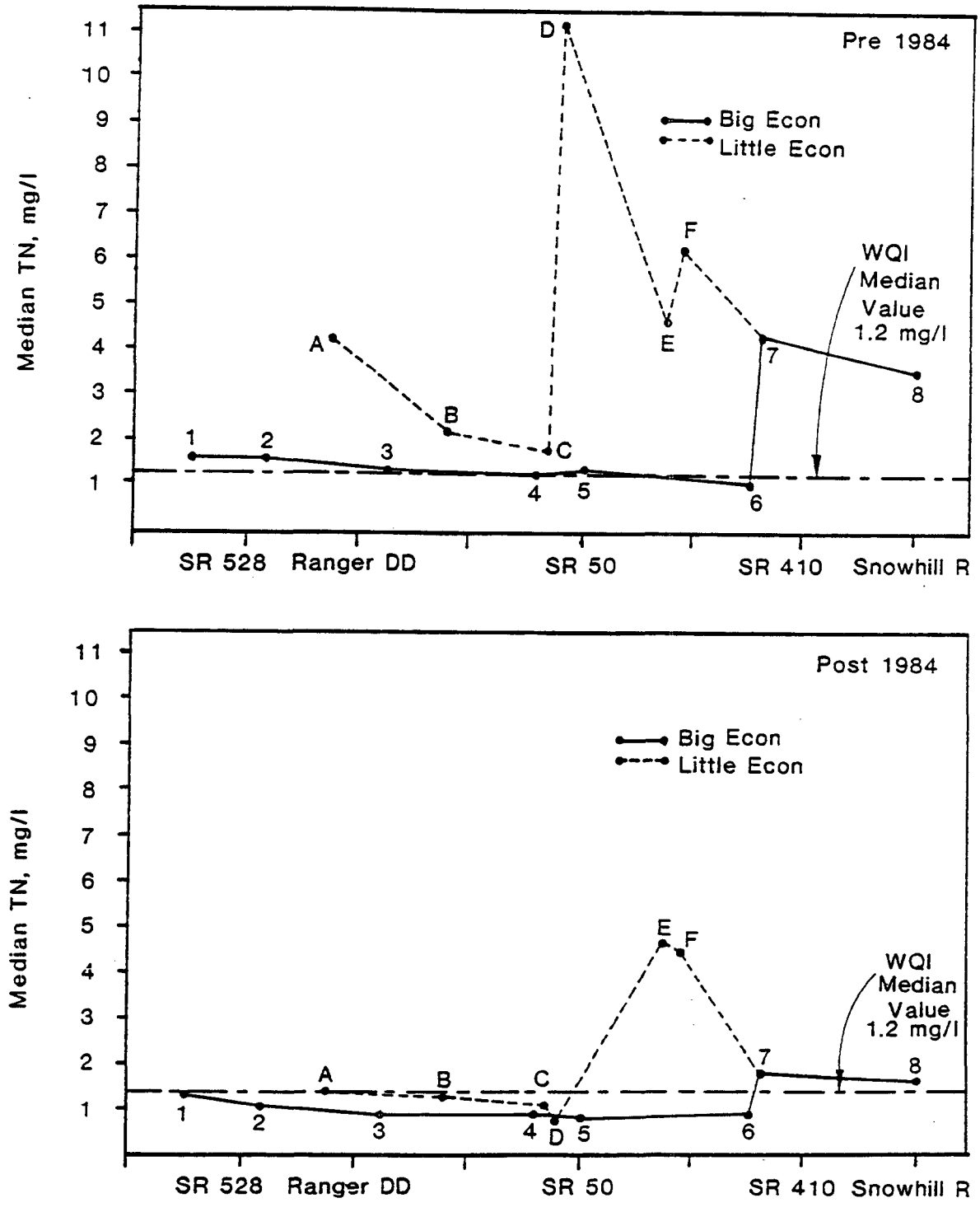


Figure 1.1 Median total nitrogen concentration in mg/l for periods 1972-1983 (PRE 1984) and 1984-1988 (POST 1984) for 14 sample sites along the Econlockhatchee River. WQI median value is from Table 1.1. Sample locations on the X-axis are for the Big Econ River and correspond to the following: SR 526 = State Road 526, Ranger DD = Ranger Drainage District, SR 50 = State Road 50, SR 410 = State Road 410, Snowhill R = Snowhill Road.

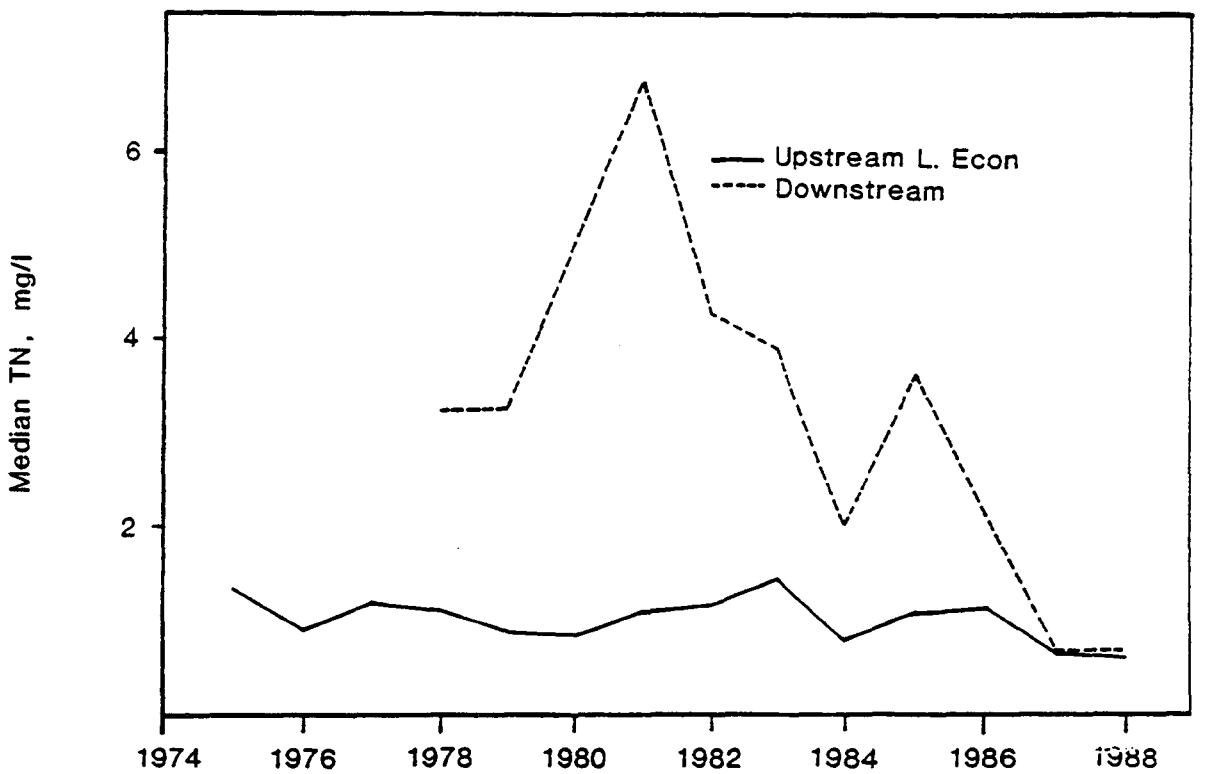


Figure 1.2 Median annual total nitrogen concentration in mg/l for Big Econlockhatchee River above and below confluence with Little Econ River for period 1975-1988.

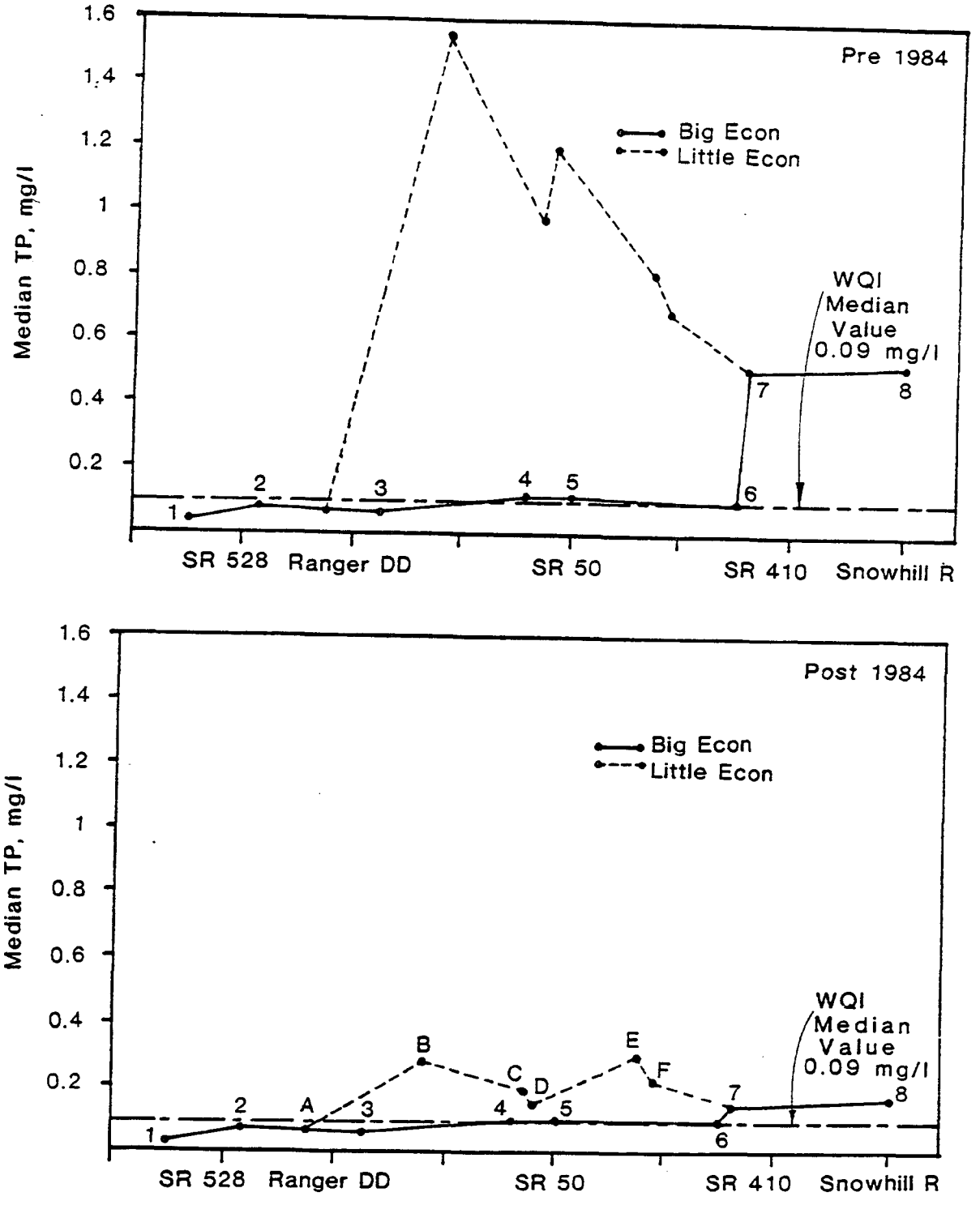


Figure 1.3 Median total phosphorous concentration in mg/l for periods 1972-1983 (PRE 1984) and 1984-1988 (POST 1984) for 14 sample sites along the Econlockhatchee River. WQI median value is from Table 1.1. Sample locations on the X-axis are for the Big Econ River and correspond to the following: SR 526 = State Road 526, Ranger DD = Ranger Drainage District, SR 50 = State Road 50, SR 410 = State Road 410, Snowhill R = Snowhill Road.

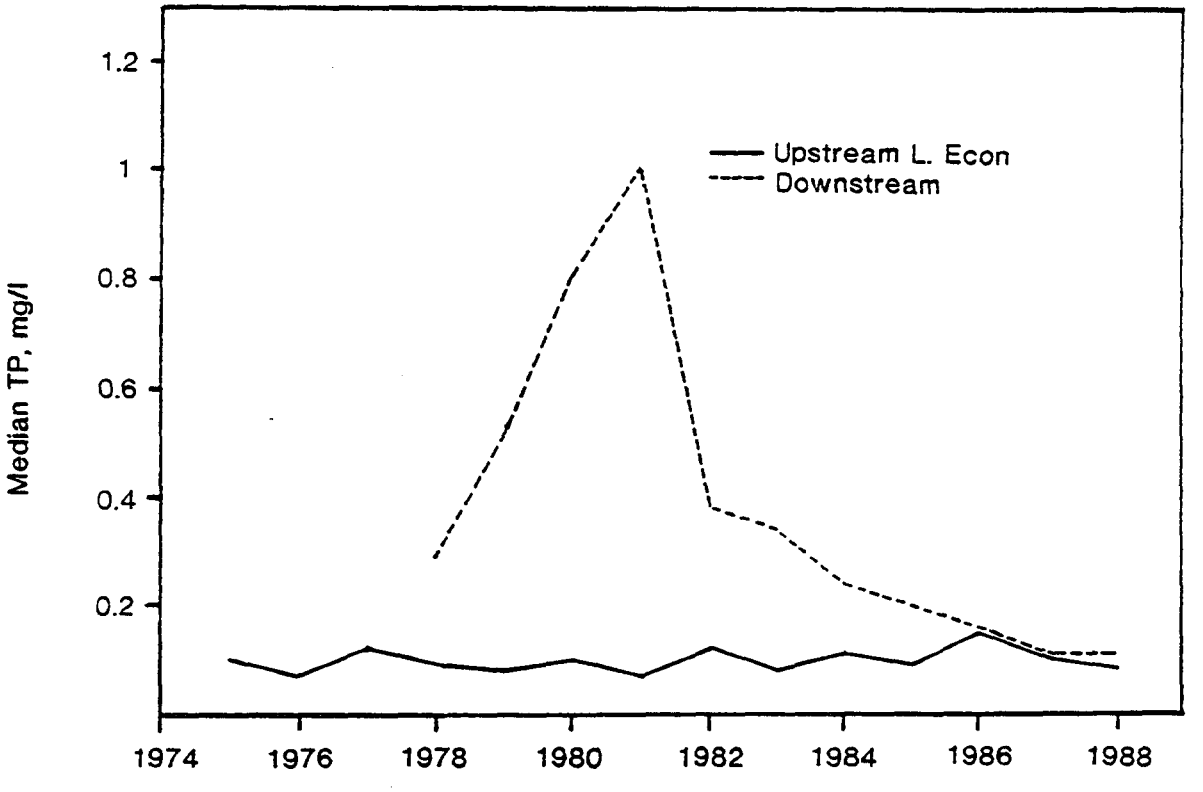


Figure 1.4 Median annual total phosphorous concentration in mg/l for Big Econlockhatchee River above and below confluence with Little Econ River for period 1975-1988.

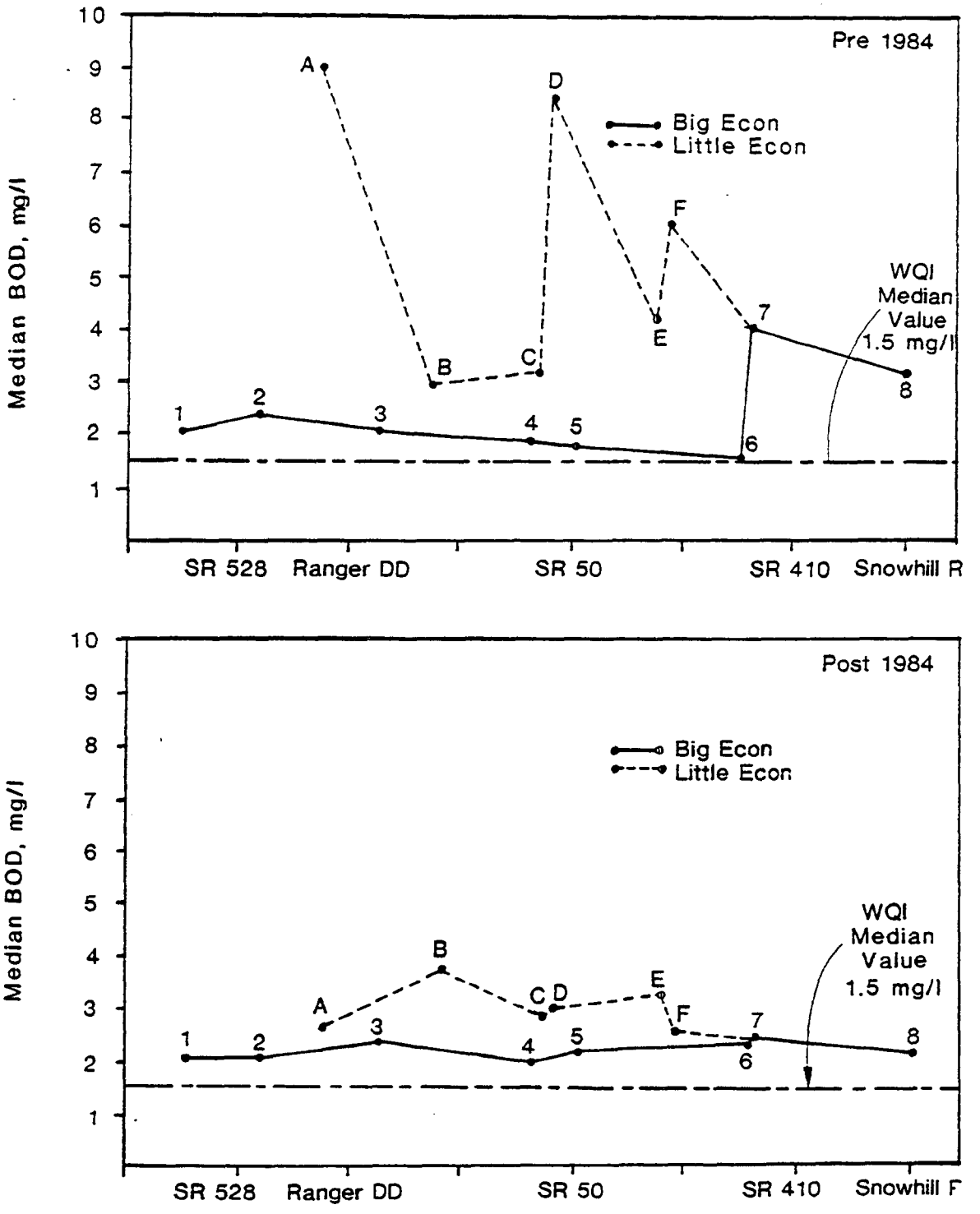


Figure 1.5 Median total BOD in mg/l for periods 1972-1983 (PRE 1984) and 1984-1988 (POST 1984) for 14 sample sites along the Econlockhatchee River. WQI median value is from Table 1.1. Sample locations on the X-axis are for the Big Econ River and correspond to the following: SR 526 = State Road 526, Ranger DD = Ranger Drainage District, SR 50 = State Road 50, SR 410 = State Road 410, Snowhill R = Snowhill Road.

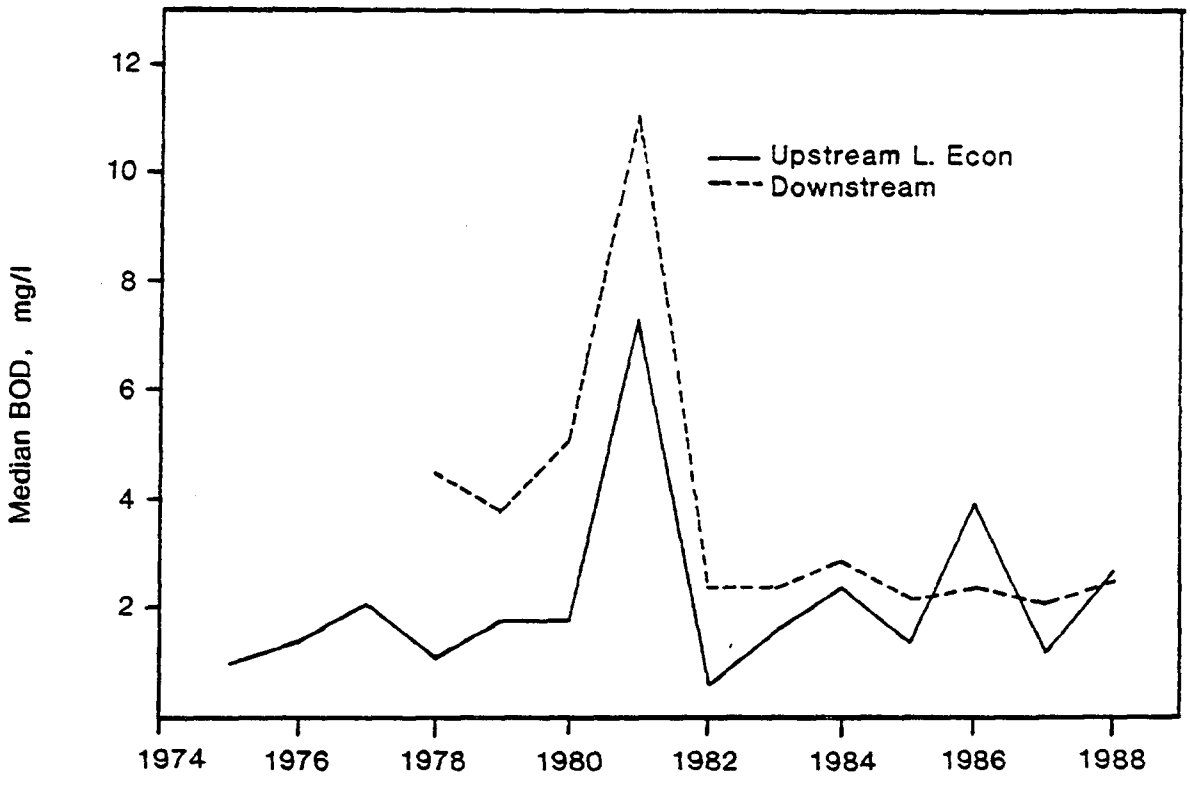


Figure 1.6 Median annual BOD concentration in mg/l for Big Econlockhatchee River above and below the confluence with Little Econ River for period 1975-1988.

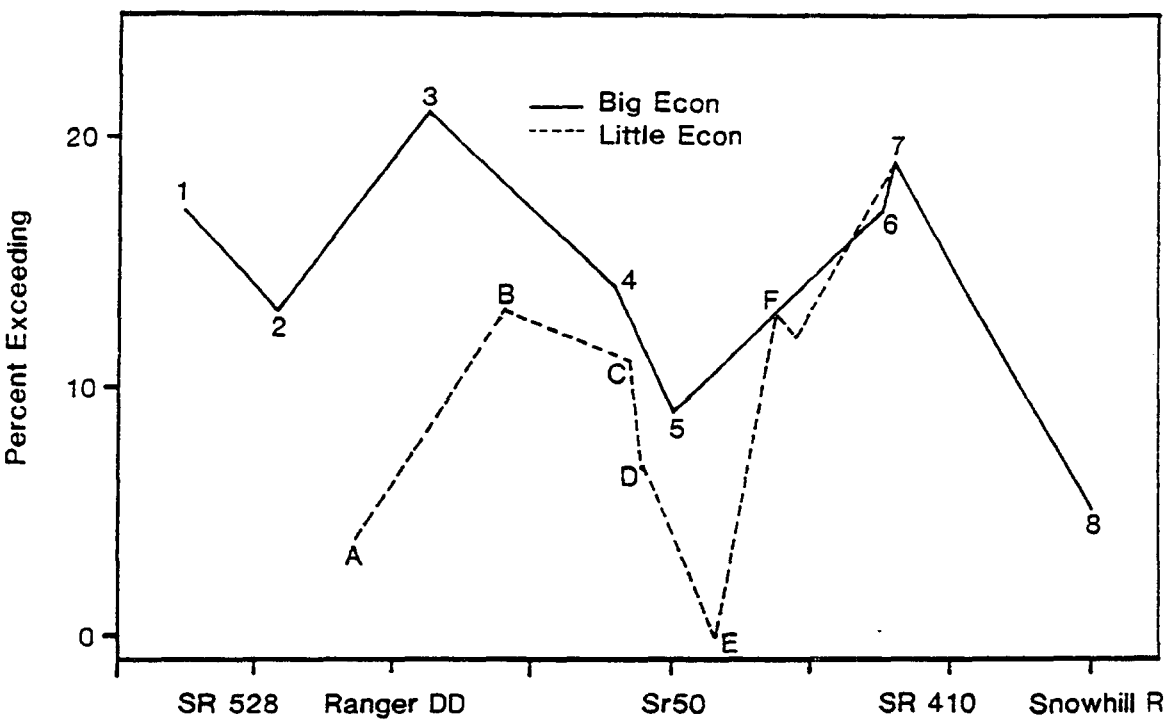


Figure 1.7 Percent of cadmium (Cd) analyses exceeding standards (0.01 mg/l) for water quality samples from Big and Little Econlockhatchee Rivers for period 1981-1988. Sample locations on the X-axis are for the Big Econ River and correspond to the following: SR 526 = State Road 526, Ranger DD = Ranger Drainage District, SR 50 = State Road 50, SR 410 = State Road 410, Snowhill R = Snowhill Road.

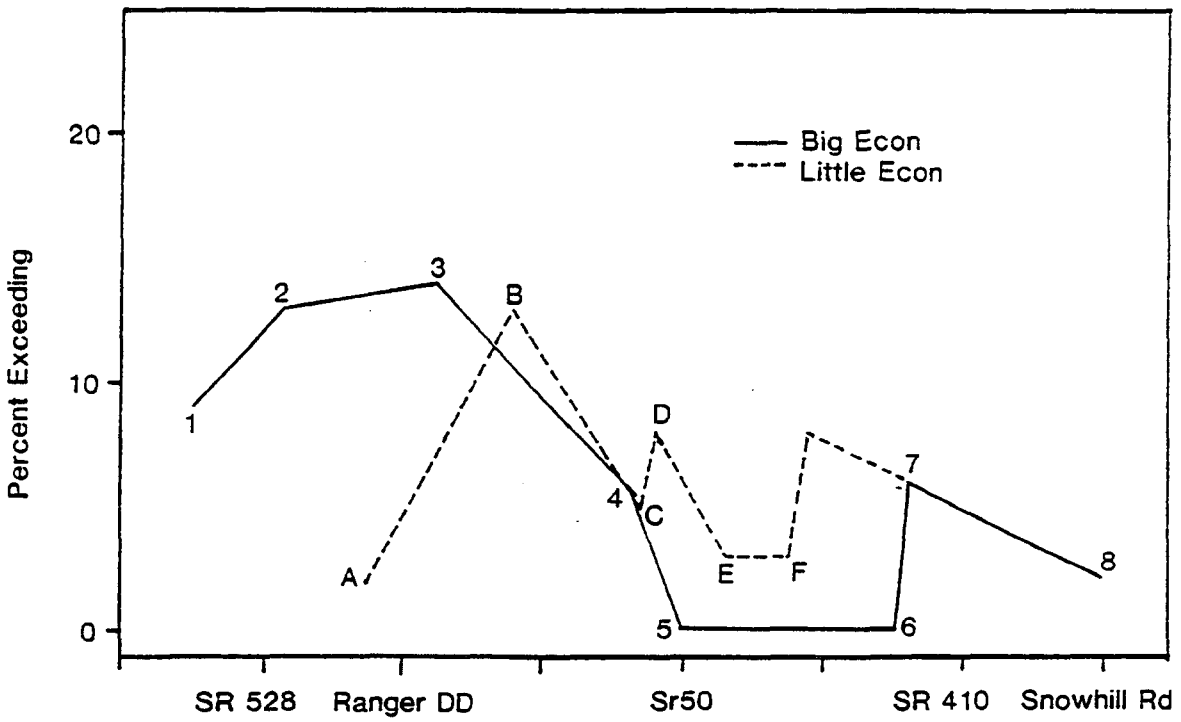


Figure 1.8 Percent of copper (Cu) analyses exceeding standard (0.03 mg/l) for water quality samples from Big and Little Econlockhatchee Rivers for period 1973-1988. Sample locations on the X-axis are for the Big Econ River and correspond to the following: SR 526 = State Road 526, Ranger DD = Ranger Drainage District, SR 50 = State Road 50, SR 410 = State Road 410, Snowhill R = Snowhill Road.

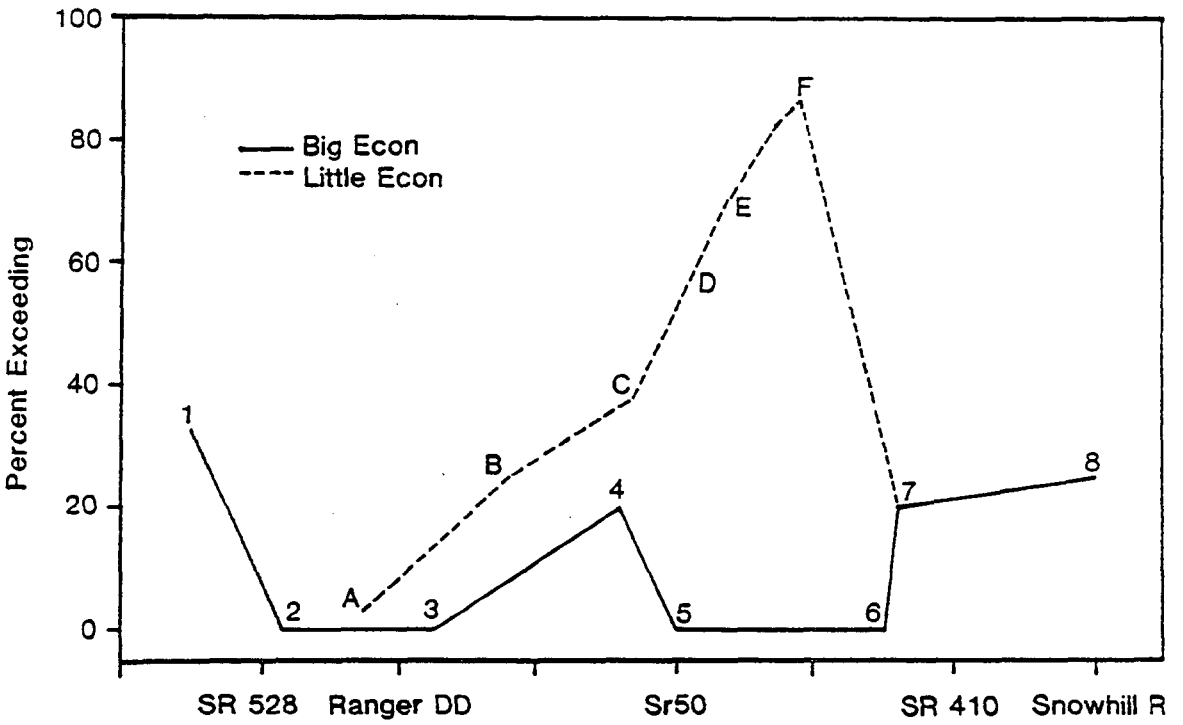


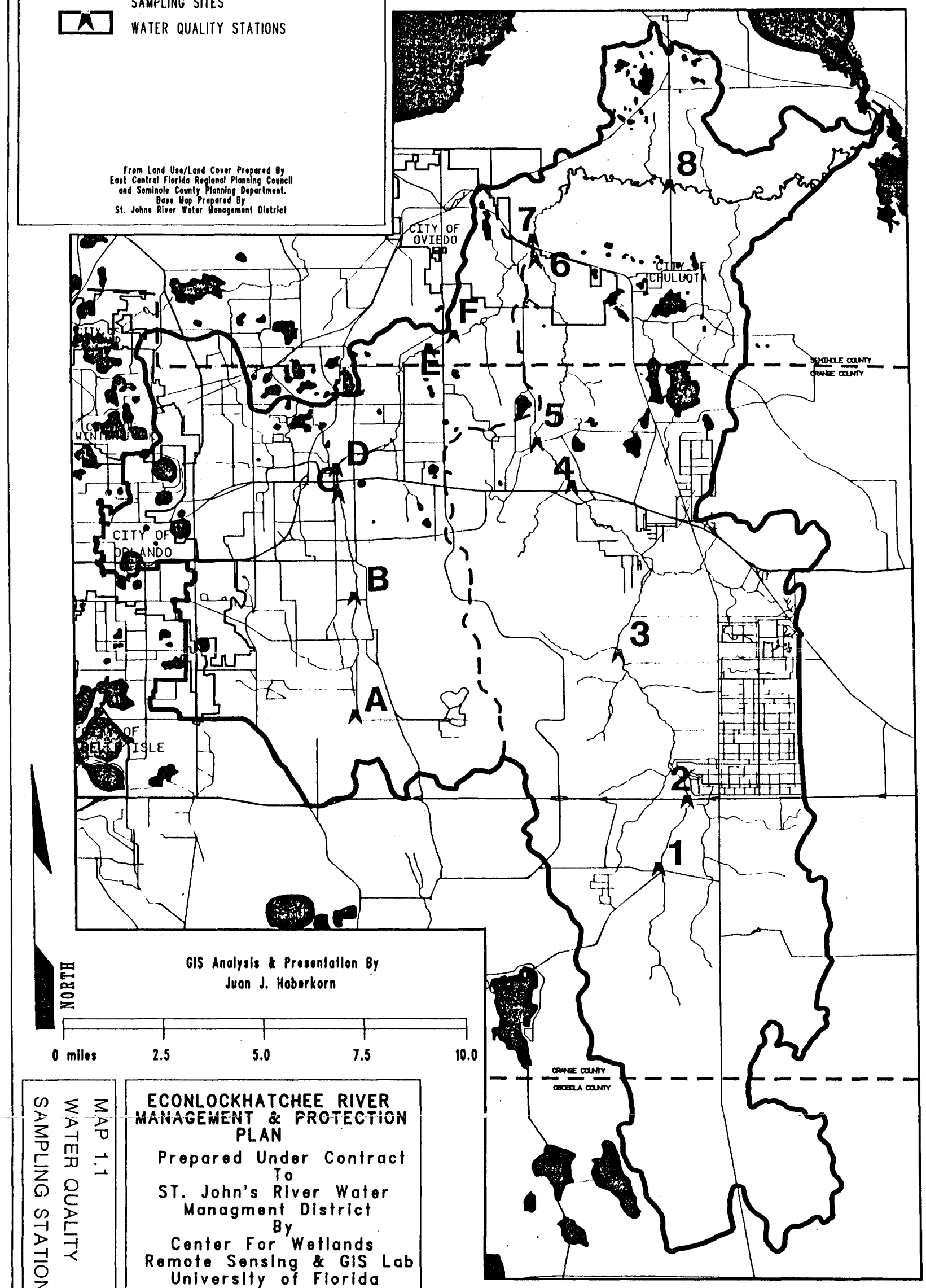
Figure 1.9 Percent of lead (Pb) analyses exceeding standard (0.03 mg/l) for water quality samples from Big and Little Econlockhatchee Rivers for period 1981-1988 (majority of data are from sample years 1987-1988). Samples locations on the X-axis are for the Big Econ River and correspond to the following: SR 526 = State Road 526, Ranger DD = Ranger Drainage District, SR 50 = State Road 50, SR 410 = State Road 410, Snowhill R =

MAP LEGEND:

SAMPLING SITES

WATER QUALITY STATIONS

From Land Use/Land Cover Prepared By
East Central Florida Regional Planning Council
and Seminole County Planning Department.
Base Map Prepared By
St. Johns River Water Management District



NORTH

GIS Analysis & Presentation By
Juan J. Haberkorn

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MAP 1.1
WATER QUALITY
SAMPLING STATIONS

ECONLOCKHATCHEE RIVER MANAGEMENT & PROTECTION PLAN

Prepared Under Contract
To
ST. John's River Water
Managment District
By
Center For Wetlands
Remote Sensing & GIS Lab
University of Florida
January 1990

MARK T. BROWN
CENTER FOR WETLANDS
UNIVERSITY OF FLORIDA

RICHARD HAMANN/JOHN TUCKER
CENTER FOR GOVERNMENTAL
RESPONSIBILITY
UNIVERSITY OF FLORIDA

JOSEPH SCHAEFER
URBAN WILDLIFE PROGRAM
DEPT. OF WILDLIFE & RANGE SCIENCES
IFAS, UNIVERSITY OF FLORIDA

LUCY WAYNE & MARTIN DICKINSON
SOUTHARC, INC.
P.O. BOX 1702
GAINESVILLE, FL. 32602

ECONLOCKHATCHEE RIVER BASIN NATURAL RESOURCES DEVELOPMENT AND PROTECTION PLAN

Chapter 2

TERRESTRIAL AND WETLAND RESOURCES OF THE ECONLOCKHATCHEE RIVER BASIN

Prepared for

St. Johns River Water Management District

October 1990

Chapter 2

TERRESTRIAL AND WETLAND RESOURCES OF THE ECONLOCKHATCHEE RIVER BASIN

Mark T. Brown

INTRODUCTION

The Econlockhatchee River system, its waters, wetlands, and wildlife, is more than just a slowly meandering river in central Florida. It is the manifestation of centuries of geologic processes, ecological succession, and human use. The Econ River is the ultimate expression of the physical, chemical, and biological processes of its entire watershed. It might be said (with great certainty)...as the basin goes, so goes the river. To manage a river one must manage its entire basin.

Located in central Florida and covering the eastern portions of Orange, Seminole, and Osceola counties, the Econ River Basin is composed of approximately 280 sq. mi. of nearly flat, poorly drained sands dominated by pine and palmetto flatwoods with numerous wetland sloughs, and relic beach ridges dominated by scrub communities. Until quite recently the main land uses within the basin were rangelands and some improved pasture. Within the past two decades, several development projects ranging from housing developments to regional landfills have begun to appear within the basin. Most recently, the pace of development has quickened, and with it an increased awareness of the potential for loss of resources of the basin--suggesting to many that it is time that a basinwide resource management plan be implemented.

Rationale

The landscape is composed of a mosaic of ecological communities driven and sustained by environmental forces like sunlight, winds, and rain and constantly "influenced" by the forces of humans and their development actions. Combined development within the Econ River Basin will change many characteristics including the balance between human activities and the environment. Scarce ecological communities will become even more scarce and sensitive communities will show signs of loss of

ecological function. Landscape scale management of development within the basin may help to minimize those consequences of development. Management of landscapes can be broken into two elements, (1) manipulation of landscape components (resource management), and (2) regulation of developmental forces. Within both elements there are several issues that form the basis for an approach to ecological management.

Issues of Resource Management

The issues surrounding sound resource management in a developing landscape are related to how best to plan, design, and then manage to ensure viable resources and sustainable use. The overriding issue is loss of ecologic function. That is, through mismanagement, or inadequate planning or design, the resource is degraded and ecologic functions and values are lost. Such things as pollution of lakes and streams, overharvest of fish and wildlife, or overdrainage and loss of wetland hydroperiod are examples of mismanagement. The increased fragmentation of the landscape into smaller and smaller fragments of ecosystems with subsequent loss of habitat value and ecological health is an example of poor planning and design. Avoidance and regulation are the simplest solutions; avoid the practices that lead to degraded conditions, or regulate them to ensure that they are kept within acceptable limits. Both strategies require a knowledge of the resource and the activities that may cause degradation and a willingness to use that knowledge.

A subset of resource management issues that follow loss of ecologic function are threefold:

1) loss of environmental services,
2) loss of biotic diversity, and
3) loss of aesthetic qualities.

Humans interact with their environments through direct use and indirect consumption of "services." Pure water, clean air, productive soils, waste assimilation, to name a few, are the products of environmental services. Whenever the demands are higher than the supply, or wherever the environment's ability to function has been degraded, free services are replaced with purchased ones. The loss of environmental services can easily be avoided through effective management that minimizes degradation of ecologic functions and that does not overtax the environment's ability to provide these services.

Biotic diversity is landscape scale diversity of organisms of differing types. Through differences in moisture, nutrient availability, and driving energies, the landscape is fashioned into a mosaic of communities each having its own special assemblages of organisms. Taken in aggregate, small-scale community diversity generates a higher diversity at the larger landscape scale. As lands are developed and landscapes are fragmented, small-scale biodiversity may be maintained in refugia, but many components of the larger scale are lost. The best examples of loss of biodiversity are the precipitous declines in large animals (panthers and bears) as development fragments habitats and increases exposure to accidental death. Accounting for biotic diversity requires not only protection at the species level, but also habitat protection at the landscape scale.

Environmental quality (i.e., its aesthetic quality) is an important yet often neglected element of landscape management most often because a description, much less measurement of the aesthetic experience, is no simple task. It is through a juxtaposition between wilderness and civilization that the aesthetic quality of a landscape can be enhanced. An integrated landscape of developed lands and undeveloped wildlands increases total environmental quality and is the result of foresight, and effective planning and design.

In all, good resource management (that is, good planning, design, and management) should be measured through how well we achieve a balanced and functioning resource base as the landscape changes and our demands increase.

Issues of Landscape Development

The dominant issue surrounding landscape development is how best to accommodate economic development and ecologic processes within the same landscape. In other words, how do we achieve a fit of humanity and nature in a ecological setting in such a way to maximize both human-oriented potentials (most often measured in economic terms) and the normal processes and functions of the landscape that support those potentials? And how do we do it in a way that is both "cost effective" and, to some degree, aesthetically pleasing?

It is fairly well known and easily visualized that, as a landscape develops, the amount of "pristine" wilderness diminishes and, therefore, its ability to provide services. Either extreme, full development on the one hand or zero development on the other, is "limiting" since in either case one or the other potential does not exist. Thus, through relatively simple reasoning, some middle ground seems to be the most logical development scenario. However, there is a confounding aspect of landscape development that makes simple logic less than adequate. As the amount of development increases, the need for environmental services increases; thus, as an area becomes more and more developed, there is more and more of a need for an environment that will supply raw resources, absorb wastes, and provide recreational opportunities. The relationship suggests that as the amount of development increases, there is some optimum point where further development has diminishing returns.

Next, assuming that some portions of the landscape should remain undeveloped to provide these services, in what spatial configuration should these developed and undeveloped lands be arranged? It has often been suggested that large parks or reserves are sufficient to preserve vestiges of the undeveloped landscape and can serve as the required undeveloped lands. And to some extent this is true. State parks, national forests, and wildlife preserves are important components of a developed landscape. Yet, they cannot serve as the only undeveloped areas for they would soon become overtaxed, overused, and degraded. Parks by their very definition cannot be "used" or fully integrated into the developed landscape for they are preserves, designed, managed, and maintained to ensure that some vestiges of the undeveloped land are retained. Use implies consumption unless the use is strictly regulated to balance consumption with production. While parks are important parts of a developed landscape, they represent the extreme, the portion within which there is no development. What is

needed is a continuum of preserves--some fully integrated into the developed landscape, others somewhat isolated and still others set aside as environmental reserves.

Finally, a third issue needs to be explored if we are to achieve a balanced landscape of developed and undeveloped lands. This third issue is related to the mix of ecological communities that should be integrated into the developed landscape. Without question, wetland communities are important resources because of their position as places of convergence of water, energy, matter, and wildlife. They are by far the most productive communities of the landscape. Yet a landscape composed entirely of developed lands and wetlands lacks the balance afforded by a heterogeneous mix of uplands and wetlands, forests and prairies. A landscape stripped of its uplands and replaced with developed lands is lopsided in its ability to function and provide the services required by a growing human population. What is needed then is an interconnected, heterogeneous mosaic of ecological communities to ensure a viable and functioning landscape.

In summary, the three issues can be distilled to the following:

How much is enough?
Where should it be?
What kind should it be?

Development of a management plan for the Econlockhatchee River Basin that protects the resources of the basin and yet fosters development offers the opportunity to test our resolve, experiment with the future, and propose a developed landscape as a balance of humanity and nature. This resource inventory is a component of the overall management plan. It is a summary of what is known about the terrestrial and wetland communities of the Econ River, a synopsis of the issues surrounding preservation on the one hand and development on the other, and a guidance mechanism with suggestions for managing the basin's resources to ensure long-term ecological viability.

Plan of Study

The process of developing a basinwide management plan for terrestrial and wetlands resources of the Econ Basin is driven by an overall set of goals and objectives, fostered by the collection of all relevant information about the current status of the resource, and organized around sound ecological planning, design, and engineering. In this study, as a consequence of the short time frame that was imposed, existing sources of information and data have been relied upon. Current comprehensive plans from the various governmental agencies that have major roles in shaping the future of the basin were consulted and relevant goals and objectives concerning natural resources were summarized.

While numerous reconnaissance field trips (both on the ground and in the air) were made, no contemporaneous field data collection was undertaken. All agency files and reports were searched, computerized library searches were acquired, and agency personnel were interviewed to collect all relevant sources of information and insights concerning the past, present, and future status of the

resources of the basin. To that end, for the most part, data collection has produced a complete project file of all relevant information and data.

Finally, over the past several years, a number of studies have been undertaken by the author that have lead to recommendations for planning guidelines, model ordinances, design criteria and engineering principles that have been drawn upon to develop recommended management and development alternatives for the Econ Basin.

Definition of Terms

The following terms, some in common use, are defined to ensure meaning and help in the task of developing a clear understanding.

Biotic Diversity -- The assemblage of biotic (living) components of a landscape expressed as a measure of contrast. That is, the number of different organisms. Diversity is most often considered a desirable trait of ecological communities--the more diverse, the more valued the community.

Buffer -- A zone of transition between two different land uses that separates and protects one from another. In this report, the word "buffer" refers to the zone between a wetland and a developed or developable area.

Channelway -- That portion of a river basin that is dominated by river or stream channel and that is composed of all lands that drain into that portion of the basin that is delimited by the mouth and point where the stream channel is no longer evident.

Community, Ecological -- A natural assemblage of plants and animals that live in the same environment, are mutually sustaining and interdependent, and are constantly fixing, utilizing, and dissipating energy.

Diversity, Biological -- The composition of a particular environment or habitat as it relates to the plant and animal species present and their relative abundance.

Drawdown -- The lowering of the upper surface of a water table.

Floodplain -- Pertaining to the area of lands adjacent to a water course that are periodically inundated during flood events.

Groundwater -- See Surficial Aquifer.

Hammock -- A common named used throughout Florida in reference to uplands forested ecological communities (See Hydric, Mesic, and Xeric).

Headwaters -- The area of a watershed or river basin that is farthest from the mouth of the stream or river and that does not have a defined river or stream channel, but is dominated by isolated wetlands and overland flow.

Hydric -- Of or pertaining to wet conditions; used in this context as a description relating to forested upland ecosystems (see Hammock).

Hydroperiod -- The length of time during which there is standing water in a wetland.

Integrity, Biological -- All of the plants and animals that are characteristic of an area and all of the processes that result from interactions between these species and their environment.

Landscape -- A heterogeneous land area composed of a cluster of interacting ecological systems that are repeated in similar form throughout. Landscapes vary in size, down to a few kilometers in diameter. (Forman and Goodron 1986).

Landscape Association -- An assemblage of ecological communities with similar topography and geology which are hydrologically connected.

Landscape Dynamics -- The areal and functional relationships between different parts of the landscape, e.g., the distribution, sizes, and topographic and hydrologic connections among ecosystems in a landscape association.

Mesic -- Midway between very wet and very dry. Used in this report as a description relating to forested upland ecosystems (see Hammock).

Overstory -- The layer of foliage (leaves and branches) formed by the largest trees in a forested area.

Riparian -- Of or relating to or living or located on the bank of a flowing watercourse (as a river or stream) and also an isolated water source such as a pond or lake.

Seepage, Groundwater -- Slow, vertical or horizontal movement of groundwater in the soil.

Silviculture -- Activities of humans involving regeneration, tending, and harvesting a forest.

Slough -- A linear wetland drainage feature usually dominated by cypress (*Taxodium* spp.) lacking a perceptual water flow and open channelway.

Species Richness -- The number of different species in an area.

Strand -- A linear wetland drainage feature usually dominated by cypress (*Taxodium* spp.) having water flow, but not in an open channelway.

Succession, Vegetational -- The process of change in the types of plants occupying an area as plants mature, are replaced, and otherwise respond to the environment.

Surficial Aquifer (Groundwater) -- The unconfined aquifer that is nearest the ground surface and is open to the air.

Transfer of Development Rights (TDR) -- A practice that allows the transfer of development density from one site (usually based on sensitivity of the site) to another site so as to protect the first site from adverse development impacts or as a means of ensuring lower densities or no development.

Transfer of Mitigation Requirements (TMR) -- A practice that allows the off-site transfer of requirements for mitigation for distruction of some vegetative community. The mitigation most often required is creation of an equal of greater area of like kind community but can include fee simple purchase.

Turbidity -- The concentration in water of suspended solids (such as silts, clays, and small particles of organic matter).

Understory -- The foliage lying beneath the tallest trees consisting mainly of seedling trees, small trees, shrubs, and herbaceous plants.

Vegetation Areas, Transitional -- Areas that contain plants that are characteristic of identifiable adjacent plant communities.

Wetland -- Lands transitional between terrestrial and aquatic ecosystems where the water table is usually at or near the surface such that the lands are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Wetlands, Ephemeral -- Areas temporarily or seasonally supporting wetland conditions.

Wetlands, Jurisdictional -- Wetlands that can be legally regulated by government.

Wildlands Management -- An approach to regulating the use and development of the landscape in such a way that portions of the landscape remain in a wild and scenic character. It is more regulation and control of the actions of humans than management of the wildland itself. Most wildlands are composed of self-sustaining ecological communities. However, in some situations it may be important to manage the wildlands area, or portions there of, through actions like controlled burns, tree planting, re-introduction of wildlife, controlled hunting, etc.

Wildlands Management Area (or Wildlands District) -- An area of the landscape that is designated as a wildlands. It is a management area where special attention is given to ensuring that human uses and development actions do not detract from its wild and scenic character, thus human uses are minimized and controlled. Districts that are designated as Wildlands Management Areas do not preclude human uses for development or recreation, only that human uses is a minor portion of the whole district. Wildlands areas are managed through development controls, regulatory actions, and in some cases through resource management to remain wild and scenic in character.

Xeric -- Of or relating to an extremely low amount of moisture available for the support of plant life. Used in this context as a description relating to forested upland ecosystems (see Hammock).

Review of the Pertinent Literature

Like many areas of Florida, the Econ River Basin is relatively undeveloped and contains many areas of interest from a natural resource perspective. Despite this, there is a paucity of specific literature about the terrestrial and wetland communities or landscape scale ecological organization of the basin. Be that as it may, the following is a brief review of the pertinent literature concerning the terrestrial and wetland resources of the basin. The literature review is organized in chronological order to give some temporal perspective to past scientific studies and reports.

Descriptions of the Econlockhatchee Basin

White (1970) devotes two pages to the Osceola Plain and one paragraph to the eastern portion of the plain within which the Econ Basin falls.

> ...there is nonetheless a notable distinction in the terrain east and west of a line running approximately parallel with the axis of the peninsula, following in general the route of United States Highway 441 between Fort Drum at the south through Osowaw Junction, Yeehaw Junction and Kenansville, to Cat Lake and then passing just east of the eastern edge of the Orlando Ridge to become the trend followed by the Sanford-Palatka reach of the St. Johns River Valley. This line is almost straight throughout its length and seems to mark a relict Atlantic shore. Where it traverses the Osceola Plain the terrain east of it has a drainage pattern and topography which shows it to be composed wholly of relict beach ridges and their intervening swales. But to the west of the dividing line the topography and drainage pattern are more indeterminate and randomly arranged.

The area occupied by the Big Econ and for the most part that occupied by the Little Econ lies in the Osceola Plain, and is composed of alternating relict beach ridges and swales (White 1970). These are readily apparent from aerial photography and vegetation maps that show wetland sloughs and strands occupying the lower swales and scrub communities on the "higher" ridges.

In the early 1970s a group of citizens from the Orange County area, sponsored by Orange County Audubon Society, carried out a year-long study of the Big Econ River and its floodplain (Orange County Audubon 1972). The study is remarkable in its breadth and in that it was carried out with little or no funding, involved volunteers, and extended over a period of one year. This study seems to be one of the earliest sources of data on water quality, flora, and fauna of the river. A preliminary draft of a report containing an introduction, methods, and results and discussion was published in December 1972. No further updates or drafts have been found. In general, the study focused on physical and chemical water parameters, aquatic vertebrates, terrestrial invertebrates and vertebrates and floodplain vegetation. Twelve sampling locations (four on the Little Econ, four on the upper Big Econ, one at the confluence, and three downstream of the confluence) were sampled at monthly intervals from November through

October. Sampling at some sites was not carried for the full year, presumably as a result of loss of interest by that team member.

Summarizing the floodplain botany, H. O. Whittier suggested that...

> To the biologist, the Econlockhatchee River represents, for much of its length, a relatively undisturbed sanctuary for plants and wildlife, a rather rare commodity in central Florida, where he can find the basis for useful studies on both plants and animals in relation to each other and their natural Florida environment. Botanical studies show the existence of a number of rare or unusual plants such as the Whisk fern (*Psilotum nudum*); carnivorous plants such as narrow-leaved sundew (*Drosera intermedia*), hooded pitcherplant (*Sarracenia minor*), butterwort (*Pinguicula* spp.), bladderwort (*Utricularia* spp.); orchids such as the rare leafless *Harrisella porrecta*...two other epiphytic orchids, and no less than five terrestrial orchid species....These and a number of others provide especial interest to students of natural history and nature lovers, in their own right, but in addition, many make special contributions to the diets of the various wildlife of the river region, forming essential components of an ecosystem unique in its state of preservation and continuity.

A survey report by the U.S. Army Corps of Engineers (COE) (1973), that considered the flood problems in the Econlockhatchee River Basin (apparently issued approximately five months after publication of the Audubon draft report), put to rest citizen concerns related to channelization. The District Engineer found that:

> ...construction of flood-control works are not needed in the sparsely developed floodplains of the Econlockhatchee River Basin...[and] there is a definite need to leave the environment of the Econlockhatchee River floodway undisturbed, both to preserve the vegetation balance in the natural floodway and to protect the spawning run of the American and hickory shad in the Econlockhatchee River.

Their descriptions of the basin support the findings of others of an "...essentially...wild, undeveloped stream that provides the outdoor enthusiast with recreational opportunities...[and] has remained relatively undeveloped due to poor drainage and frequent low floods which make it unsatisfactory for agricultural or residential use." The proximity of the river to the rapidly expanding Orlando urban area is suggested as the reason for gradual depredation of its natural values. In apparent disagreement with White (1970), the corps report suggests that "the topography of the area is influenced more by underground solution activity than by any other natural process." In addition the report contains strong recommendations that:

> In view of the drift of urban development into the floodprone areas, it is recommended that local agencies implement to the maximum extent possible a floodplain management program to reduce the potential for future flood-damage problems.

In a report on water quality of the Econ River, Alt et al. (1974) provide a general description of the drainage basin, its vegetation and soils. Most notable is their description of the Big Econ south of the Beeline Highway as being in a "natural state" and "one of the few remaining 'clean' aquatic habitats in the county. Water quality is good and the ecological aspects of the stream are balanced as of this time." Changes in the Big Econ Basin were noted with the most important change "...the Ranger Drainage District which will discharge to the upper reaches of the Big Econ....[and] drain approximately 6,000 acres of what is presently pine flatwoods..."

The East Central Florida Regional Planning Council (1978) in a report on the 208 Area Wide Water Quality Management Plan give a brief description of the Big and Little Econ watersheds with some comparisons. Generally, they conclude that the majority of the Big Econ is dominated by pine and palmetto flatwoods with mixed hardwood swamp forests along water courses. There are several very gently sloping, low ridges but changes in elevation for the most part are so gradual as to be barely perceptible. In many respects they suggest the physical characteristics of the Little Econ are similar to those of the Big Econ, except in the extreme western portion of the basin where elevations are in excess of 90 feet and are occupied by xeric communities with a majority of the lakes of the basin.

Describing the Osceola Plain from a "soils" perspective, Readle (1979) wrote that....

> Elevations range between 25 and 80 feet above sea level. The vegetation consists mostly of pine and palmetto flatwoods with numerous large to small lakes and fewer areas of broad, grassy sloughs and depressions and poorly defined drainageways. The soils are predominately nearly level, wet, and sandy. The sandy subsoil is weakly cemented with organic matter. Some of the soils have a loamy subsoil, and some are organic. Large areas of this region are used for range and improved pasture.

In a study initiated for the purposes of determining existing water quality problems within the Little Econ watershed, identifying the sources of pollutants, and recommending methods of restoring the river system to a more ecologically diverse and aesthetically pleasing water body, Miller and Miller (1984) described that portion of the river within Orange County as a river that has experienced severe water quality problems. Their description of the basin is one of low topographic relief with numerous swamps and sloughs, and several gently sloping, low ridges. The natural setting is described as dominated by pine palmetto flatwoods, with lesser areas of longleaf pine and xerophytic oak forests occurring on the higher lands in the western portions of the basin. The mixed hardwood swamp forest is common along water courses and in sloughs and swamps. They suggest that prior to development the Little Econ Basin's land cover was composed of 58% flatwoods, 25% swamp, 15% well drained, and 2% open water.

Wilson et al. (1987) concluded in a study that analyzed the causative factors related to sinkhole development in the Orlando area that the Osceola Plain in eastern Orange, Osceola, and Seminole counties exhibits conditions that are not suitable for sinkhole development. Much of the Big Econ Basin is within areas where conditions are unsuitable for sinkhole development, while most of the Little Econ Basin is within an area that is marginally suitable, but where none have been reported. They suggest that "ancient sinkhole lakes occur in scattered localities, but are not common overall." Recharge rates seem to be a positive indicator of potential sinkhole development. Most of the Econ Basin is situated within an area of very poor recharge potential (less than 3 inches per year) while portions of the upper Little Econ occupy areas having moderate recharge potential (3 to 10 inches per year).

The Conservation Element of Seminole County (Seminole County 1988) describes the portion of the Econ River within Seminole County as "...one of the most natural settings in central Florida. This pristine bottomland hardwood forest is surrounded by a watershed of undisturbed ranchlands." The conservation element proposed that the county pass a resolution in favor of acquisition of the proposed lower Econ River parcel under the state CARL program.

Descriptions of Ecologic Communities

Some of the most useful information concerning the terrestrial and wetland community resources of the Econ Basin are contained in numerous Applications for Development Approval (residential developments) and environmental evaluations related to utility siting studies. While these studies were conducted for specific tracts of land scattered throughout the basin (see Map 2.1), they serve as an important resource in developing an overview of the vegetation and characteristics of ecological communities.

In its Site Certification Application, the Orlando Utilities Commission (ca. 1981) described eight plant communities occupying the approximately 5 sq. mi area of the Stanton Energy Center. They included: pine flatwoods, xeric oak scrub, pond cypress, pond pine, bay hardwood, oak hardwood, mixed forested wetlands, and wet prairie. In addition to species lists, the studies provide quantitative data on community composition, aerial extent of communities, discussion of importance of fire in succession, and soil moisture control of plant community composition.

Best et al. (1982) described the site of the Easterly Regional Waste Treatment Plant finding seven communities including: sand pine scrub, xeric oak scrub, mixed hardwood swamp, longleaf pine-palmetto flatwood, pond pine flatwood, wet prairie, and cypress dome. Community surveys were conducted in each community and species composition determined. They discussed the importance of both wetland communities and, in particular, the scrub communities which they felt were endangered ecosystems. Their closing remarks include:

> Large areas of sand pine scrub are preserved in the Big Scrub of the Ocala National Forest, but outside the national forest the scrub is one of the endangered ecosystems of the state. There are currently no regulatory restrictions to development of upland habitats, and subsequently the development pressures in the central Florida region represent chronic threat to what little scrub habitat remains.

The Andean Group of Florida (1985) identified six "vegetation associations" in their ADA for the Riverwood development project including: pine flatwoods, xeric oak, other hardwoods, pond pine, wetland hardwood forest, and freshwater marsh. Some species lists for wetland communities were given, but relatively little information on other ecological communities was included.

In the Application for Development Approval for the International Corporate Park, Inc. Canin and Associates (1985) classified vegetation uses into three classes of Rangeland, Upland Forest, and Wetlands. Rangeland included pastureland, palmetto prairie, and shrub and bushland. There were six upland forest types, including pine flatwoods, longleaf pine, xeric oak, other hardwood mixed forest, and clear-cut. The wetlands class included cypress, pond pine, freshwater swamp, mixed forest, and freshwater marsh. In an apparent contradiction, pond pine communities are classified as wetlands for the purposes of mapping, but considered uplands and included in developable portions of the tract. In later submittals (Canin Associates September 1985), the contradiction is explained as differences in classification between the FLUCC system and jurisdictional determination because of understory vegetation.

Level IV classification (FL Dept. of Administration 1976) was used by Orange County Research and Development Authority (1987) to classify more than 26 different community types in one of the

most detailed vegetation classifications found in any ADA. The comuunity types are too numerous to list here, but of particular interest is their splitting of pond pine communities between a wetland variety and an upland variety.

Defining wetlands as stressed and healthy, on a site near the Orange County Landfill, Glatting, Lopez, Kercher, Anglin (1988) in the ADA for Young Pine showed very graphically the impact of drainage canals on wetlands. The East Orlando Canal bisects the Young Pine site dewatering the majority of wetlands (about 73%). They attributed the stress to interruption of surface-water flows in the wetland strands and general lowering of the groundwater. The effects of the canal appear to extend as far away as 2700 feet, where stressed wetlands extend off-site on the southside of the canal. They suggest that:

> Evidence of stress attributed to the artificial dewatering caused by the canal system primarily takes the form of vegetative succession favoring upland species within the historic strand. Pine, myrtles, wild grape, and fennels have become established within this wetland system, extending several hundred feet in each direction from the drainage canal.

Further, they state that one isolated wetland near the canal was particularly stressed due to long-term dewatering as a result of its close proximity to the canal.

Several other ADAs (Canin Associates 1982, 1984, 1987) provide further documentation of ecological communities found throughout the Econ Basin. For the most part, their community analysis shows the same basic array of communities.

THE TERRESTRIAL AND WETLAND RESOURCES

The terrestrial and wetland resources of the Econlockhatchee River Basin are as varied as the river itself. Beginning as a broad expanse of wetland slough dominated by forested areas of cypress and bays with extensive areas of marsh, the Big Econlockhatchee River flows northward from northeast Osceola County through eastern Orange and Seminole counties and takes an abrupt right turn to exit eastward to the St. Johns River. Abundant rainfall, relatively flat terrain, and the poorly drained character of the soils are the main factors that have produced a basin dominated by pine flatwoods interspersed with significant areas of cypress domes, strands and sloughs. The biggest recent changes in the vegetative communities of the basin have resulted from improved drainage and conversion of flatwoods to pasture and rangeland. Serious loss of wetland and pineland habitat have occurred recently as the result of fire and conversions to other uses. For example, the area immediately south of the Orange County Landfill know as Wide Cypress Swamp, experienced a disasterous fire after the construction of a 10-mile drainage canal that significantly lowered water tables in the area. The fire reduced what was once a 1200-acre cypress slough to a shrub wetland composed of young big trees and large expanses of cattail (*Typha* spp.) in impounded areas to the north of the canal. Areas south of the canal are still overdrained and dominated by bay trees and wax myrtle (*M. cerifera*).

The river has a second major tributary, the Little Econlockhatchee River which joins the Big Econ approximately two-thirds of the distance from headwaters to the mouth. The Little Econ drains higher lands in the extreme western portions of its basin that were dominated by gently rolling hammocks and sandhill communities, but most of the basin was relatively flat, poorly drained and dominated by pine flatwoods. In the early 1980s, the basin had more than 50% of its land area in urban, agricultural or other uses (Miller and Miller 1984).

Map 2.2 shows urban and agricultural land uses within the basin. Table 2.1 gives total area in urban and agricultural uses and their percent of the total land area. Obvious is the extent of urban uses in the Little Econ Basin when compared to the Big Econ. Most agricultural uses are confined to the Big Econ Basin.

As a means of simplifying the complexity of the basin into larger scale classes of ecological systems, the basin was classified and mapped in what might be called a FLUCC Level 0 classification by "lumping" or aggregating ecological communities into landscape associations. Map 2.3 shows the landscape associations of the basin. The following section describes associations and their topographic and hydrologic characteristics.

Table 2.1 Land use in the Econlockhatchee River Basin.

Region		Area (acres)	Percent of Region
Seminole County			
	Urban	2563	8.2%
	Agriculture	3475	11.1%
	Wooded	17142	54.7%
	Wetlands	6787	21.6%
	Lakes	1387	4.4%
	Total	31354	
Orange County			
	Urban	39734	31.2%
	Agriculture	11790	9.3%
	Forested (300,400)	43601	34.2%
	Wetlands (600)	28934	22.7%
	Lakes	3256	2.6%
	Total	127315	
Osceola County			
	Urban	0	0.0%
	Agriculture	180	1.1%
	Range	8550	52.8%
	Wetlands	7473	46.1%
	Total	16203	
	Total Basin	174872	

Landscape Associations

From previous studies (Brown and Best 1985; Brown, Schaefer and Brandt 1989) a technique of landscape scale classification has been developed that generalizes somewhat characteristics of ecological organization with topographical and hydrological gradients. Called landscape associations, they are an assemblage of ecological communities classified on the basis of similarity of topographic, geologic, and hydrologic conditions as well as landscape position. Using this system of classification, the central Florida region within which the Econ Basin is found is composed of eight associations. Three landscape associations are characteristic of the Econ Basin and they are

1) pine flatwoods with isolated wetlands,
2) pine flatwoods with flowing water wetlands, and
3) pine flatwoods and/or hammocks with hardwood swamps wetlands.

The following paragraphs describe the associations. For complete descriptions of the communities that comprise these associations see Brown (1980) and Brown and Starnes (1982).

Landscape Classification 1. Flatwoods/Isolated Wetlands

This association is characterized by very low topographic relief and very minor surface drainage features. As a result, overland flow during the wet season and significant storm events is quite common. During normal years, water tables are at or near the ground surface for about six months of the year.

Pine flatwoods are so named because of the flat topography on which this association is typically found. The lack of gradient results in frequent flooding during the summer rainy season (Brown 1980). Often underlain by a "hardpan" of organic materials, clays or accreted oxides, that retard downward migration of groundwaters, flatwood soils are often poorly drained and flood easily. Many grassy scrub areas and palmetto prairies were probably once pine flatwoods that have been converted to grassy scrub by tree harvest, increased drainage, and/or greater fire frequency (Brown 1980).

Interspersed throughout the flatwoods are topographic low areas, which are occupied by patches of wetlands of various types. Wetlands are typically circular in shape and vary from quite small (less than one-half acre) to large (tens of acres). Depth of standing water in isolated wetlands during the rainy season is typically 18 to 24 inches. Wetland types include cypress domes, bayheads, wet prairie, and shallow marshes (Brown and Schaefer 1987). Occasionally deep freshwater marshes (Brown 1980) are found although they most often are associated with areas of higher relief and greater surface water drainage. The wetlands in this association are relatively oligotrophic whose main source of nutrients is rainfall and a minor surface drainage from small surrounding watersheds.

Cypress domes are dominated by pond cypress (*Taxodium ascendens*). Dominant tree species in bayheads include red bay (*Persea borbonia*), sweet bay (*Magnolia virginiana*), loblolly bay (*Gordonia lasianthus*), black gum (*Nyssa sylvatica*), red maple (*Acer rubrum*), pond pine (*Pinus serotina*), and slash pine (*Pinus elliottii*). Typical wet prairie plants include St. John's wort (*Hypericum fasciculatum*),

primrose willow (*Ludwigia* spp.), elderberry (*Sambucus simpsonii*), panicum grasses (*Panicum* spp.), soft rush (*Juncus effusus*), spike rush (*Eleocharis cellulosa*), and pickerelweed (*Pontederia cordata*).

Deepwater marshes are usually dominated by free-floating plants such as water hyacinth (*Eichhornia crasspipes*) and water lettuce (*Pistia stratiodes*) or rooted aquatic plants such as water lily (*Nymphaea odorata*) and spatterdock (*Nuphar luteum*). Shallow marshes may be dominated by one of the following species: pickerelweed (*P. cordata*), sawgrass (*Cladium jamaicense*), arrowhead (*Sagittaria* spp.), fire flag (*Thalia geniculata*), cattail (*Typha* spp.), spikerush (*E. cellulosa*), bulrush (*Scirpus* spp.), or maidencane (*Panicum hemitomon*); some marshes contain patches or mixtures of some or all of these species (Brown and Starnes 1983).

The flatwoods/isolated wetland association is found throughout the Econ Basin occupying the flat table lands between drainage features and as the headwaters areas of many first order streams.

Landscape Classification 2. Flatwoods/Flowing Water Wetlands

The soils in this category are poorly drained and have higher percentages of clay and organic matter than do those of the flatwoods/isolated wetland association. Unlike the table lands of the first association, the topography of this association is more variable. Having somewhat greater relief, the flatwoods of this association have surface drainage features that resemble elongated swales dominated by wetland vegetation. Both surface and groundwaters contribute water flows to the wetland drainage features.

Sloughs or strands are elongated wetlands with no open water channels; however, water flows imperceptibly slow as sheet flow during the wet season and through small, braided channels during drier times.

Flowing water wetlands include both bald cypress (*Taxodium distichum*) and southern mixed hardwood forests growing throughout sloughs and strands. Common hardwood species include red maple (*A. rubrum*), water tupelo (*Nyssa aquatica*), swamp black gum (*Nyssa sylvatica* var. *biflora*), sweet gum (*Liquidambar styraciflua*), pop ash (*Fraxinus caroliniana*), Florida elm (*Ulmus floridana*), and cabbage palm (*Sabal palmetto*) (Brown 1980).

The seasonal flooding that is characteristic of flowing water wetlands provides the nutrients needed for plant growth. Water levels can fluctuate about 2.5 feet between the wet and dry season in an average year. The normal depths of inundation are about 24 to 30 inches. Often deeper pools in a slough may be as deep as 5 feet (Brown and Starnes 1983). Flooding is also important for seed distribution, seed scarification, and elimination of upland plant species (Brandt and Ewel 1989).

The flatwoods/flowing water wetlands association is the most common association of the Econ Basin. The southern and central portions of the basin where alternating relic beach ridges and sloughs are characteristic (Osceola and Orange counties) are dominated by this association type. The linear drainage features of this portion of the basin are an easy means of identification.

Landscape Classification 3. Flatwoods/mesic hammocks/hydric hammocks/hardwood swamps

More moderate to moderately well drained sandy soils and level to sloping topography characterize the uplands of this association. Between the upland communities of flatwoods and mesic hammock and the lower zone communities of hardwood swamp or marsh, hydric hammocks often occur where moisture conditions maintain soils in constant saturation but rarely, if ever, flood.

The excellent growing conditions and good soils foster the development of quite diverse and robust pine flatwoods. If fire is excluded, the mesic hammocks that follow are the most diverse of the upland communities in the central Florida region and may contain between 8 and 35 tree species. Overstory species in mesic hammocks include Southern magnolia (*Magnolia grandiflora*), laurel oak (*Quercus laurifolia*), red bay (*P. borbonia*), pignut (*Carya glabra*), American holly (*Ilex opaca*), water oak (*Quercus nigra*), black cherry (*Prunus serotina*), and live oak (*Quercus virginiana*). The canopy is so dense that little sunlight reaches the forest floor. Soils are moderately well drained to somewhat poorly drained. Rainfall is the major water source for mesic hammocks, although seepage and runoff may provide water to some stands (Brown 1980).

Soils in hydric hammocks are generally shallow and sandy, and limestone (either in bedrock or in nodules in the soil) is most often present (Vince et al. in press). Hardpans (weakly cemented Bh horizons) do not occur in hydric hammocks, but clay layers that support surficial water tables occur in some hammocks (Vince et al. in press).

Where high water tables are characteristic hydric hammock soils are saturated most of the year (Brown and Schaefer 1987). Sources of water to hydric hammocks include groundwater seepage, rainfall, stream overflows, and aquifer discharge (Simons et al. in press); groundwater seepage from uplands is the major source of water for many hydric hammocks found bordering floodplain swamps. Hydric hammocks have the most diverse flora of any wetland in central Florida. Species include pop ash (*F. caroliniana*), live oak (*Q. virginiana*), laurel oak (*Q. laurifolia*), water oak (*Q. nigra*), Southern magnolia (*M. grandiflora*), red bay (*P. borbonia*), sweet bay (*M. virginiana*), tulip poplar (*Liriodendron tulipifera*), red maple (*A. rubrum*), red cedar (*Juniperus silicicola*), cabbage palm (*S. palmetto*), slash pine (*P. elliottii*), and blue beech (*Carpinus caroliniana*) (Brown and Starnes 1983).

Hardwood swamps are characterized by seasonal flooding of the flowing waters along which they are found. Species composition depends upon the flow rate, water quality, and turbidity of the adjacent waterway. The most common species are red maple (*A. rubrum*), water tupelo (*N. aquatica*), swamp black gum (*N. sylvatica* var. *biflora*), sweet gum (*L. styriciflua*), bald cypress (*T. distichum*), pop ash (*F. caroliniana*), Florida elm (*U. floridana*), and cabbage palm (*S. palmetto*) (Brown 1980). Soils associated with this community are nearly level, very poorly drained, and dark in color. They are either organic or have coarse- to medium-textured surfaces underlain by finer textured material (Brown and Starnes 1983).

The higher relief and better drained topography of the lower Econ near and below the confluence of Little and Big Econ rivers are dominated by this landscape association.

Ecological Communities

Generalized land cover for the Econ Basin are shown in Maps 2.4, 2.5, and 2.6. Because of the limited size of maps that may be included within the report, land cover categories have been greatly simplified. Larger detailed maps at a FLUCC Level 3 classification are available from either the Center for Wetlands, University of Florida, or the St. Johns River Water Management District, Palatka, FL. Land use and land cover have been generalized and are shown on separate maps for clarity. Urban and agricultural uses are shown on Map 2.3; xeric forests are shown on Map 2.4; pine flatwoods and mesic hammocks on Map 2.5; and wetlands are shown on Map 2.5. Quite obvious is the difference between the Little Econ Basin and the Big Econ Basin in the extent of ecological communities in both basins reflecting the greater urbanization of the Little Econ.

Xeric Communities

Xeric communities in the Big Econ Basin are given in Map 2.4. They have been mapped separately because of their limited distribution and status as communities of special concern. As a result of their limited distribution and integral relationship within the ridge and swale system of the basin, they are of special significance. The best remaining examples can be found in the western portions of the Big Econ Basin along the "ridge" between the Big and Little Econ watersheds. This ridge occupies a line that runs through the Stanton Energy Center and the Easterly Waste Treatment Plant, and east of Lake Mary Jane in Orange County. Unfortunately both the Stanton Energy Center and the Easterly Waste Treatment Rapid Infiltration Basins (RIBs) were constructed on relatively intact xeric communities, reducing the total area of these communities significantly. The International Corporate Park ADA lists a total of 225.3 acres of xeric oak community on their site now approved for development, of which all are subject to development. Some relatively intact scrub exist on the UCF Campus, but recently portions were developed.

Xeric communities occupy topographic ridges, in some locations the ridges can be many meters in height, but in the Big Econ Basin they are often less than a meter higher than the surrounding landscape. Often called xeric oak scrub, xeric scrub, or scrub oak communities, they are characterized by soils that are well drained (droughty), often white and well washed, with little herbaceous cover. When fire has been withheld, the shrub layer can become extremely dense. Most often the sole canopy species is sand live oak (*Quercus geminata*) growing in a relatively open and discontinuous canopy of individuals that are low, arching and mostly less than 10 meters in height. The shrub layer is composed of saw palmetto (*Serenoa repens*), live oak (*Q. virginiana*), myrtle oak (*Quercus myrtifolia*), staggerbush (*Lyonia fruticosa*), Chapman's oak (*Quercus chapmanii*), and fetterbush (*Lyonia lucida*). Rosemary (*Ceratiola ericoides*), tarflower (*Befaria racemosa*), and gopher apple (*Licania michauxii*) are also encountered in the shrub layer. Herbaceous species are relatively uncommon and, when encountered, they occupy open patches of bleached white sand. Most frequently encountered herbaceous species

include: wire grass (*Aristida stricta*), roserush (*Lygodesmia aphylla*), reindeermoss (*Cladonia* spp.), beak sedge (*Rhynchospora dodecandra*) and others.

The sand pine scrub, a variation of the xeric scrub community, is apparently even less common than the xeric oak scrub in the Econ Basin (the only mention of sand pine scrub is by Best et al. 1982), and the RIBs of the Easterly Waste Treatment Plant now occupy the site where they were documented). Like the xeric oak scrub, the sand pine scrub canopy is composed of a single species; sand pine (*Pinus clausa*), whose spacing is quite variable such that the canopy is not fully closed in most places. While there is no woody subcanopy, the shrub layer is well developed and often extremely dense, impenetrable thickets are formed. In general, the shrubs are the same as are found in the xeric oak scrub, as are the herbaceous species.

Pine Flatwoods

The pine flatwoods ecosystem is the most common and widespread in Florida. Given its extensive coverage, the pine flatwoods exhibits a broad variety of growth forms from communities resembling prairies with widely scattered longleaf pines (*Pinus palustris*) to extremely dense communities of longleaf pine (*P. palustris*) and slash pine (*P. elliottii*) on moderately drained soils, to dense communities of pond pine (*P. serotina*) often growing in poorly drained sloughs. Most frequently, pine flatwoods occupy nearly level, poorly drained soils that are strongly acidic, and have a "hardpan" several feet below the ground surface. These conditions lead to frequent flooding during the wet season, and often flatwoods are flooded from June through September. However, just as they are prone to flooding during the wet season, they are also prone to drought conditions during the dry season (October to May). With the dry season drought and the flammable nature of the litter layer, fire is a common occurrence in the pine flatwoods. The community is adapted to fire and often referred to as a "fire climax" community; if fire is withheld, the community often succeeds to a hardwood forest or hammock.

Throughout the Big Econ Basin, the flatwoods are dominated by longleaf pine (*P. palustris*). In many locations, as the result of logging and killing fires, the canopy of longleaf pine (*P. palustris*) has been almost eliminated. Where the canopy is open and much sunlight can reach the understory vegetation, a dense layer of saw palmetto (*S. repens*) often becomes the dominant species in the shrub layer. Other species in the shrub layer include: fetterbush (*L. lucida*), staggerbush (*L. fruticosa*), pawpaw (*Asimina reticulatus*), shiny blueberry (*Vaccinium myrsinites*), sparkleberry (*Vaccinium arboreum*), tarflower (*B. racemosa*), wax myrtle (*Myrica cerifera*), gallberry (*Ilex glabra*), and dwarf huckleberry (*Gaylussacia dumosa*).

While quite common, "healthy" examples of robust flatwoods are increasingly hard to come by. The majority of the drier longleaf communities seem to occupy an area along a line through the Easterly Waste Treatment Plant, Stanton Energy Center southward, east of Lake Mary Jane. The headwaters area of the Big Econ south of the Beeline Highway is dominated by relatively open canopied flatwoods and palmetto prairies. The palmetto prairies may have once been pine flatwoods, but due to fire, logging, and cattle grazing the canopy has been much reduced.

Mesic Hammock

The mesic hammock community is a hardwood forest ecosystem also called a southern mixed forest. The term "hammock" seems to be an old colloquial term meaning grove or stand of trees. Over the years it has come into common usage and is often used to describe forested communities in conjunction with the terms xeric, mesic and hydric, to differentiate between dry, moist, and wet hammocks, respectively.

The mesic hammock occupies moderately well-drained, neutral soils and is believed to be the latter successional stage resulting from the absence of fire in pine flatwoods. The canopy is quite diverse and dominated by any of the following: Southern magnolia (*M. grandiflora*), laurel oak (*Q. laurifolia*), red bay (*P. borbonia*), pignut (*C. glabra*), American holly (*I. opaca*), water oak (*Q. nigra*), black cherry (*P. serotina*), live oak (*Q. virginiana*), sweet gum (*L. styriciflua*), and cabbage palm (*S. palmetto*). The understory is often composed of seedlings of the overstory as well as saw palmetto (*S. repens*), wax myrtle (*M. cerifera*), persimmon (*Dispyros virginana*), fetterbush (*L. lucida*), and various grasses and sedges.

The most extensive areas of this community type occur in the Lower Econ Basin and along the Big Econ, south of the confluence, mostly within Seminole County.

Wetland communities

There are several types of wetlands occurring within the Econ Basin. In general, community structure of wetlands is controlled primarily by hydrologic parameters (hydroperiod and depth of inundation) and then by other factors such as soils, recent fire history, and logging activities. The types of wetlands occurring within the basin are as follows: Pond pine communities (sometimes considered an upland or transitional community), bayheads, cypress domes/strands/sloughs, mixed hardwood swamps, hydric hammocks, wet prairies, shallow marshes, and deepwater marshes. Each is discussed in some detail below.

Pond pine community - The pond pine community is found on poorly drained soils downslope from flatwoods, often in transitional areas between flatwoods and cypress or mixed hardwoods swamps. The soils of the pond pine community remain wet to flooded throughout much of the year. As a result, the community, while adapted to fire, does not burn as frequently as the drier flatwoods. When the community does burn, fire is often disastrous, killing canopy trees, but releasing new seedlings from serotinous (meaning fire loving) cones that are held on branches unopened for several years at a time.

The canopy is principally composed of pond pine (*P. serotina*) but intergrades on the upland edges with longleaf pine (*P. palustris*) and along the wetland edge with cypress and several of the bay species. Distributions of the shrub species varies along the soil moisture gradient. On the drier soils, saw palmetto (*S. repens*) and gallberry (*I. glabra*) predominate, while on the wetter soils, fetterbush (*L. lucida*) and St. John's wort (*H. fasciculatum*) are quite common.

Most all wetland sloughs of the Big Econ Basin have adjacent pond pine communities; some of the best examples are along the line running from the Easterly Waste Treatment Plant southeast through the Stanton Energy Site into southern Orange County east of Lake Mary Jane, and along the Big Econ and its tributaries between the Beeline Highway and Highway 50.

Bay swamp communities - The bay communities of the Big Econ Basin are, for the most part, quite young, suggesting recent changes in wetland community structure and ecological organization. Often, wetland community structure can be radically reorganized as the result of changing groundwater conditions (drier or wetter). This may be the case throughout the basin. Many observations by ecologists documenting community structure allude to increased fire, drier conditions, drained and burned wetlands, and so forth; suggesting that the overall trend throughout the basin has been one of decreasing water table levels. Young bay communities suggest that recently some change has occurred that is more conducive to bay trees (shorter hydroperiods, with minimal inundation) than for other forested wetland community types.

Bay swamps naturally occur where ground surfaces are rarely inundated to any degree for long periods of time, but saturation is quite common for most of the year. Seepage areas at the base of sandy ridges are often dominated by bay communities. Experience has shown community shifts from cypress wetlands to bay swamps in response to lowered groundwater tables and fire.

Bay swamps are dominated by sweet bay (*M. virginiana*), loblolly bay (*G. lasianthus*), and, to a lesser extent, swamp red bay (*Persea palustria*). Other species sometimes reaching canopy stature include: wax myrtle (*M. cerifera*) and dahoon holly (*Ilex cassine*). The understory often resembles a thicket dominated by wax myrtle (*M. cerifera*), fetterbush (*L. lucida*), and vines like wild grape (*Vitisis rotundifolia*) and catbrier (*Smilax laurifolia*).

Numerous throughout the Big Econ Basin some of the areas within and adjacent to the Econlockhatchee River Swamp in northern Osceola County are dominated by bay swamps, interdigitated with marshes, cypress and wet prairies. Many of the cypress domes and swamps of the central portions of the Big Econ are increasingly becoming dominated by bays, presumably resulting from lowered groundwater tables and increased fires.

Cypress Swamps - Cypress swamps are probably one of the most common forested wetlands in Florida. When circular in shape and isolated they are called cypress domes. When elongated and exhibiting sluggish surface-water flow in nondistinct channels, they are called cypress sloughs; and when surface flows are evident but still without distinct channels, they are referred to as cypress strands. Riverine cypress occupy the margins of channelways of streams and rivers. Lake border swamps are often dominated by cypress along the lake margins. Growth rates, density of trees and basal area all seem to increase with increasing hydrologic function and access to nutrients from cypress domes (smallest trees and lowest growth rates) to riverine cypress swamps (largest trees and highest growth rates).

Cypress domes, sloughs, and sometimes strands are dominated by pond cypress (*T. ascendens*) while riverine swamps and lake border swamps are more characteristically dominated by bald cypress (*T. distichum*). Other trees sharing the canopy include black gum (*N. sylvatica*), pond pine (*P.*

serotina), slash pine (*P. elliottii*), red maple (*A. rubrum*), and one or more of the bay species. The understory can be relatively diverse having fetterbush (*L. lucida*), wax myrtle (*M. cerifera*), dahoon holly (*I. cassine*), buttonbush (*Cephalanthus occidentalis*), Virginia willow (*Itea virginica*) and numerous others.

Cypress domes, sloughs and strands are quite common throughout the Big Econ Basin. Although many show successional trends and the effects of earlier logging to the extent that they are now co-dominated with other tree species, some have only remanent cypress trees. The large headwater swamp called the Econlockhatchee River Swamp in northern Osceola County has extensive stands of cypress, although a recent over flight revealed significant logging in some portions of the swamp.

When the dominance of cypress gives way to other species, especially in the riverine floodplain swamps of the river, the community is classified as a mixed hardwood swamp.

Mixed hardwood swamp - When hydroperiods are short, inundation is moderate, and ground topography is relatively rough, the diversity of plant species that can colonize, survive and grow is richer. Mixed hardwood swamps have the highest diversity of the forested wetland communities, primarily as a result of the variation in hydrologic regimes of "micro-sites" within the wetland.

The canopy in these wetlands is a rich assemblage of hardwood species and cypress such that no single species dominates. Canopy species include: red maple (*A. rubrum*), water tupelo (*N. aquatica*), swamp black gum (*N. sylvatica* var. *biflora*), sweet gum (*L. styriciflua*), bald cypress (*T. distichum*), pond cypress (*T. ascendens*), pop ash (*F. caroliniana*), Florida elm (*U. floridana*), cabbage palm (*S. palmetto*), sweet bay (*M. virginiana*), and loblolly bay (*G. lasianthus*). The understory is similar to cypress swamps.

The preponderance of mixed hardwood swamps are associated with the riverine swamps of the floodplain of the Big and Little Econ rivers, although there are numerous isolated wetlands that resemble cypress domes or strands but, because of hydrologic conditions, have mixed canopies.

Wet prairies - Surrounding many forested wetlands in a transitional zone from several meters to as much as 50 meters wide, and in isolated depressions, wet prairies are found. Wet prairies are essentially treeless wetlands inundated for short periods of time, and often ravaged by fire. Wet prairies often occur on mineral soils and do not exhibit accumulations of organic matter; however, when fire is not a recurrent element, minor organic accumulations may occur. Wet prairies are maintained by high water tables, infrequent inundation, frequent fires, and most recently, heavy grazing. Changes in groundwater table elevations as a result of "improved drainage" is practically disasterous to wet prairies, often eliminating them entirely from the landscape after only two dry years.

St. John's wort is often the only woody species present. Sometimes on the drier margins dense stands of wax myrtle (*M. cerifera*) may grow to heights of 4 meters or more. There is a wide variety of herbaceous species associated with wet prairies including: grassy arrowhead (*Sagittaria graminea*), pipewort (*Eriocaulon decangulare*), capitate beaked-rush (*Rhynchospora microcephala*), mermaid-weed (*Proserpinaca pectinata*), yellow-eyed grass (*Xyris caroliniana*), bloodroot (*Lachnanthes caroliniana*), red ludwigia (*Ludwigia repens*), Virginia chain-fern (*Woodwardia virginica*), Baldwin's spikerush

(*Eleocharis baldwinnii*), maidencane (*P. hemitomon*), water smartweed (*Polygonum punctatum*), (*Pluchea rosea*), (*Cyperus* spp.), and water pennywort (*Hydrocotyle umbellata*).

Wet prairie communities are common throughout the headwater and channelway of the Big Econ River Basin, but are not as common throughout the Little Econ Basin and below the confluence in eastern Seminole County.

Shallow marshes - Where inundation is more frequent, depths of inundation are around 0.5 meters, and fire is somewhat less frequent than wet prairies, shallow marshes are common. With deeper inundation, longer hydroperiods and accumulations of organic matter, broad-leaved marshes occur (sometimes called flag ponds) dominated by the following species: pickerelweed (*P. cordata*), arrowhead (*Sagittaria* spp.), fire flag (*T. geniculata*), and cattail (*Typha*, spp.). Dominant in the grassy shallow marshes are sawgrass (*C. jamaicense*), spikerush (*E. cellulosa*), soft rush (*J. effusus*), bulrush (*Scirpus* spp.), maidencane (*P. hemitomon*), to name but a few.

Shallow marshes are common throughout the Big Econ Basin, where they appear as isolated flatwoods marshes and sometimes as fringing forested swamps. The magnificent headwaters swamp of the Big Econ River is an extensive, shallow marsh intermixed with cypress wetlands, bays, and shrubby swamps. Like wet prairies, shallow marshes are particularly susceptible to lowered groundwater tables.

Deepwater marshes - Where hydroperiods are long, and depths of inundation greater than 0.5 meters to a much as 1 m., deepwater marshes prevail. Often found as deeper pools within other wetland systems (including forested wetlands) they are usually dominated by free-floating plants such as water hyacinth and water lettuce if nutrients are high, or rooted aquatic plants such as water lily and spatterdock in lower nutrient conditions.

The extent of deepwater marshes is usually small and relatively local in occurrence. Their spatial distribution within the basin is unknown at this time.

MANAGEMENT ALTERNATIVES

Landscape management in developing regions must be approached from two perspectives. First, from the perspective of resource management, that is, manipulating ecological communities directly as a means of controlling growth, productivity, or species composition. Silviculture is one of the most common landscape management techniques, native range cattle grazing is another. In both of these schemes, the ecological communities of the landscape are manipulated (burned, planted, harvested, ditched, etc.) to increase yields and direct ecological succession in "desirable" directions. Examples of resource management are creating ecological communities, recycling treated sewage effluent through wetlands, controlling burns, manipulating of groundwater levels, and enhancing natural succession.

The second approach is controlling or managing development actions. How much development and how it is placed on the landscape are probably the most important factors affecting overall landscape "health." Management of development includes such things as wetlands protection, zoning, habitat set-asides, floodplain ordinances, and wetland buffers.

Management suggestions for maintenance of a vital and sustainable landscape for the Econ River Basin are included in this chapter. First are resource management alternatives followed by suggestions for managing development impacts.

Managing the Terrestrial and Wetland Resources of the Econlockhatchee River Basin

Principles

The ecological communities of the Econ Basin are self-organizing systems driven by natural forces of sunlight, wind and rains and reorganized through the actions of pulses of flood, drought and fire. The development actions of humans often create conditions that increase the frequency and severity of pulses. Good landscape management does not interrupt natural cycles or alter driving forces. It fits development into the landscape instead of upon it. Effective landscape management balances a symbiotic relationship between ecological communities and human uses for a long-term sustainable yield rather than short-term gain.

Management Suggestions

Managing Fire - The ecological communities of the basin suffer from overexposure to fire. Throughout the Econ Basin fire has increased in severity and frequency as a result of increased presence of humans and lowered water tables. Increased frequency has the net effect of decreasing ecological potential because vegetation is killed and survival of many seedlings is greatly reduced by recurrent fires. Severity of fire is from two sources: first, when fire is suppressed, the buildup of understory vegetation and litter causes fires to burn hotter; and second, many fires result from the actions of humans and occur during the driest portions of the year increasing the likelihood of a hot, killing fire. The drier conditions resulting from combinations of natural drought cycles and drainage activities by humans has dried many ecological communities (especially wetlands) that now burn on a regular basis, killing indigenous species and opening the system to invasion.

To minimize the impacts of fire several management strategies are important:

1) Control burn all terrestrial communities on proper frequency and during wet season when fires are better controlled.
2) Maintain a strong fire control presence in the basin to extinguish fires quickly prior to their getting out of control.
3) Re-establish historic groundwater levels to minimize burning of wetland ecological communities.

Managing Silviculture - Often silvicultural operations are managed for short-term gain with little attention to long-term sustainability or to concepts of multiple use. Cutting practices that cut all timber including wetland timber, site preparation practices that ditch and drain wetter sites, and clear-cutting in general should be discouraged. Sustainable yields can easily be achieved through selective harvesting, and/or rotating clear-cutting in smaller strips leaving uncut trees in alternating rows. Sustainable management alternatives are as follows:

1) Observe best management practices throughout all logging operations.
2) Suspend large clear-cutting in favor of harvesting in small clear-cuts in alternating strips of cut and uncut lands.
3) Suspend clear-cutting in wetlands and wetland buffers in favor of selective logging on a long-term saw timber rotation.
4) Suspend all cutting in wildlands management areas.

Establish Wildlands Management Areas - Fragmentation of landscapes into ever smaller parcels has the net effect of reducing biotic diversity by elimination of wildlife habitat. To ensure that there are some wild landscapes, especially around fast urbanizing metropolitan areas, wildlands management districts need to be established. Through purchase, transfer of development rights (TDR), and transfer of mitigation requirements (TMR), portions of the developing landscape that are wild in character, large enough in size, and a network in design should be set aside.

Wildlands greenbelts that contain and give definition to urban areas and that provide close proximity to a wild and scenic landscape for urban dwellers need to be planned far in advance of their actual need. Once the landscape is developed, reversing urbanization and retrieving a wild landscape, while desirable, becomes impossible. The great greenbelts of Europe were not afterthoughts, but planned well in advance.

Establish Wetlands Buffer Requirements - The purpose of setting aside buffer zones between a wetland and a developed upland area is to protect the integrity of the wetland's water supply, it's water quality, and associated wetland dependent wildlife. A buffer can be thought of as a zone of transition between two different land uses that separates and protects one from the other. Based on previous studies (Brown and Schaefer et al. 1987; Brandt and Brown 1988; and Brown, Schaefer, and Brandt 1989) it is recommended that a wetlands buffer be established that protects wetland integrity and wildlife habitat.

In general, a buffer is necessary to ensure against the degradation of adequate quantity of water (i.e., hydroperiods and depths of inundation are not negatively effected by drainage activities in surrounding lands), adequate quality of water (protection from erosion and sediment) and wildlife habitat value for wetland and aquatic-dependent species. Methods for determining appropriate buffers for landscapes typical of the Econ Basin are provided in Brown, Schaefer, and Brandt (1989).

Dechannalize Streams and Rivers - Natural drainage patterns are organized to minimize slope and water velocities, and to maximize potential use of surface waters. Engineering that reverses these basic organizational principles is destructive to ecological processes landscape wide. Deep drainage canals and ditches lower water tables and cause increased drought in wetlands and uplands alike. Straight ditches increase velocity and allow waters with suspended nutrients and pollutants to quickly exit the upper reaches of a watershed and carry materials far downstream where they contribute to water quality problems. Meandering wetland drainage structures retard runoff during low flows, filter runoff, act as wildlife habitat corridors, and provide aesthetic buffers between lands uses.

Manage for both eutrophy and oligotrophy conditions - Much of the Florida landscape is naturally high in nutrients, while other areas have become nutrient rich as a result of runoff from urban and agriculture lands. Policies trying to maintain nutrient-rich areas (eutrophic areas) as if they were nutrient poor (oligotrophic) run counter to good ecological management. Vegetation should be encouraged to grow, wetlands planted, and surface waters routed so as to maximize the filtration capacity and uptake capacity of ecological communities. Where sunlight and nutrients are abundant, vegetation will invade, taking advantage of these conditions. Herbiciding invading vegetation only allows nutrients and other pollutants to move farther downstream spreading the eutrophic conditions across a wider portion of the landscape.

Managing Development Impacts on Terrestrial and Wetland Ecological Communities

The key to minimizing developmental impacts on the Econlockhatchee River is managing development throughout the basin. Water quality and quantity are fundamental to maintaining a high quality environment and are dealt with in detail in the first chapter of this volume. However, to maintain good water quality, adequate water quantity, and productive wildlife habitat, development of ecological communities throughout the basin needs to be controlled. How much development, where it is located, and how it is designed are important factors that will determine the fate of the Econlockhatchee River.

Principles

Those managing development to minimize impacts to ecological communities should be cognizant of two basic postulates: (1) There are few abrupt changes in nature, and (2) increased economies of scale may apply to economic systems but are often detrimental to ecologic systems. In the first postulate the concern is related to transition. In the second postulate the concern is with "bigness" and the ability of the environment to assimilate wastes. These two postulates lead to the following management suggestions.

Management Suggestions

Confine intense land uses to least sensitive lands - As the intensity of use increases, so do the impacts to the environment. A general environmental planning principle that makes good ecological sense is to confine intense uses (industry, landfills, and commercial uses that have significant impacts on ecological communities) to locations where there is sufficient distance to mitigate negative effects prior to impacting sensitive communities. Intense uses should be confined to areas at the greatest distance from surface-water bodies; and stormwater runoff should be routed through wetlands and other ecologically engineered ecosystems to filter nutrients and pollutants.

Confine development to 50% of land - As a general rule, at least 50% of lands should be left intact as integral urban/ecological communities. These wildlands can be so designed and located as to form an ecological system of corridors and habitats of connected uplands and wetlands that will provide open space and enhance property values. They are necessary components of a landscape and, as such, landowners should be given tax incentives to ensure they are justly compensated for their contribution of these environmental values to society.

Preserve landscape associations instead of communities - It is well known that no ecological community can be isolated from the landscape within which it is imbedded and hope to maintain ecologic functions. Once a community becomes isolated and is driven by a different suite of environmental conditions, it becomes host to a different suite of wildlife. Recent trends in wetlands preservation have left numerous wetlands isolated within large expanses of developed lands. Wetlands found in these situations often have degraded ecologic function and have lost much of their habitat value by virtue of the fact that they are isolated from other interdependent communities. Where trade-offs are appropriate, healthy "mosiacs" of landscape associations of uplands and wetlands should be preserved within developed areas to ensure viable and effective ecological communities. These mosaics should be connected to local and regional wildland corridors in a effort to achieve an integrated wildlands network.

Design stormwater systems as forested ecosystems - There are numerous reasons why stormwater conveyance systems should resemble natural watersheds, the most important are:

1) Natural systems are self maintaining. Wetlands and first-order stream floodplains need no maintenance once they have become established.
2) Constructed wetland retention ponds and first-order stream floodplains provide wildlife habitat.
3) Constructed wetland retention ponds and floodplain ecosystems retard the flow of water.
4) Constructed wetland ecosystems conserve water over open water ponds.
5) Constructed wetland ecosystems provide visual buffers.

Maximize use of native vegetation in landscaping - Maintain existing vegetation, both overstory and understory plants, as elements in developed landscape design wherever possible. They provide food and shelter for native wildlife species and are self maintaining. The use of sod as a ground cover should be minimized because of its lack of wildlife value, its requirements for fertilizer and watering, and the fact that it increases stormwater runoff.

Minimize use of pavement - Use permeable materials for paved surfaces so as to minimize stormwater runoff wherever possible. The design of all paved areas should be such that surface water runoff is routed through constructed wetland filters for sufficient distance and time to remove 99% of sediments, nutrients, oils and greases, and other pollutants.

Minimize groundwater drawdown - When groundwater tables are lowered, soils are drier, hydroperiods shorter and depths of inundation shallower in all communities of the affected area. Soil moisture conditions in upland ecological communities and hydroperiods and depths of inundation in wetland communities are important parameters that control species distributions, productivity, and overall community organization.

Groundwater tables are often manipulated within developments as part of stormwater management. Surrounding ecological communities, preservation areas, and wetlands within the development are adversely affected by the loss of soil moisture and flooding. The overall ecological health declines and their habitat value deteriorates as the landscape becomes more desiccated.

SUMMARY AND RECOMMENDATIONS

Probably the single most important factor to consider in managing the Econlockhatchee River Basin, is the interconnections between elements of the landscape mosaic. Vital and sustainable economic development should not be separated from sound environmental and resource management. River water quality should not be separated from wetlands protection and sound development planning. Healthy wetland ecosystems cannot be separated from the landscape within which they are embedded. Effective management of the water resources of the basin requires effective management of the land resources of the basin. Basin management must recognize the inseparability of good water quality from sound environmental and land use planning. To achieve basinwide management, it is recommended that a special planning district be formed to encompass the Econ Basin and that basin-specific planning criteria be developed to protect the resources of the basin.

It is strongly recommended that in order to achieve some measure of control over the way in which the basin develops, detailed planning studies be conducted to evaluate the resources and condition of the basin in great detail, and then a detailed basin development plan be generated. The plan should be driven by the natural resources of the basin and how best to protect and enhance them. It should be basinwide in scope and include an overall evaluation of the developmental carrying capacity based on maintenance of environmental quality and good water quality in the Econlockhatchee River.

The Econ River Basin is not remarkable in its flora. There are numerous areas throughout central Florida where these same communities can be found. What makes the Econ unique is the fact that much of the basin (Big Econ) is still relatively intact. What is worrisome is the number of new developments and DRI proposals that have recently been made known. Development of a basinwide, cohesive planning initiative offers the opportunity to plan ahead of time how the basin will look and how it will function ecologically and hydrologically.

The Econ River Basin unlike other basins that have greater relief is dominated by slow runoff, high surface storage of stormwaters in wetlands, and high groundwater tables. Development actions within this landscape and studies (Brown, Schaefer, and Brandt 1989) have shown that the flatter a landscape the greater the spatial impacts of drainage structures. Greater care is required in developing the poorly drained lands of the Econ Basin, for the potential negative impacts are larger.

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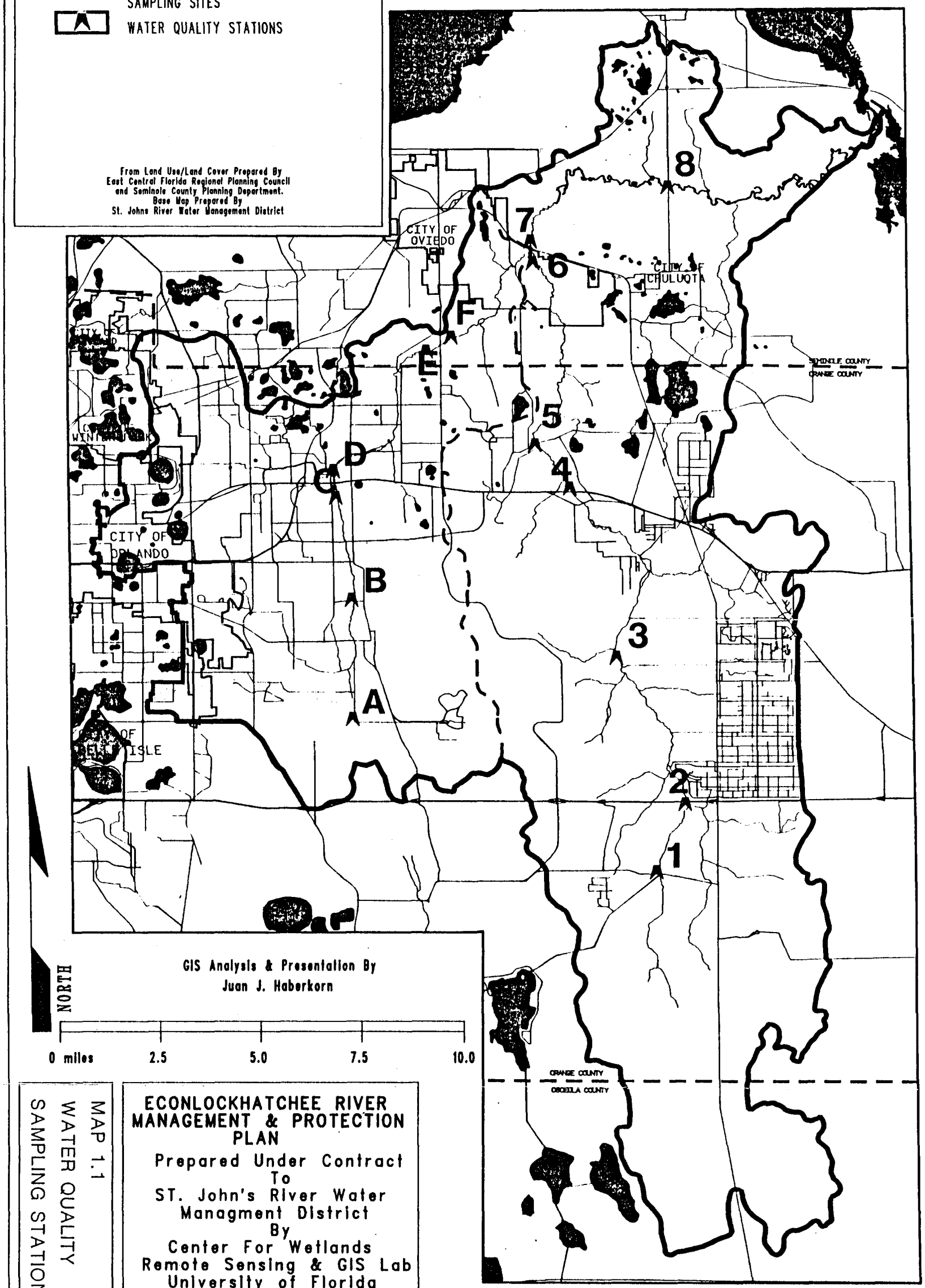
MAP LEGEND:

SAMPLING SITES
WATER QUALITY STATIONS

From Land Use/Land Cover Prepared By
East Central Florida Regional Planning Council
and Seminole County Planning Department.
Base Map Prepared By
St. Johns River Water Management District



MAP 1.1
WATER QUALITY
SAMPLING STATIONS

ECONLOCKHATCHEE RIVER MANAGEMENT & PROTECTION PLAN
Prepared Under Contract
To
ST. John's River Water
Managment District
By
Center For Wetlands
Remote Sensing & GIS Lab
University of Florida
January 1990

MARK T. BROWN
CENTER FOR WETLANDS
UNIVERSITY OF FLORIDA

RICHARD HAMANN/JOHN TUCKER
CENTER FOR GOVERNMENTAL
RESPONSIBILITY
UNIVERSITY OF FLORIDA

JOSEPH SCHAEFER
URBAN WILDLIFE PROGRAM
DEPT. OF WILDLIFE & RANGE SCIENCES
IFAS, UNIVERSITY OF FLORIDA

LUCY WAYNE & MARTIN DICKINSON
SOUTHARC, INC.
P.O. BOX 1702
GAINESVILLE, FL. 32602

ECONLOCKHATCHEE RIVER BASIN NATURAL RESOURCES DEVELOPMENT AND PROTECTION PLAN

Chapter 3

WILDLIFE RESOURCES OF THE ECONLOCKHATCHEE RIVER BASIN

Prepared for

St. Johns River Water Management District

October 1990

Chapter 3

WILDLIFE RESOURCES OF THE ECONLOCKHATCHEE RIVER BASIN

Joseph M. Schaefer

INTRODUCTION

The annual projected population growth rate for the Orlando area through 1992 is 38,670 (West 1989). This is more than one-tenth of the total state growth and second only to Tampa. The real income growth will be more than three-quarters of a billion dollars and about 25,000 new jobs will be created. This growth will also bring more crimes, greater and the clearing of approximately 20 square miles of natural habitat each year to meet the demands for housing, roads, shopping centers, schools and other development-related uses (calculated from data presented by Bethea 1974, Edwards 1988).

From 1980 to 1987, urban development caused the deforestation of almost 5% of the total Florida timberland surveyed in 1980 (Brown 1987). Florida has the second largest number of federally listed threatened and endangered species in the nation. The ecological and recreational values (about $5.2 billion annually) of Florida's wildlife resources are becoming more and more jeopardized by urbanization.

As development continues to spread across the landscape toward the Econlockhatchee River, protecting wildlife from extinction within the basin becomes increasingly difficult. Cumulative effects of sub-DRI developments are often overlooked, resulting in the slow degradation of habitats. Land use decisions made without full knowledge of their potential consequences have altered and fragmented wildlife habitats, destroyed critical nesting and feeding areas, and polluted aquatic and terrestrial environments. Growth management objectives and policies that generally state the obvious need to protect habitat are not measurable and do not adequately address the ultimate problem of species' extinctions.

Every time the ground, understory or canopy layers in a natural vegetation community are altered, food and cover requirements for certain wildlife are removed. When an essential habitat component is diminished to a level that is not enough for a species to survive, that species can no longer live there. In other words, it becomes extinct in that area.

Of course, there are different levels of extinction. Species first become extinct on individual sites. When enough sites are altered, the extinction spreads to a township level. County, region, state, nation, and world are other levels of extinction.

Legally classified endangered species already have become extinct in much of their former range and are found only where their essential requirements remain. Land use around these critical

habitat areas is restricted. The rationale for these mandates is to prevent endangered species from becoming extinct at the state level. Very few species that have reached this stage in the extinction process have been recovered to the point where they no longer need special protection. The best endangered species recovery plan will only help to keep the status quo and places the burden of habitat protection on the few landowners with critical habitat on their properties. This method is also species specific and does not address the needs of other wildlife that are rapidly approaching statewide endangerment or extinction.

A proactive, holistic wildlife protection strategy designed to preserve enough habitat for viable populations of wildlife would be more ecologically sound and equitable for landowners. Growth management standards that protect existing species from extinctions within various jurisdictions need to be developed. Then implementation of conservation plans will be based on scientific data and can be evaluated easily through periodic wildlife surveys.

The small "conservation areas" and "wildlife corridors" that are included in individual DRIs are usually not adequate to protect species that are most adversely affected by development activities. These token habitats only provide enough area for common species such as cardinals, mockingbirds, mourning doves, blue jays, and others that merely need a well-landscaped yard to survive. Large, connecting systems that include several wetland and upland vegetation community types are needed to preserve viable populations of all wildlife species within the Econ Basin.

Of the state's 111 endangered, threatened, or special concern species, 22 are found in various habitats within the Econ Basin. Three of these occur only in Florida. Unless something is done to reverse present trends, these unique components of our natural heritage will be gone forever.

The need for managing growth in a manner that is compatible with wildlife preservation efforts is addressed in the State and Regional Planning Act of 1984 (Chapter 186 of Florida Statutes) and the Local Government Comprehensive Planning and Land Development Regulation Act of 1985 (Chapter 163 of Florida Statutes). Within the State, Regional, and Local Comprehensive Plans mandated by these Acts, Conservation Elements were established "to promote the conservation, use and protection of natural resources." An important aspect of this planned attempt to manage growth in an environmentally acceptable manner involves generating the necessary information base to carry out specific requirements of the minimum criteria rule (Section 9J-5 Florida Administrative Code).

The Model Conservation Element provided by the Florida Game and Fresh Water Fish Commission suggests excellent policies such as maintaining upland buffers, establishing wildlife corridors, and maintaining the current complement of wildlife species (Florida Game and Fresh Water Fish Commission 1987.) However no, information is available to tell planners the proper dimensions or the specific ingredients of a local refuge system that will maintain current biological diversity. Without the credibility of research, recommendations that will benefit wildlife have gone unheeded because of the intense economic and political pressures to develop natural areas near and in cities (Murphy 1988).

Preserving viable populations on each development site certainly is not feasible. However, establishing a properly designed conservation reserve system in the basin will protect all existing species from extinction. Setting aside small, token parcels on each development site will not prevent extinctions unless the set-asides are part of a planned conservation reserve system for the entire basin. This reserve will be delineated by assessing the habitat values of the basin.

Rationale

Issues Related to Resource Utilization/Management

There are many issues related to the wildlife resources in the Econlockhatchee River Basin. These problems must be clearly understood before they can be properly addressed. The major wildlife issues include: (1) habitat fragmentation, (2) wildlife corridor misconceptions, (3) decrease in landscape diversity, (4) reduction in habitat quality, (5) impacts of adjacent land use, (6) impacts of public recreation, (7) impacts of cattle grazing, and (8) impacts of silviculture.

Many of the habitats in this basin already have been fragmented or reduced in size. Major east-west highways such as Routes 420, 50, and 528 have divided the basin into four large habitat blocks. These roads are serious obstacles to north-south animal movements along the Econ River. Their effectiveness as barriers increases as urban sprawl travels down these infrastructures. Highways also are responsible for significant mortality rates of many species.

Other unnatural modifications of native habitats have encroached from the east and west. Many acres have been deforested for agricultural, silvicultural, and housing construction purposes. The relatively unaltered, native habitat has been compressed into four somewhat disjunct corridors along the Big Econ River.

One of the reasons for the great richness of wildlife in the Econ Basin is because of its historic linkages with the vast flatwoods to the east and the sandhills to the west. Several current land use practices probably are interfering with wildlife movements which are essential for recolonization and maintaining genetic variation in viable populations. Very narrow token strips of vegetation that do not actually connect large habitat areas are commonly used in landscaping to provide visual screening and are mistakenly sold as wildlife corridors. These strips support very few, if any, wildlife that are sensitive to development and in greater need of conservation.

Most wildlife species use more than one vegetation community to obtain their life-sustaining requirements. Semi-aquatic and wetland-dependent wildlife need access to uplands to feed or nest at different times of the year. Conversely, upland species also are dependent on wetland resources. Even if the dependency is restricted to only a couple of hours each year, these feeding and nesting requirements often are essential to survival and reproduction.

Several upland patches in the Econ Basin have been developed, altered, and isolated from once-adjacent wetlands. Limiting contiguous habitat diversity will cause local extinctions of many species.

The quality of habitats in the study area varies from relatively natural and good to extremely modified and poor. The highly exploited areas along the Little Econ retain very little value for wildlife that need protection.

Although development has been restricted in the Econlockhatchee Basin, its impacts have far-reaching effects. Noise and other pollutants originating from developed areas penetrate adjacent natural areas and interfere with courtship, feeding, and other behaviors of animals. Free-ranging cat and dog pets exert unnaturally high predation pressure on ground-feeding and nesting species. Nest predators

and competitors are attracted to open areas in and along the forest canopy and cause reductions and even local extinctions of native, forest-adapted species.

A common protection strategy for development-sensitive areas is to purchase and include them into the local or state park system. However, once it receives a parkland title, it is subjected to other forms of habitat alteration and disturbance--park development and use. Human impacts on wildlife and their habitats have been documented in several parks and refugia. Vistor use was reduce this year at Itchetucknee State Park because the current use level was visibly destroying the aquatic vegetation. Not assessments of the obvious direct disturbances of wildlife were made. Many bird species at Ding Darling Refuge were found to be adversely affected by the thousands of visitors who drive and walk through this public area. Endangered manatees (*Tichechus manatus latirostris*) that concentrate in King's Bay at Crystal River each winter are subjected to harassment and are forced away from the relatively warm water springs by hundreds of people who are attracted to this critical habitat area located on public property.

The disturbance factor in some of our public lands is no less than that which occurs in residential developments. Wildlife species that are adversely affected by development are sensitive to human presence regardless of whether it occurs on public or private land.

Scope of the Study

Developing an effective management and protection plan for the wildlife resources in the Econlockhatchee River Basin will be based on: (1) a literature review of the Econlockhatchee River Basin wildlife resources and appropriate wildlife conservation principles, (2) an assessment of the status of the resource, (3) an identification and evaluation of existing and potential threats, and (4) and identification of actions that will minimize development impacts and give the best assurance for preserving the wildlife integrity of the basin.

Due to the short time frame of this study, existing sources of information were used to assess the current status of the wildlife resource and their habitats. A comprehensive review of literature that relates to wildlife in the Econ and to wildlife conservation issues that apply to the study area was conducted. An aerial survey was made of the basin. Aerial photos and maps of vegetation communities and development trends were also analyzed.

The following data bases were obtained from several sources or created during the study to develop a description of the wildlife resources in the basin:

* Distribution of documented occurrences of listed species. Florida Natural Areas Inventory, Florida Game and Fresh Water Fish Commission, and Orange County Planning Office.
* Distribution of wading bird rookeries. Nongame Section of Florida Game and Fresh Water Fish Commission.
* Breeding bird survey data. U.S. Fish and Wildlife Service, Florida Audubon (Breeding Bird Atlas).

* Fisheries data. Florida Game and Fresh Water Fish Commission, Florida Museum of Natural History.
* DRI data. East Central Florida Regional Planning Council, and Seminole, Orange, and Osceola county planning offices.
* Species lists. Created from information obtained from the University of Central Florida and various references that describe species' distributions and habitat uses.

During the next project phase, this information will be used to assign values to several habitat evaluation criteria. As time allows, these values will be compiled and digitized for randomly selected vegetation communities in the basin. A comparison of total values for each community will help to identify important wildlife habitat systems. This process will provide an objective, quantified, defensible basis for delineating wildlife preservation areas and developing an effective protection plan for the Econ Basin wildlife resources.

The variables selected for this purpose were chosen because of their ecological significance in maintaining wildlife populations. Criteria that will be used in this study and their potential point values follow.

1. Size:

> 75 acres	= 5 pts.
10-75 acres	= 3 pts.
≤ 10 acres	= 1 pt.

2. Landscape Diversity:

≥ 3 plant communities bordering	= 5 pts.
2 plant communities bordering	= 3 pts.
1 plant community bordering	= 1 pt.

3. Insularity:

0-30% of perimeter developed	= 5 pts.
31-69% of perimeter developed	= 3 pts.
70-100% isolated	= 1 pt.

4. Quality:

Relatively natural state	= 5 pts.
Some development (e.g. timbering or pasture)	= 3 pts.
Highly developed	= 1 pt.

5. Uniqueness in basin:

Vegetation type makes up 1-25% of entire basin = 5 pts.
Vegetation type makes up 26-50% of entire basin = 3 pts.
Vegetation type makes up > 50% of entire basin = 1 pt.

6. Quality of Adjacent Areas:

Relatively natural with no development = 5 pts.
Minor development present = 3 pts.
Major development has occurred = 1 pt.

7. Biological Diversity in Habitat:

The major vegetation community types will be ranked by the number of wildlife species that occur in each. The highest criterion value will be given to the community type with the highest number of species.

8. Proportion of Imperiled Species:

The percentage of total species occurring in the major community types that are imperiled will be determined (Millsap et al. 1990). Then the communities will be ranked by assigning the highest ranking number to the community with the greatest percentage of imperiled species.

The most accurate method of determining current baseline data on wildlife species within the basin would be through systematic species' surveys. The need for this is exemplified by the fact that only 8 of the 22 listed (endangered, threatened, and special concern) species that are assumed to occur in the basin have been documented. The brief surveys that are conducted during DRI proposal preparation would be unlikely to document species such as the gopher frog (*Rana areolata aesopus*).

Definition of Terms

Biota -- The animal and plant life of a particular region considered as a total ecological entity.

Carrying Capacity -- The size of a population that an environment or habitat can support indefinitely.

Community, Ecological -- A natural assemblage of plants and animals that live in the same environment, are mutually sustaining and interdependent, and are constantly fixing, using, and dissipating energy.

Community, Wildlife -- All the populations of different species of animals that live in the same environment.

Cursorial -- Adapted to or specialized for running as opposed to flying, crawling, etc.

Diversity, Biological -- The composition of a particular environment or habitat as it relates to the plant and animal species present and their relative abundance.

Extirpation -- Extinction of a species from a particular area (not its entire range) where it formerly occurred.

Genetic Viability -- The chance of survival from egg to adult.

Habitat, Wildlife -- The area or type of environment in which an organism or biological population normally lives or occurs.

Insularity -- Of or relating to the extent that a specific habitat area is surrounded by dissimilar landuses that in an ecological sense isolates it from natural animal and plant dispersion mechanisms.

Integrity, Biological -- All the plants and animals that are characteristic of an area and all the processes that result from interactions between these species and their environment.

Life Requisites -- Those components of a habitat that an organism needs to survive.

Mesic -- Between very wet and very dry.

Overstory -- The layer of foliage (leaves and branches) formed by the largest trees in a forested area.

Population, Minimum Viable -- The smallest number of individuals that will give 99% probability of the species surviving in a particular area for at least 1,000 years.

Riparian -- Of or relating to or living or located on the bank of a flowing watercourse (as a river or stream) and also an isolated water source such as a pond or lake.

Semi-aquatic -- Adapted for living near water and needing water to survive but living in water all the time such as fish.

Silviculture -- Activities of man involving regeneration, tending, and harvesting a forest.

Species Richness -- The number of different species in an area.

Succession, Vegetational -- The process of change in the types of plants occupying an area as plants mature, are replaced, and otherwise respond to the environment.

Taxa -- Plural of taxon.

Taxon -- A group of organisms constituting one of the categories in taxonomic classification of living organisms such as class, order, family, genus, species.

Territory, Breeding -- An area usually including the nesting or denning site and possibly a variable foraging range that is preempted by an individual male animal and defended against the intrusion of rival individuals.

Understory -- The foliage lying beneath the tallest trees consisting mainly of seedling trees, small trees, shrubs, and herbaceous plants.

Vegetation, Transitional -- Areas that contain plants that are characteristic of identifiable adjacent plant communities.

Vertebrate -- Of or relating to the taxonomic subphylum "vertebrata" that compromises bilaterally symmetrical animals with a segmented spinal column or in primitive forms with a persistent notochord, a tubular dorsal nervous system divisible into brain and spinal cord, an anterior head bearing a mouth and the major sense organs, an internal articulated skeleton of bone and cartilage, respiration by gills or lungs, and not more than two pairs of limbs which may be modified as grasping, walking, swimming or flying organs in different members of the division, and that includes the mammals, birds, reptiles, amphibians, fishes, elasmobranchs, and cyclostomes and sometimes the lancelets.

Water-Dependent -- Of or relating to the need for water as a necessary habitat component for survival.

Wetland -- Lands transitional between terrestrial and aquatic ecosystems where the water table is usually at or near the surface.

Wetlands, Ephemeral -- Lands that fluctuate between wet and dry stages to the extent that the needs of organisms depending on wet environments are only ocassionally and temporarily satisfied.

Xeric -- Of or relating to an extremely low amount of moisture available for the support of plant life.

Review of All Pertinent Literature

Resources of the Econlockhatchee Basin

The literature data base for wildlife resources in this basin is limited. Dr. Jack Stout and others have collected information on small mammals found in different communities including sand-pine-scrub on the campus of the University of Central Florida. Stout and Demmer (1982), and Stafford and Stout (1983) reported on dispersal movements of cotton rats. Habitat partitioning also was studied (Swindell 1977).

Stout et al. (1989) and Bard (1989) reported on the home range, movements, habitat use and survival of relocated gopher tortoises near UCF campus.

In a comprehensive report on short-tailed hawks, Ogden (1974) found several nesting pairs in the Econ Basin. He remarked that this area provided excellent habitat for this species because of the patches of large trees adjacent to open country. This hawk prefers to nest in swamps and feeds in nearby pastures, marshes, or native prairies.

Very little is known about the fish communities in the Econ. Williams and Bruger (1972) found that American shad spawned in the Econ in 1969 and 1970. Gerry (1983) also reported that the upper Econ is near the southern limit of the geographic range of the freckled madtom and blackbanded darter.

Issue 1. Habitat Fragmentation

The effects of fragmenting or reducing habitat size on animal communities (especially birds) has been popular research topic during the last two decades. These investigations have provided the scientific bases for the proper designing of nature preserves surrounded by areas with little or no habitat values.

Most early work on this problem was essentially a confirmation of the familiar species-area relationship - larger pieces of habitat support more species (Arrhenius 1921, Gleason 1922, Preston 1960 and 1962, MacArthur and Wilson 1967).

The original intent of this theory proposed by MacArthur and Wilson (1967) was to explain species richness on oceanic islands that are isolated from mainlands. More recently, forest fragments also have been portrayed as islands because they are patches of natural habitats surrounded by a sea of culturally modified land (Terborgh 1974, Sullivan and Shaffer 1975, Wilson and Willis 1975, Diamond and May 1976, Forman et al. 1976, Galli et al. 1976, and many others).

The process of habitat fragmentation is accompanied by insularization of fragments, i.e., isolated pieces of habitat surrounded by dissimilar habitat. Eventually, fewer native species will be found in a habitat island than in a sample area of equal size within an extensive block of habitat (Harris 1984). The number of species may not change much, or may even increase in isolated habitats, but species composition will shift toward the more common non-forest-dependent species such as cardinals,

pigeons, doves, blue jays, house sparrows, and mockingbirds. These adaptable species are prevalent in the developed landscape and do not need reserves or special protection for survival.

The equilibrium number of species found on an area is a function of immigration to the area and extinction of species originally present. In general, species capable of flight exhibit significant immigration to isolated habitat islands. Cursorial (non-flying) animals are less likely to disperse across inhospitable terrain (Frankel and Soule 1981). McLellan et al. (1986) suggest that extinctions of species increase rapidly once a critical percentage of the original habitat has been destroyed.

Smaller forest islands surrounded by clear cuts or agricultural fields contained fewer bird species than larger contiguous stands (Linehan et al. 1967, Moore and Hooper 1975, Forman et al. 1976, Galli et al. 1976, McElveen 1978, Wilson and Carothers 1979, Stauffer and Best 1980, Martin 1980, Robbins 1980, Tassone 1981, Ambuel and Temple 1983, Lynch and Whigham 1984, Blake 1986, Blake and Karr 1987, Temple 1986).

Similar results have been shown from Florida studies. Harris and Wallace (1984) reported that the number of breeding bird species occupying habitat islands in north central Florida hammocks increased as a direct function of island size. Of the 45 bird species that commonly breed in expansive tracts of north Florida hardwood forests, only 24 used the 12 forest island fragments.

Research in urban areas also has suggested that the species-area concept applies when forest fragments are surrounded by development. In study areas bounded by housing developments, farm land, streams, and rail roads, Burr and Jones (1968) found bird species diversity to be directly related to urban parkland habitat size in Delaware. Gavareski (1976) reported identical numbers of non-urban bird species (29) in a large rural forest and a large undeveloped urban park but only 21 non-urban species in a small undeveloped urban park in Seattle, Washington.

Few studies have tested the validity of this model with other taxa. Variations in mammalian species richness was reported by Kitchener et al. (1980b) and Matthiae and Sterns (1981). Shreeve and Mason (1980) found area to be correlated with the number of butterfly species.

There are many potential interpretations of the species-area relationship. Four general explanations are (1) larger areas support more kinds of habitats (and thus more habitat-specific species), (2) larger areas offer bigger "targets" for organisms dispersing across the landscape, (3) larger areas maintain larger populations that are less vulnerable to extinction due to random or deterministic population fluctuations, and (4) larger areas support animals with large territory and home range size that cannot be supported in small areas. Any one of these explanations is powerful enough to support the general recommendation that nature preserves should be as large as possible (Soule and Wilcox 1980, Frankel and Soule 1981, Schonewald-Cox et al. 1983, Harris 1984, Soule 1986).

A great deal of recent literature in the field of island biogeography has discussed the effects of inbreeding and genetic drift on wildlife due to genetic isolation and small population sizes (Miller 1979, Soule 1980, Senner 1980, Wilcox 1980, Franklin 1980). Inbreeding has the effect of decreasing population heterozygosity (genetic variation) by increasing the chance that progeny will receive duplicate alleles from a common ancestor. This loss of genetic variation can have both immediate and future implications for a species' survival. Inbreeding can lower species vigor and fecundity within a few generations (Soule 1980). The very reduced population of Florida panthers may be suffering from the effects of inbreeding. All five males examined have had greater than 93% abnormal sperm (Roelke

1986). Over the long term, inbreeding also can limit the ability of a population to evolve to meet changing environmental conditions (Soule 1980, Harris et al. 1984).

In order to develop a conservation strategy that addresses the need to assure continued perpetuation of all currently existing wildlife populations within a large geographic area, minimum viable or minimum functional population considerations must be made. A minimum viable population is the lowest number of individuals that can assure the capability of the population to persist through time dealing successfully with agents of extinction (Shaffer 1981). Put in more specific terms, a minimum viable population can be defined as the smallest population that will give a 99% probability of surviving at least 1,000 years (Shaffer 1981). Too small a population is subject to extirpation due to the accumulation of detrimental genetic make-up through inbreeding (Ralls and Ballou 1983). It is well recognized that population extinction is inversely related to population size in its frequency of occurrence (MacArthur 1972, Diamond 1984). Genetic variability provides a basis for populations to adapt to a changing environment.

Minimum viable populations are dangerously close to extinction or extirpation and should not be considered as bottom line constraints in land-use decisions. If the intent of creating preserves is to prevent the extirpation of species from an area, then specific standards should be set to higher, ecologically functional levels rather than minimum viable levels.

It is important to note that the process of extirpation for longer-lived species may take several decades. Therefore, the impacts of some ineffective land-use decisions will not be realized for several generations.

Once the minimum viable population size is determined then the minimum area required to support that population can be calculated by extrapolating the home range size of the average individual. In landscapes with isolated wetland habitats, area requirements should be satisfied in large contiguous blocks. In flowing water wetlands that are situated between two larger habitat islands, area requirements may be satisfied merely by providing the appropriate link or wildlife corridor.

Many recent studies have examined methods of determining minimum viable population size (Shaffer 1981, LaCava and Hughes 1984, Samson et al. 1985, Reed et al. 1986, Cox et al. 1987). Because this is an evolving science, accurate and undisputable figures are not available for population sizes that will be able to remain genetically viable over time. Cox et al. (1987) stated that 40-50 gopher tortoises satisfied several conditions for population viability for at least several hundred years. LaCava and Hughes (1984) determined that a population of 46 northern goshawks was adequate to maintain genetic variability. Reed et al. (1986) calculated the minimum population of goshawks to be 122 plus the number of nonbreeders.

These authors also disagreed with the minimum number of elk that could remain genetically viable. The LaCava and Hughes (1984) estimate was 214 and Reed et al. (1986) concluded that twice as many individuals (426) were required.

The major variables in the population models used to calculate minimum viable population size include: the number of breeding males and females, the number of young born, the probability that a newborn survives to the mean age of reproduction, and the mean age of all males and females that reproduce. Wildlife species composition in east central Florida's significant wetlands vary tremendously with respect to these factors.

Reed et al. (1986) recommended an effective population size of more than 50 for short-term survival of species and 500 for long-term population and species survival. Franklin (1980) warned that populations as large as 300 individuals may be needed to provide for minimum levels of persistence for populations faced with consistently harsh conditions over 200 years. Land managers and planners should, of course, aim above the minimum levels whenever possible because the consequences of falling below are extreme and these population models have not been substantially validated.

Other literature has questioned the effectiveness of fragmented parks and preserves in maintaining viable populations of animals which require large ranges or activity areas (Pickett and Thompson 1978, Lovejoy and Oren 1981, Harris and Noss 1985, Harris 1984, Noss and Harris 1986). In Florida, black bears may range over 15,000 acres and bobcats over 5,000 acres. An otter may require several miles of linear river and riparian habitat (Harris 1985).

Application of the species-area relationship or island biogeography theory is useful in determining the minimum area needed to support viable or functional populations of species in these fragments (Diamond 1975, 1978). Rosenberg and Raphael (1986) found that highly isolated Douglas-fir forest stands (>50% insularity) should be at least 125 acres to preserve the full complement of associated vertebrate species. Harris and Wallace (1984) found that small (< 75 acres), mesic hardwood hammock islands in Florida supported only 53% of the bird species that normally breed in this habitat type.

The best strategy for isolated preserve design has been a topic of considerable debate during the past decade. Simberloff and Abele (1976) suggested that the species-area relationship does not imply that a large reserve is always the optimum conservation strategy. Pickett and Thompson (1978) introduced the concept of "minimal dynamic area" as the smallest area capable of maintaining all ecosystem components in the face of a natural disturbance. Kushlan (1979) has shown that shape and area were inadequate design criteria to predict wildlife diversity in Everglades National Park. Frankel and Soule (1981) and Cole (1981) refuted this concept and emphasized large preserves. Higgs (1981) took exception to this generality. Temple (1986) presented the core-area (the area of forest more than 100 m from an edge) model for recommending preserves. Seagle (1986) suggested that elements of both the area-per se and habitat-diversity hypotheses contribute to the development of species-area relationships through interaction between area and landscape dynamics. Soule and Simberloff (1986) have focused attention from the minimum-sized fragment that will contain a species to the area necessary to maintain minimum viable populations of species.

It is important to note that not only will some species not use small preserves, but there are no species that are restricted to small habitat patches. This is highly relevant to the design of wildlife preserves.

Issue 2. Wildlife Corridor Misconceptions

Wildlife corridors can be defined as bands or parcels of land which allow safe passage of wildlife between larger blocks of habitat. This contiguity effectively increases the size of protected lands and their ability to maintain viable wildlife populations. Genetic variation is maintained because genetic material is carried freely back and forth across the corridor and among large habitat blocks by

dispersing wildlife. Scattered animals also can recolonize areas which have suffered from local extinctions (Fahrig and Merriam 1985).

MacClintock et al. (1977) provided evidence that forested corridors increased the number and diversity of breeding birds in smaller forests that were connected to larger habitat tracts. Wildlife populations in isolated blocks of forest have been shown to have lower growth rates than populations in forest blocks tied together by corridors (Fahrig and Merriam 1985). Harris (1984) suggested the use of riparian corridors to link isolated habitat islands. Kautz (1984) recommended preserving forested corridors approximately 100 meters wide. Noss (1987) stated that more research is needed to develop optimal connectivity strategies but active methodologies to prevent fragmentation must proceed quickly, with or without sufficient data. Brown et al. (1990) provided evidence to show that 550 foot wide corridors (buffers) on one side of a river would be sufficient space to maintain about 50 % of the species associated with swamp wetlands. Smaller buffers would give the same results in marsh systems and larger buffers are required in sandhills.

Although the term wildlife corridor is used in many DRI proposals and Comprehensive Plans, the concept behind the term is poorly understood. Planners and developers often refer to 10 foot wide green areas between houses as corridors and conservation areas. These narrow strips only provide food and cover requirements for species such as blue jays, cardinals, doves, and mockingbirds that are commonly found in developed areas. These token corridors support very few if any wildlife that are sensitive to development and in greater need of conservation efforts. In fact, these areas have been referred to as "ecological traps" because of the abnormally high predation and cowbird parasitism that occurs (Gates and Gysel 1978, Wilcove et al. 1986).

Forman (1983) has stated that width is the most important variable affecting corridor function. Stauffer (1978) found that bird species richness increased significantly with the width of wooded riparian habitat and half of the species were restricted to wider strips. Tassone (1981) reported similar results from a study of hardwood leave strips in large clear cut areas. Acadian flycatchers were only infrequently found in corridors less than 50 meters. Hairy and pileated woodpeckers required minimum strip widths of 50 and 60 meters respectively, while the northern parula required at least 80 meters. In a preliminary study, Smith (unpub.) found that the minimum width of forested riparian habitats for yellow-billed cuckoos, barred owls and acadian flycatchers in Gainesville, Florida was 180 feet. Prothonotary and hooded warblers were not recorded in any riparian habitats up to 450 feet wide, but were found in a nearby large state preserve, San Felasco Hammock.

The importance of stream and river-associated habitats as wildlife corridors has received much attention. However, to function effectively as an area through which animals will travel and gain access to larger connected habitat areas, the corridor must be of sufficient size and quality to provide essential requirements for animals to be attracted to it. Cursorial (non-flying) animals are especially unlikely to disperse across unsuitable terrain (Frankel and Soule 1981). Brown et al. (1990) presented a scientific basis for wildlife buffers (development set backs) of 322 to 732 feet for significant wetlands in east central Florida.

Issue 3. Decrease in Landscape Diversity

. Most wildlife species utilize more than one habitat type to obtain their requirements. Decreases in landscape diversity have limited the amount of resources available for wildlife. Several authors have substantiated the close association and interaction of wildlife in wetland and adjacent upland communities. Fredrickson (1978) reported that various species more commonly associated with wetlands or uplands make seasonal or daily shifts into different habitat types to escape flooding, to forage, to disperse or to hibernate. Examples that he cited are: turkey river, otter, swamp rabbit, deer, bobcat, and gray fox. Other species such as raccoon, gray squirrel, tree frogs and many woodland bird species occur with similar frequency in both wetlands and uplands. Fredrickson also points out the paucity of specific data describing the relationship between remnant lowland area size and animal numbers and distribution.

Bottomland hardwoods are integrally coupled to the surrounding uplands (Wharton et al. 1982). Terrestrial lowland fauna may be coupled to the uplands, as when deer who base their home range in floodplains graze in uplands. Conversely, upland forms such as the black racer, slimy salamander and pine vole may use the floodplain at drydown. Although many species breed in both habitat types, their densities may differ considerably between adjacent areas. However, the lower density populations may serve as important recruitment sources. The narrow greenbelts of bottomland hardwoods also provide routes for migration and restocking.

Many semi-aquatic Florida turtles such as the mud turtle and snapping turtle loaf and feed in marshes and need sandy upland sites to lay eggs (Weller 1978). The river cooter is an example of another turtle which is largely confined to permanent water but must trek to adjacent uplands to deposit eggs (Patrick et al. 1981). Paul Moler (Herpetologist, Florida Game and Fresh Water Fish Commission, Gainesville, pers. comm.) said documented cases of Florida aquatic turtles laying eggs several hundred yards from a river is not uncommon. Weller (1978) also indicated a need for more information relating to the wetland-upland interface. He stated, "Upland areas often serve as buffers, nesting areas, or food resources for wetlands wildlife but their relative importance is undocumented."

The eastern indigo snake is classified as a wetland species but frequently occurs in dry, sandy areas (Kockman 1978). Speake et al. (1978) found that indigo snakes concentrated on the higher ridges of sandhill habitat during winter and moved down into stream bottom thickets in summer. Shelter provided by gopher tortoise burrows is critical to the survival of this snake while it is in upland areas. Peak mast production occurs at different times of the year in uplands and lowlands (Harris et al. 1979). Winter and spring is the fruiting season for most bottomland species while upland plants bear fruit in the summer and fall. Correspondingly, both upland and wetland nesting birds often concentrate in wetland areas during the non-nesting season (Wharton et al. 1981). Wild turkeys may be found in a variety of wet and dry habitats and normally depend on acorns as a staple food in Florida. But they also have been known to eat crawfish (Wild turkeys were recently reintroduced into the Rock Springs Run State Reserve on the Wekiva River). During the egg-laying season, female wood ducks eat a large percentage of invertebrates obtained from the wetland-upland transitional areas (Fredrickson 1979). Pileated woodpeckers nest and roost primarily in wet hardwoods and cypress habitats but forage in uplands (Hoyt 1957, Jackson 1978). Conner et al. (1975) did not find any pileated woodpecker nest trees farther than 150 meters from water in southwestern Virginia.

Landers et al. (1979) found that black bears also respond to seasonal differences in mast production. In North Carolina, they shift their food preferences from predominantly bottomland species in the winter and spring to predominantly upland fruits and nuts in summer and fall. Florida bears primarily inhabit "swamps" in the center of the state but are long distance travellers utilizing both wetlands and uplands (Williams 1978). They eat acorns, palmetto berries and the terminal bud ("swamp cabbage") of the Cabbage Palm.

Jennings (1951) observed that gray squirrels in the Gulf Hammock region of Levy County, Florida were dispersed through all habitats while food was plentiful in the fall. When red maple and elm began to bud and produce seed in mid-January, the squirrels began to concentrate in the hydric hammocks and swamps to utilize this food source. As upland foods became available in the spring and the lowland areas flooded, the squirrels moved to higher elevations.

Kantola (1986) found higher fox squirrel densities in ecotone or transitional areas than in upland areas on the Ordway Reserve in Putnam County, Florida. However, she also reported that home-range size and use within ecotones and uplands may vary with seasonal food abundance, reproductive activity and climate.

More than 33% of the 30 small vertebrates species caught by pit-fall traps in the floodplain of the Chattahoochee River in Georgia were classified as upland species (Wharton et al. 1981). Whereas only 14% of 21 small vertebrates sampled by the same method along the Alcovy River in Georgia received the same classification. This dissimilarity was attributed to vegetation structural differences in the floodplain.

Many researchers have been interested in the response of small mammals to flooding. Most studies concluded that floodplains were marginal habitats for these species. However, Batzli (1977) found that Illinois floodplain populations of the white-footed mouse were remarkably similar in density, adult survival and age structure to that in the adjacent upland areas. The exchange of individuals between these two communities consisted mainly of a few floodplain mice occasionally moving into the uplands. He suggested that mature trees with abundant holes and cavities may be necessary refuges for small mammal survival during flooding.

In a blackwater creek bottom in South Carolina's inner Coastal Plain, Gentry et al. (1968) found that the cotton mouse, short-tailed shrew and southeastern shrew were two, three and ten times respectively more abundant in the bottomland hardwood than in the adjacent uplands. Whereas, golden mouse specimens were collected only from the hardwoods.

Because wetlands often are the last land to be developed, some species normally considered upland wildlife are sometimes forced to adapt to wetlands that can supply their habitat needs (Schitoskey and Linder 1978). When upland requirements for animals are destroyed, they may concentrate in the nearby wetlands. Ozoga and Verme (1968) reported that deer mice, which are upland-dependent, were also found in the wetlands. White-tailed deer, an edge species, is known to adapt well the swamps and lowland areas (Verme 1961, Verme 1965, Sparrowe and Springer 1970). Weller and Spatcher (1965) found that upland bird species such as the meadowlark and mourning dove nested in unflooded portions of wetlands.

High densities of prey species also attract upland predators such as the skunk, raccoon and red fox. Bailey (1971) found that striped skunk densities were greater in wetlands than in uplands where

cultivation and other development adversely affected upland feeding sites. This situation is suspected to cause an abnormally high skunk predation rate on waterfowl eggs. Another example is prairie raccoons feed in farmyards during early spring. However, as the growing season progresses, use of wetlands increases where relatively more foods are available than in the adjacent cultivated uplands.

Bobcats in the Welaka Reserve showed a preference for bottomland hardwoods (Progulske 1982). More than 20% of the 269 recorded locations of two radio-collared bobcats from July 1980 to December 1981 were in this type of overstory habitat. The other locations were spread among seven different upland habitat types.

Melquist and Hornocker (1983) found that although Idaho otters generally followed streambeds, they often took shortcuts across peninsulas formed by stream meanders. Overland travel of up to about 3 kilometers was recorded. Extensive crosscountry movements considerably reduced the distance an animal would normally have had to travel to reach the same destination by water. However, these movements also subjected the animals to highway hazards. Three of nine known mortalities were roadkills. In Great Britain, Chanin and Jefferies (1978) reported that in some areas dead otters were found repeatedly at the same location on roads over a number of years.

In a report that synthesized extant literature for Southeastern bottomland hardwood swamp habitats, Wharton et al. (1982) stated that bottomland animals do not occur in the same distinct zonal pattern as plants ranging from aquatic to upland ecosystems. Wetland inhabitants are opportunists, and many move freely into irregularly flooded or dry zones over the year. They also noted that some overlap among zones occurs, especially in the transitional areas characterized by periodic annual flooding and a duration of flooding during a portion of the growing season. Their examples of overlapping species that might occur along the Wekiva River are: the mole salamander, slimy salamander, narrowmouth toad, spadefoot toad, cricket frogs, chorus frogs, box turtle, five-lined skink, southeastern five-lined skink, brown snake, garter snake, ribbon snakes, rat snakes, kingsnake, southern black racer, coachwhip snake, barred owl, downy and red-bellied woodpeckers, cardinal, turkey, common yellowthroat, wood thrush, eastern wood peewee, white-breasted nuthatch, Swainson's warbler, carolina wren, yellow-throated vireo, cotton mouse, golden mouse, short-tailed, least and southeastern shrews, woodrat, marsh rabbit, pine vole, and eastern mole.

The use of various bottomland hardwood ecological zones by wildlife differs by species, season and flooding regime (Larson 1981). Some are site specific during the breeding period while at other times may use a broad range of ecological zones. Larson also referred to many of the species examples use by Wharton et al. (1981).

Many studies have documented wetland wildlife species use of adjacent uplands. Removal or alteration of this important habitat type could destroy critical requirements for many species and thus render the riverine system no longer inhabitable for them.

Issue 4. Reduction in Habitat Quality

Food, cover, and water are life-sustaining elements for all wildlife species. If every requirement for an animal is available in a particular area, the area is considered to be good quality habitat for that species; if one or more of a species' requirements is not available, the area is not suitable.

Some habitats are more suitable (of greater quality) than others and produce greater densities of wildlife than those of poorer quality. Much of the variability observed in numbers of species and numbers of individuals between populations in similar or different habitat types results from differences in available food, cover, water, and other requirements (Black and Thomas 1978). Habitats with a high suitability (abundant food, cover, and water resources readily available) have a greater potential to support more individuals per area. The number of individuals within a population for which a particular area is able to supply all energetic and physiological requirements over a long period, barring no major perturbations, is called carrying capacity (Smith 1974). Numbers of species and numbers of individuals within species often fluctuate due to a variety of causes including diseases, catastrophic events, predation, and competition. However, the carrying capacity potential of an area remains relatively unchanged. Therefore, the extent of a buffer required to perpetuate populations is highly dependent on the long-term quality of the habitat in question.

By far, the most common cause of wildlife population reduction is natural landscape alteration through agriculture, silviculture, or construction activities. Altering or changing natural conditions to which species are adapted often harms native wildlife communities by destroying key elements that make a habitat suitable. An obvious example is the removal of snags (dead trees) that provide essential nesting structures, food sources, and perches for many birds, mammals, reptiles, and amphibians. A common misconception is that no harm is done because there are plenty of other undeveloped areas containing the same requirements. On the contrary, other areas that have the necessary elements for a particular species are probably already occupied at a saturation level, leaving no room for individuals that are ousted by development occurring elsewhere. Therefore, the most effective method of protecting wetland wildlife resources would be to preserve areas in their most natural conditions.

Timber harvesting stops natural succession of aging forests. This results in forest landscapes dominated by relatively young, even-aged stands. These young forests lack the structural and functional diversity of older forests. These managed forest landscapes may be ecologically inadequate to ensure long-term forest productivity (Maser and Trappe 1984, Spies and Franklin 1988) and the perpetuation of the full array of wildlife populations (Norse et al. 1986). Many species of wildlife including flying squirrels, several species of bats, pileated woodpecker, red-cockaded woodpecker, a variety of cavity-nesting birds, and several species of amphibians are dependent on old, mature forests. Exctinction of the ivory-billed woodpecker (*Campehilus principais*) in the United States and the endangered status of the red-cockaded woodpecker are associated with the loss of old forests (Thomas et al. 1988). Forests in the Econ Basin should be allowed to mature naturally so they can maintain some semblance of natural biotic diversity and ecosystem function.

A few studies have shown how habitat quality is diminished through development. The only known investigation of urban birds in the southeastern United States was conducted in Pinellas County residential suburbs (Woolfenden and Rohwer 1969). They found that many native species were replaced by exotics when natural areas were developed and breeding pair densities increased with the maturing of the planted vegetation. Similar results were reached by Tweit and Tweit (1986) in Tucson, Arizona and Vale and Vale (1976) near Oakland, California. Some authors have reported that insectivorous birds declined, and omnivorous and grainivorous species increased as residential suburbs were built into naturally forested landscapes (Beissinger and Osborne 1982, DeGraaf and Wentworth 1981). DeGraaf

(1986) and (1987) also noted that insectivorous birds were more prevalent near urban woodlots in Massachusetts. Beissinger and Osborne (1982), Goldstein et al. (1986), and DeGraaf and Wentworth (1986) described relationships between vegetation volume in residential areas and bird species richness, and recommended extensive landscaping with native plants and retaining sizeable natural forest patches. Goldstein et al. (1983) examined some of the trade-offs among wildlife, visual and recreational amenities associated with different arrangements of a given amount of greenspace and encouraged preserving large forested clumps instead of thin borders.

There are no accurate and easily applied methods to specifically quantify habitat quality. However, the following qualitative classifications can be used when assessing site values for wildlife.

1) High Quality: If an area is still in a relatively natural state, and large enough to provide requirements for at least one pair of most species associated with the habitat type occupying the area, it is suitable for those species.
2) Medium Quality: If an area has been cleared for agricultural or silvicultural purposes but no permanent structures such as roads and buildings have been constructed, it still has some current wildlife value and a potential for increased future wildlife habitat values. Because these areas can be converted easily back into native habitat, they should not be excluded from any buffer areas.
3) Low Quality: If an area has been cleared and developed with roads, buildings, and other permanent structures, its suitability for wildlife dependent on the original natural habitat type would be minimal.

Issue 5. Impacts of Adjacent Land Use

The question of how large a habitat area must be to maintain biological integrity cannot be answered without considering the impacts of land uses adjacent to the preserve. The negative effects of induced edge on species have been reported by Faaborg (1980), Samson (1980), Noss (1981, 1983), Samson and Knopf (1982), Harris (1984), and Noss and Harris (1986). The type of habitat on the outside of a forest edge determines the nature of edge effects. A general principle is that the greater the contrast between habitat types, the greater the edge effect (Harris 1984). Modified areas surrounding a forest fragment are usually altered into earlier successional stages. These types of habitats are then attractive to pioneering species that invade several hundred meters into the adjacent forest fragment and alter species composition and relative abundances.

The negative impacts of induced (man-made) edges in a forested system and of the noise and domestic animal problems associated with development adjacent to natural habitat areas have been reported by Brown et al. (1990). Some of the major points will be highlighted here.

Whitcome et al. (1976) provided evidence that, in areas along forest edges avian brood parasites (brown-headed cowbirds), nest predators (small mammals, grackles, jays, and crows), and non-native nest hole competitors (e.g. starlings) are usually abundant. Gates and Gysel (1978) found that a field-forest edge attracts a variety of open-nesting birds, but such an edge functions as an "ecological trap." Birds nesting near the edge had smaller clutches and were more subject to higher rates of predation and cowbird parasitism than those nesting in either adjoining habitats. This abnormally high

predation rate is related to the artificially high densities of many opportunistic animals near forest edges and in disturbed habitats including suburbs; (Wilcove et al. 1986).

The cowbird problem is a relatively new but very real dilemma in east central Florida. This bird feeds in open areas and lays its eggs in other species' nest found along forest edges. Many birds cannot distinguish this foreign egg from their own and devote all of their energy to raising the young cowbirds. The eggs of the host species are either removed by the adult cowbird or are pushed out of the nest by the more aggressive cowbird nestling. Several species such as the Kirtland's warbler have been seriously affected by nest parasitism, and now the extinction of the Bachman's warbler is expected due to this alien source of mortality. The Florida Breeding Bird Atlas surveys in east central Florida have revealed an increased presence of the cowbird as the naturally forested landscape is cleared and more open habitat is provided for this species.

Any forest tract has a "core area" that is relatively immune to deleterious edge effects and is always far smaller than the total area of the forest (Temple 1986). Relatively round forest tracts with small edge-to-interior ratios would thus be more secure, whereas thin, elongated forests (such as those along unbuffered riparian strips) may have very little or no core area and would be highly vulnerable to negative edge effects.

Predation and harassment of wildlife by free-ranging domestic cats and dogs are other detrimental effects of development adjacent to significant wildlife habitat areas. Several authors have documented the occurrence to wildlife prey in the diets of free-ranging cats and dogs and the effects of their predatory behavior on individual wildlife animals and populations (Errington 1936, Korschgen 1957, Smith 1966, Gilbert 1971, Jackson 1971, Gill 1975). Cats can be especially devastating on local wildlife populations. Hunting is a feline instinct, and predation rates are not related to hunger (Davis 1957, Holling 1966, Holling and Buckingham 1976). Bradt (1949) reported that a single cat, who regularly consumed domestic food, killed over 1,600 mammals and 60 birds in Michigan during an 18-month period. Local extinctions of the Anastasia beach mouse along Florida's coast (Stephen R. Humphery, pers. comm. 1989); a dove on a south Pacific island (Jehl and Parkes 1983); and diving petrels, broad-billed prions, yellow-crowned parakeet, robin, fern-bird, brown creeper, Stewart Island snipe and banded rail in New Zealand (Fitzgerald and Veitch 1985) have been attributed to cat predation. Churcher and Lawton (1989) concluded from their study that domestic cats kill at least twenty million birds a year in Britain.

Cats and dogs can be especially devastating on ground feeding and ground breeding species. These guilds represent the majority of semi-aquatic and wetland-dependent wildlife species in east central Florida (Brown et al. 1990).

Sound is a physical phenomenon and defined as an oscillation in pressure of a medium measured in decibels (dB); (American National Standards Institute 1971). Sometimes, sound is noise which is defined as unwanted or undesirable sound (U.S. Environmental Protection Agency 1978). This annoyance factor of sound negatively impacts all hearing animals. Along with air and water contaminants, noise has been recognized as a serious pollutant.

The physiological impacts of noise on people is well documented. Short-term exposure to very high sound levels (120 to 130 dB) and long-term exposure to lower levels (80 dB) can cause temporary or permanent changes in human ability to hear (Carelstam 1972), and increased blood pressure, elevated

rates of heartbeat and respiration, muscle tension, hormone release, cardiovascular disorders and increased susceptibility to disease (Alexandre and Barde 1981). Long-term exposure above 55 dB interferes with activity and causes annoyance for people in outdoor settings (U.S. Environmental Protection Agency 1974). However, the physiological and behavioral impacts on wildlife are little known.

Noise associated with construction, operation, and maintenance of developments can cause harmful impacts on wildlife. Animals that rely on their hearing for courtship and mating behavior, prey location, predator detection, homing, etc., will be more threatened by increased noise than will species that use other sensory modalities. However, due to the complex interrelationships that exist among all the organisms in an ecosystem, direct interference with one species will indirectly affect many others.

Unfortunately, few data are available that demonstrate the specific effects of noise on wildlife . Much of what is found in the literature lacks specific information concerning sound intensity, spectrum, and duration of exposure. There have been no systematic studies with experimental designs that show definite relationships between specific noise disturbances for various species and different sound levels. Brandt and Brown (1988) conducted an extensive literature search on this topic and found that most of our current knowledge of sound impacts on wildlife are based on observations of animal reactions to aircraft overflights and laboratory studies. Because such little research emphasis has been given to this topic, it is not surprising that results are inconclusive and sometimes contradictory.

While general understanding and consequences of noise impacts on wildlife are not very specific, a few conclusions are obvious. Short-term exposure to loud sounds can cause physiological changes in animals as it does in humans. Chronic lower level sounds (55 dB) are annoying to humans and also probably make an area relatively less desireable to wildlife. Some, but not all, species can adapt to some sounds. Human activity also disturbs wildlife and can have similar effects such as nest abandonment. Noise and human activity will negatively impact semi-aquatic and wetland-dependent wildlife from the landward side as well as the water side if the water is used for recreational purposes.

Edge effects have been shown to negatively impact wildlife species within at least 300 feet of forest boundaries. Studies of nature reserve boundaries have provided data that support the need for buffer zones of decreasing use outside reserve boundary (Unesco 1974, Dasmann 1988, Schonewald-Cox 1988). The core of these areas must be protected from cats, dogs, human activities, noise, predators, exotic competitors, parasitism and other detrimental effects of development.

Issue 6. Impacts of Public Recreation

Assessing direct impacts of human recreational activities on wildlife is a newly evolving science. Boyle and Samson (1985) summarized 106 recreational impact studies and reported that 73% of these concluded nonconsumptive activities negatively affected bird communities. Hiking and camping affect wildlife through trampling of habitat (Liddle 1975), disturbance of animals (Ward et al. 1973, Aune 1981) and less directly through discarded food or other items (Foin et al. 1977). Klein (1989) documented effects of visitor use on avian species at Ding Darling Refuge, Florida. A majority of the species that she classified as most sensitive to humans (reacted negatively to human presence) occur in the Econlockhatchee Basin. These include: pied-billed grebe, white ibis, willet, sanderling,

dunlin, and blue-winged teal. The average minimum distance from humans tolerated by these species was 260 feet.

Human disturbance of waterbird colonies has been shown to cause nest losses through predation (Schreiber and Risebrough 1972, Hand 1980, Anderson and Kieth 1980) and nest abandonment (Hunt 1972, Ellison and Cleary 1978). Some duck species and the great crested grebe did not winter in one reservoir since it was opened to sailboats, even though these species were observed elsewhere in the vicinity (Batten 1977). Rodgers and Burger (1981) reported that human activities in waterbird colonies may delay nesting for some pairs, eliminate late-nesting pairs, or cause late-nesting pairs to shift to other less suitable nesting sites. Tremblay and Ellison (1979) reported that visits to black-crowned night heron colonies just before or during laying provoked abandonment of newly constructed nests and either predation of eggs or abandonment of eggs followed by predation. This study also concluded that herons did not nest in areas where human interference occurred. Ellison and Cleary (1978) found similar results with double-crested cormorants. Wintering eagles were more disturbed by infrequent activities than by regular activities (Stalmaster and Newman 1978). Landin (1978) recommended protecting all wading bird nesting areas from human activities during the nesting season.

Effects of boating and swimming have been reported primarily for birds. In a comprehensive review, Liddle and Scorgie (1980) noted that wildlife is affected through sight and sound of recreationists, pollution from boats and recreational facilities, and habitat changes caused by vegetation control practices and facility construction. Beach and shore recreationists can disrupt shorebird breeding (Norman and Saunders 1969) or force birds into less preferred habitats (Erwin 1980).

Lynch and Whitcomb (1978) reported that existing urban and suburban parks in the Washington, D.C. area have failed as avifaunal preserves. From 1950 to 1970, many specialized, fragment-sensitive species were extirpated locally and replaced by generalized permanent residents. They attributed this unnatural change to inadequate size of parks, isolation from sources of potential colonists, and increasing levels of disturbances related to human activities (trampling of understory vegetation, repeated disturbance of nesting and feeding birds, predation by cats and dogs, competition for food and nest sites with native and introduced common species that invade forest patches, increased levels of brood-parasitism by the brown-headed cowbird, and increased levels of pollution by noise, light, and toxic chemicals).

Issue 7. Impacts of Cattle Grazing and Related Activities

It is difficult to determine specific impacts of cattle grazing that may occur on ecosystems and wildlife within the Econ Basin. These impacts, positive or negative, would depend on several variables such as the number and density of cattle, type of ecosystem, the current condition of the vegetation, the amount of vegetation or forage available, the time of year, the grazing schedule, the size of the area, surrounding land use, and the species of wildlife present also affect the impact of cattle in a given area. Data found through our literature search suggest that if grazing is controlled at some level, it can be compatible with wildlife conservation efforts. The impacts of several activities associated with grazing such as creating and maintaining improved pastures also will be addressed in this section.

Most grazing/wildlife studies have focused on the competition of wildlife and cattle for food resources in western rangelands. Landowner interest in managing game species as a valued commodity

has stimulated some research on the compatibility of cattle grazing and game management. Several studies have concluded that grazing must be controlled to effectively manage for game species. Elk preferred spring feeding sites in Montana that were **moderately** grazed previously by cattle (Grover and Thompson 1986). However, Knowles and Campbell (1982) indicated that the availability of forested cover vegetation also is an important factor for elk selection of an open feeding area. Proper livestock grazing has been shown to maintain or improve habitat for mule deer (Austin and Urness 1986). Contrarily, Compton (1986) found that white-tailed deer avoided areas with cattle in eastern Montana.

Mearns quail food supply on an Arizona Ranch was not reduced but the elimination of escape cover and nesting grass by cattle was detrimental, especially to breeding populations (Brown 1982). Murray (1958) reported that overgrazing diminished the food supply and reduced escape cover in bobwhite habitat. Jackson (1969) also found overgrazing reduced the concealment value of escape cover. Klimstra and Scott (1957) found little or no use by nesting bobwhites where heavy grazing occurred. Johnsgard (1973) noted that bobwhites existed in large numbers in western and southern Texas wherever excessive grazing did not occur. Overgrazing also limited woodcock numbers in Oklahoma (Lambert 1980).

Most of these game species are open-canopied, early successional species. Game species comprise less than 10% of Florida's terrestrial wildlife and it is our opinion that they are not good indicators of cattle grazing impacts on obligate forest species.

There also are some studies that provide evidence of grazing practices benefit nongame wildlife. Grazing was found to improve habitat for long-billed curlews in Idaho (Bicak et al. 1982). This is not unexpected because many birds in the sandpiper family prefer open areas with very little vegetation for nesting (Harrison 1975). However, total numbers of terrestrial nongame birds were significantly greater on ungrazed than on grazed bottomland areas in Colorado (Crouch 1982).

Significant differences also were found in small mammal communities between grazed and ungrazed sites in both riparian and nonriparian habitats in Idaho (Johnson 1982). However, few differences between pastures in small mammal communities were evident prior to grazing, one month following grazing, and no differences in numbers or distribution of small mammals were observed five months following grazing levels **recommended by SCS** in Colorado (Samson et al. 1988). Consistent differences also were not found in abundance, diversity, and microhabitat of small mammals between an ungrazed and a **deferred-rotational grazed** areas in Nevada (Oldemeyer and Allen-Johnson 1988).

Platt (1985) reported that snakes and lizards were much more abundant and diverse in a natural sand prairie than in a pasture in central Kansas.

Trampling and grazing also have been found to be detrimental to the recovery of listed plants such as Mesa Verde Cactus (Benson 1984) and Gypsum wild buckwheat (U.S. Fish and Wildlife Service 1984).

Among four treatments tested at the University of Florida, intensive grazing for about two weeks followed by four months of rest reduced roughage and stimulated desireable plant growth the best (Moore and Terry 1979). Such a grazing system requires a minimum of nine pastures and three years to complete the grazing cycle.

After a review of the literature, May and Davis (1982) concluded there is little question that overgrazing and excessive livestock use of streamside areas can exert negative imfluences on stream

ecosystems. They added that these influences can be minimized with proper planning and controlled livestock use.

Trout stream habitat was detrimentally influenced by livestock grazing in Montana (Hitchcock 1988).

Many amphibians prefer ponds with emergent vegetation (Delzell 1958, Collins 1975, Conant 1975, Fellers 1979, Collins 1982). It is our opinion that removal of emergent vegetation by grazing will reduce the suitability of wetlands for these species.

Bue et al. (1952) found that grazing intensity was inversely related to pairs of breeding waterfowl and use of shorelines by broods in South Dakota isolated ponds. These authors recommended a stocking rate of 27 acres per cow per year and fencing out a portion of the pond shorelines. Rees (1982) reported that grazing had both positive and negative impacts on different waterfowl species in Washington.

Snyder (1978) observed that during the winter heavily grazed river bottoms did not provide adequate cover for bobwhites.

Holder et al. (1980) recommended an upper density of one animal unit per 2.5 hectares to maintain preferred dusky seaside sparrow habitat in cordgrass marshes.

Wildlife species diversity is strongly influenced by vegetation composition and structural heterogeneity or diversity within a habitat type (MacArthur et al. 1962, MacArthur 1964, Weller 1978). This type of heterogeneity is a function of foliage height and cover diversity. The vertical and horizontal stratification of plants within a forest habitat is positively correlated with the variety of species that reside in that ecosystem. Therefore, it is our opinion that alteration of ground vegetation caused by grazing impacts species that feed or nest at this level. Mosconi and Hutto (1982) reported significant differences in bird species composition and density between heavily-grazed and lightly-grazed riparian plots in Montana. Brown et al. (1990) showed that more wildlife species are dependent on the ground layer than any of the other vertical strata in most east central Florida vegetation communities.

If a forested area is cleared of all woody vegetation and replaced by a completely different monoculture ecosystem of only ground vegetation, it is logical to assume that this area will no longer be suitable for wildlife species dependent on a forested environment. In fact, studies have demonstrated that wildlife species composition is different between various communities that have dissimilar characteristic plant species (Robertson 1955, Rohwer and Woolfenden 1969, Hirth and Marion 1979, Cutright 1981).

Therefore, removal of the woody vegetation would be detrimental to species that are associated with the upper canopy, and beneficial to those that are adapted to a more open, low vegetation community. Brown et al. (1990) reported that more than 50% of wildlife species in most east central Florida forested vegetation communities are dependent on trees for feeding or nesting. Because of differences in microclimates and other habitat variables, species composition of ground feeding or nesting guilds in forested and open vegetation communities are dissimilar. Ground species that use both habitats also may show a preference. For example, Gopher tortoise densities in improved pastures in Florida were estimated to be only 2.59/acre compared to 5.26/acre in a scrubby flatwoods (Cox et al. 1987).

No data were found that compare wildlife use between improved pastures and native prairies without overstory canopies. However, it is our opinion that the greater vegetation diversity in the native prairies would harbor a greater diversity of wildlife.

Ditching and lowering of the water table eliminates or at least reduces the amount of water in sloughs and isolated wetlands that may contain water only during periods of high rainfall. These temporary wetlands are important for many wildlife species. Some amphibians such as the oak toad, chorus frog, little grass frog, pinewoods treefrog, squirrel treefrog, eastern narrowmouth toad, and eastern spadefoot toad breed almost exclusively in temporary wetlands that do not contain predatory fish (Heyer et al. 1975, Woodward 1983, Morin 1983, Caldwell 1987, Moler and Franz 1987).

The endangered wood stork and other wading birds depend on a variety of water feeding areas to maintain feeding efficiency during different hydrologic regimes (Frederick and Collopy 1988). Ogden and Nesbitt (1979) attributed shifts of stork rookery sites in central and north Florida from cypress swamps to impoundments and mangrove islands, to unfavorable drainage practices. Some wading bird foraging may be ineffective in anything but very shallow water (Jenni 1969, Kushlan 1976). For example, Kushlan (1974) found that white ibises avoided water deeper than 10 cm when foraging; though they are tall enough to wade in water 16 to 25 cm deep (Kushlan 1974, Powell 1987). Frederick and Collopy (1988) stated that at least part of the 95% reduction in wading bird numbers in the Everglades is attributed to the conversion of seasonal wetlands into drained agricultural land.

Many waterbirds use different types of wetlands for mating and for rearing young. Individual mallard hens used more than 20 different wetlands during the nesting season in the prairie pothole region (Dwyer et al. 1979). Lowering the water table would reduce the number of wetlands and, therefore, reduce the carrying capacity of the area for wildlife.

Chabreck (1968) reported that marsh drainage to improve cattle range negatively effects most marsh wildlife.

Issue 8. Impacts of Silviculture

Alteration or manipulation of vegetation in any area will impact wildlife species living there. Some animals will benefit by these changes and others will lose life sustaining requirements. Removing trees will enhance the landscape for wildlife that prefer early succession, open habitats. Such areas will become unsuitable for species that depend on mature trees for food and cover.

During a 15 year study of wildlife responses to even-aged silvicultural practices in Alabama, potential food availability was highest for deer, turkey and quail during years 3 and 4 of the study (Johnson 1986). Use generally increased for deer, however, their overall physical condition decreased following crown closure. Use decreased for quail, squirrels, raccoons and opossums while turkey and rabbit usage was generally stable. No data was collected on other species.

Bird and small mammal abundance and diversity was greater in a mature longleaf pine stand than in nine-year-old slash pine plantations Harris et al. (1975).

Of 55 amphibian, reptile and mammal species observed in Douglas-fir forests in northwestern California, nine species were strongly associated with older stands and 11 species were strongly associated with younger stands (Raphael 1988). Assuming that current forestry practices would continue, the overall estimated trend is for increased abundance among species associated with open,

drier habitats, and decreased abundance among species associated with moist, old-age coniferous forests. Most of the increasers are widespread species with large distributions. In contrast, the decreasers are almost all species with rather restricted total ranges, most of which are in threatened habitats.

Following harvest in flatwoods stands in north Florida, bird use shifted from being evenly dispersed to concentrating in cypress domes and edges of stands (Marion and O'Meara 1982). Amphibian and reptiles abundance post harvest was only half of that recorded in pre-harvest areas.

Even selective logging can alter wildlife species composition. Red-tailed hawks were able to displace red-shouldered hawks from mature forests with crown closure < 79% (Bryant 1986).

Clearcutting in mixed oak stands in Virginia initially reduced breeding bird species diversity and abundance (Conner and Adkisson 1975). This management practice also altered species composition.

Although clearcutting in north Florida flatwoods did not affect amphibian species richness, reptile richness was lower in the maximum-treatment clearcut, amphibian abundance was reduced, reptile abundance was reduced, and species composition was altered (Enge and Marion 1986).

Reported average ages of cavity trees for the endangered red-cockaded woodpecker range from 63-176 years for longleaf pine and 70-76 years for slash pine (U.S. Fish and Wildlife Service 1985).

DESCRIPTION OF RESOURCE CHARACTERISTICS

Characteristics of Wildlife in East Central Florida and the St. Johns Basin

A great diversity of wildlife occupy the various habitats found in east central Florida. Many of these areas are unique and jeopardized by growth and development in this section of the state. More than 30 natural communities have been identified by the Florida Natural Areas Inventory as threatened or endangered in the state. Although most of the listed ecosystems are wetlands, nearly half (13) are uplands. A large part of the uplands (five) are xeric scrub communities which occur only on the excessively drained, sandy soils which are largely associated with ancient dune lines.

The Econlockhatchee River Basin is relatively flat. Ground elevations range from about 5 feet near the confluence with the St. Johns River to about 70 feet in the headwater marshes in Osceola County and several scrub patches of about 80 feet west of the river.

The predominant landscape association in the area is flatwoods with swamps and hydric hammocks following river and streams channels and isolated wetlands interspersed throughout. Ground elevation increases from East to West. In the Econ Basin area, there are several small patches of scrub habitat. This high landscape diversity provides many different feeding and nesting resources for a variety of wildlife.

Longitudinally, Central Florida also is a transitional area where ranges of tropical and temperate species overlap. Many large lakes such as Jessup, Harney, and Monroe provide large areas of open water habitat.

Characteristics of Wildlife in the Econ River Basin

Habitats can be characterized by a dominant plant form or some physical characteristic (Ricklefs 1973). Each species requires a particular habitat or a combination of habitat types (ecological communities) to supply the space, food, cover, and other requirements for survival. Thus wildlife species are products of their habitats.

To properly assess the value of wetland buffers or any other conservation/management scheme, it is important to understand the wildlife communities that may be potentially benefitted or adversely impacted by any activities that will alter the natural landscape.

The first step in this method involved developing wildlife species lists (Appendix C, Tables C.1 - C.5) based on checklists published by the Florida Game and Fresh Water Fish Commission; the Florida Breeding Bird Atlas surveys; the Rare and Endangered Biota of Florida series; several other

references; and personal knowledge. All native, vertebrate species known to breed in the Econ River Basin are listed by taxonomic class. Migrant species that are found in this area during non-breeding seasons are not included.

Of the 706 non-fish, vertebrate, native species identified by the Florida Game and Fresh Water Fish Commission to occur in the state, 214 (30%) are assumed to be present in the Econ Basin (Table 3.1 and Appendix C, Tables C.2 - C.5). The largest taxonomic class was birds and the smallest was mammals. The distribution of these species among the three Counties (Seminole, Orange, and Osceola) is fairly even.

The next step was to determine which habitat types were utilized by these species. We used many references as well as personal knowledge to compile this listing. Although all vegetation communities support large numbers of wildlife, flatwoods and hardwood hammocks have the greatest species richness (Table 3.1 and Appendix C, Tables C.6 - C.9).

Some species occur almost exclusively in only wetlands or in uplands (Table 3.2). More than 50% of the species found in the Econ Basin use both wetlands and uplands in order to satisfy their life sustaining requirements.

The range of wildlife species and their susceptibility to extinction are important criteria to consider for the development of an effective protection plan. As a result of the diverse landscape in this system, 27 non-fish species and subspecies occur here but not outside of the state (Muller et al. 1989; Tables 3.3 and 3.4). These species are endemic to the state of Florida. The number of endemics is evenly distributed across habitats.

The Nongame Section of the Florida Game and Fresh Water Fish Commission recently completed a two year project of ranking species according to biological vulnerability, extent of current knowledge of population status, and management needs. The result of this effort was a list of wildlife most in need of conservation attention in Florida (Millsap et al. 1990). According to this ranking system, 21 species are in danger of becoming extinct (imperiled; Table 3.3 and 3.5). Using this method, the most important or vulnerable habitats are xeric scrub and flatwoods.

Of all the species that occur in the basin, 21 are listed by either the U.S. Fish and Wildlife Service or the Florida Game and Fresh Water Fish Commission as endangered, threatened or special concern species (Tables 3.3 and 3.6). Flatwoods contain the largest number of listed species.

Of the 21 listed species, 52 occurrences of 8 species (not counting reports of wading bird colonies) in and near the basin have been documented (Map 3.1). Distribution patterns of this conservative data base include several bald eagle nests along the shorelines of Lakes Jessup and Harney and also along the St. Johns River. Several scrub species have been documented on the campus of the University of Central Florida and on both the north and south sides of Route 528.

Each major habitat in this basin has more than two dozen species with special ecological or legal status (endemic, imperiled, or listed; Table 3.7). More than 1/5 of all species in the Basin are either unique to Florida or are in jeopardy of becoming extinct. The greatest percentage was found in the group of species that use ephemeral wetlands.

To better understand how these communities function ecologically, feeding and breeding zones (guilds) were determined for each habitat type. The guilding technique for describing and evaluating impacts on wildlife communities was first proposed by Root (1967). He defined a guild as a group of

Table 3.1 Number of wildlife species associated with various habitats that occur within the Econ Basin.

Habitat Type	Amphibians	Reptiles	Birds	Mammals	Totals
Xeric Scrub	9	33	45	24	111
Flatwoods	14	39	79	26	158
Hardwood Hammock	15	40	71	25	151
Cypress Swamp	23	27	49	20	119
Swamp Hardwoods	23	31	52	20	126
Freshwater Marsh and River	17	21	41	16	95
Ephemeral Wetland[1]	19	-	13	-	32
Totals	**26**	**50**	**104**	**34**	**214**
	(12%)	**(23%)**	**(49%)**	**(16%)**	**(100%)**

[1] Only species that are dependent on ephemeral are included in this category.

Table 3.2 Number of wildlife species that occur almost exclusively in wetlands, that occur in both wetlands and uplands, and that occur almost exclusively in upland habitats within the Econlockhatchee River Basin. Wildlife use of the various wetland and upland habitats are shown in Appendix C, Tables C.6. - Table C.9.

Habitat Type	Amphibians	Reptiles	Birds	Mammals	Totals
Wetlands	7	4	20	4	35 (16%)
Wetland and Uplands	19	30	51	19	119 (57%)
Uplands	0	16	33	11	60 (27%)
Totals	**26**	**50**	**104**	**34**	**214** (100%)

Table 3.3 Wildlife of the Econlockhatchee River Basin that have important ecological and legal status.

	Ecological Status		
Species	Endemic[1]	Imperiled[2]	State/Fed. Status[3]
Fish			
Seminole Killifish	1		
Flagfish	1		
Amphibians			
Florida Cricket Frog	4		
Florida Chorus Frog	3		
Florida Gopher Frog		3	SSC/NL
Striped Newt	2	2	
Peninsula Newt	3		
Narrow-striped Dwarf Siren	3		
Reptiles			
American Alligator			SSC/T
Florida Snapping Turtle	4		
Florida Chicken Turtle	3		
Peninsula Cooter	3		
Florida Redbelly Turtle	2		
Florida Box Turtle	4		
Striped Mud Turtle	4		
Florida Mud Turtle	3		
Gopher Tortoise		3	SSC/NL
Florida Worm Lizard	1		
Peninsula Mole Skink	3	3	
Florida Scarlet Snake	3		
Eastern Indigo Snake		3	T/T
Florida Water Snake	4		
Rough Green Snake	3		
Florida Pine Snake		3	SSC/NL
South Florida Swamp Snake	3		
Short-tailed Snake	1	2	T/NL
Central Florida Crowned Snake	3	2	
Eastern Diamondback Rattlesnake		3	
Birds			
Little Blue Heron			SSC/NL
Snowy Egret			SSC/NL
Tricolored Heron			SSC/NL
Wood Stork			E/E
Short-tailed Hawk		1	
American Swallow-tailed Kite		2	
Southern Bald Eagle		3	T/E

Table 3.3 continued.

Species	Ecological Status		
	Endemic[1]	Imperiled[2]	State/Fed. Status[3]
Birds (continued)			
Florida Everglade Kite	4	1	E/E
Southeastern American Kestrel			T/NL
Crested Caracara		1	T/T
Limpkin			SSC/NL
Sandhill Crane	4	1	T/NL
Burrowing Owl		3	SSC/NL
Red-cockaded Woodpecker		2	T/E
Florida Scrub Jay	3	2	T/T
Mammals			
Sherman's Fox Squirrel	3	3	SSC/NL
Round-tailed Muskrat	2		
Florida Mouse	1		SSC/NL
River Otter		3	
Long-tailed Weasel	3		

[1] Endemic:
1 = species' entire distribution occurs entirely within the state of Florida.
2 = species is nearly endemic
3 = Florida subspecies of this species is endemic
4 = Florida subspecies of this species is nearly endemic

[2] Imperiled refers to the vulnerability of a species to extirpation as determined by a ranking system developed and used by the Florida Game and Fresh Water Fish Commission to assess the ecological status of 668 native vertebrate species in the state (Millsap et al. 1990).
1 = highest vulnerability indicated by a biological score $\geq$ median score for Endangered Species
2 = higher vulnerability indicated by a biological score $\geq$ median score for Threatened Species
3 = high vulnerability indicated by a biological score $\geq$ median score for Species of Special Concern

[3] State (Florida Game and Fresh Water Fish Commission)/Federal (U.S. Fish and Wildlife Service) legal status:
SSC = Species of Special Concern
T = Threatened Species
E = Endangered Species
NL = Not Listed

Table 3.4 Number of **Endemic** species and subspecies[1] associated with various habitats within the Econlockhatchee River Basin.

Habitat Type	Amphibians	Reptiles	Birds	Mammals	Totals
Xeric Scrub	1	12	2	3	18
Flatwoods	1	12	1	3	17
Hardwood Hammock	2	12	-	1	15
Cypress Swamp	5	10	-	1	16
Swamp Hardwoods	4	10	-	1	15
Freshwater Marsh and River	3	9	2	1	15
Ephemeral Wetland	5	-	-	-	5
Totals	**5**	**15**	**3**	**4**	27

[1] Endemic species and subspecies have distributions that occur entirely or almost entirely within the state of Florida.

Table 3.5 Number of **Imperiled** species[1] associated with various habitats within the Econlockhatchee River Basin.

Habitat Type	Amphibians	Reptiles	Birds	Mammals	Totals
Xeric Scrub	2	7	6	1	16
Flatwoods	1	6	7	2	16
Hardwood Hammock	-	5	4	1	10
Cypress Swamp	2	1	3	2	8
Swamp Hardwoods	-	1	3	1	5
Freshwater Marsh and River	-	-	4	1	5
Ephemeral Wetland	2	-	-	-	2
Totals	**2**	**7**	**9**	**2**	**20**

1 Imperiled species are vulnerable to extirpation as determined by a ranking system developed and used by the Florida Game and Fresh Water Fish Commission to assess the ecological status of 668 native vertebrate species in the state (Millsap et al. 1990).

Table 3.6 Number of State and Federally Listed species[1] associated with various habitats within the Econlockhatchee River Basin.

Habitat Type	Amphibians	Reptiles	Birds	Mammals	Totals
Xeric Scrub	1	4	6	2	13
Flatwoods	1	4	10	2	17
Hardwood Hammock	-	4	6	-	10
Cypress Swamp	1	1	6	-	8
Swamp Hardwoods	-	2	6	-	8
Freshwater Marsh and River	-	1	8	-	9
Ephemeral Wetland	1	-	4	-	5
Totals	**1**	**5**	**13**	**2**	**21**

[1] Listed species: endangered, threatened, and special concern species.

Table 3.7 Number of combined endemic, imperiled, and listed species[1] associated with various habitats within the Econlockhatchee River Basin.

Habitat Type	Amphibians	Reptiles	Birds	Mammals	Totals	
Xeric Scrub	2	16	6	3	27	(24%)[2]
Flatwoods	2	16	12	3	33	(22%)
Hardwood Hammock	2	16	8	2	27	(18%)
Cypress Swamp	6	11	8	2	27	(23%)
Swamp Hardwoods	4	12	8	2	27	(21%)
Freshwater Marsh and River	3	10	9	2	24	(26%)
Ephemeral Wetland	6	-	4	-	10	(31%)
Totals	**6**	**20**	**15**	**5**	**46**	

[1] Endemic species and subspecies have distributions that occur entirely or almost entirely within the state of Florida.

Imperiled species are vulnerable to extirpation as determined by a ranking system developed and used by the Florida Game and Fresh Water Fish Commission to assess the ecological status of 668 native vertebrate species in the state (Millsap et al. 1990).

Listed species: endangered, threatened, and special concern species.

[2] Percentage of the number of species that occur in each habitat type within the Econlockhatchee River Basin.

species that exploit the same class of environmental resources in a similar way. Basically, guilding is a functional as opposed to a taxonomic classification of species.

We followed an approach used most commonly by other guilding studies to identify appropriate guilds (Short and Burnham 1982, Verner 1984). We selected feeding sources and physical breeding requirements as the basis for organizing wildlife information in our guilding analysis. We then developed a simple two-dimensional species-habitat matrix with feeding resources along the y-axis and physical features of the habitat required for breeding along the x-axis. Both axes of the matrix were partitioned by physical strata, because of the importance of strata in describing the form and function of ecological communities. Seven strata were selected to describe utilization of food resources in habitats. Two additional categories, "breeds in other habitat" and "feeds in other habitat," were added to to describe situations such as semi-aquatic turtles that feed in one habitat and nest in another. This matrix resulted in a possible 64 (8 x 8) feeding and breeding combinations for each habitat type.

Appropriate feeding and breeding strata used by each species were compiled and then species were assigned to these guilds within each habitat type (Appendix C, Tables C.10 - C.15). Several species that use more than one habitat were placed in all relevant habitat matrices. However, each species was not represented more than once within each habitat type. Species such as bats, nighthawks and other that feed on on flying insects were categorized as feeding in the canopy layer.

The number of species utilizing each feeding/breeding guild block is shown in Appendix C, Figures C.1 - C.6. The number in the center of each block signifies the number of different species in that guild. The number in the upper-right corner of a block indicates the number of listed (endangered, threatened, special concern), imperiled, and endemic species in the guild (See Table 3.7).

Many species/habitat relationships can be derived from these matrices. Only some of the major interpretations are pointed out here. The ground feeding and ground breeding zones in all upland habitats are utilized by more species than other zones. Water column zones are heavily used in wetlands habitats. Tree canopies are more heavily utilized as breeding zones than feeding zones.

Trees are not as important in marshes as in other habitats, although, members of the heron family use this strata in habitats for breeding.

The next step in our analysis of habitat quantity involved assigning spatial requirement values to each species and then compiling these values for those species that almost exclusively use wetlands, those that use both wetlands and uplands, and those that almost exclusively use uplands (Appendix C, Tables C.16 - C.18). Several spatial requirement data types including the following were used: distance from humans tolerated before taking flight, home range diameter, nest location landward from the waterward extent of the forest, maximum distance found from closest water source, maximum distance from closest water to nest, and distance between captures of the same individual. If spatial requirement data were not found for a species, values were assigned from species that are closely related, similar-sized, found in comparable habitats, and categorized in corresponding guilds. Spatial data varied even within species. Whenever available, ranges of home range values and other spatial data are provided in the tables. All information obtained from the literature are presented as linear distances. Other data formats such as home range area were transformed to linear distances (e.g. diameter of home range).

These values represent distances required by individuals within a species. Much larger areas would be necessary to accommodate the spatial needs of viable populations.

The consequences of providing protection zones of different widths can be estimated by comparing a proposed width with the values presented for various species. For example, a 550 foot wide protection zone measured landward from the edge of the river would provide enough wetland habitat for the river otter because its normal movement patterns parallel the river channel (Figure 3.1). The data also support the assumption that the hooded warbler's needs would be satisfied. The northern parula warbler has relatively small area requirements but would have to have access to some uplands. The data do not provide any evidence that the yellow rat snake would be able to continue to survive within a protection zone of only 550 feet. Also, a protection zone that included only wetlands would not address the needs of species such as the red-headed woodpecker that occur almost exclusively in uplands. Although the river probably does not present much of a barrier to the red-shouldered hawk, its spatial needs are much greater than a 550 foot protection zone on either side of the river would provide.

Although these data were not obtained from animals living in the Econ River Basin, they are applicable. These spatial values are credible and believable as evidenced by the fact that most were published in scientific journals reviewed by peers. Determining the appropriate dimensions of a protection zone necessary to provide adequate habitat for wildlife without consideration of these values would be arbitrary.

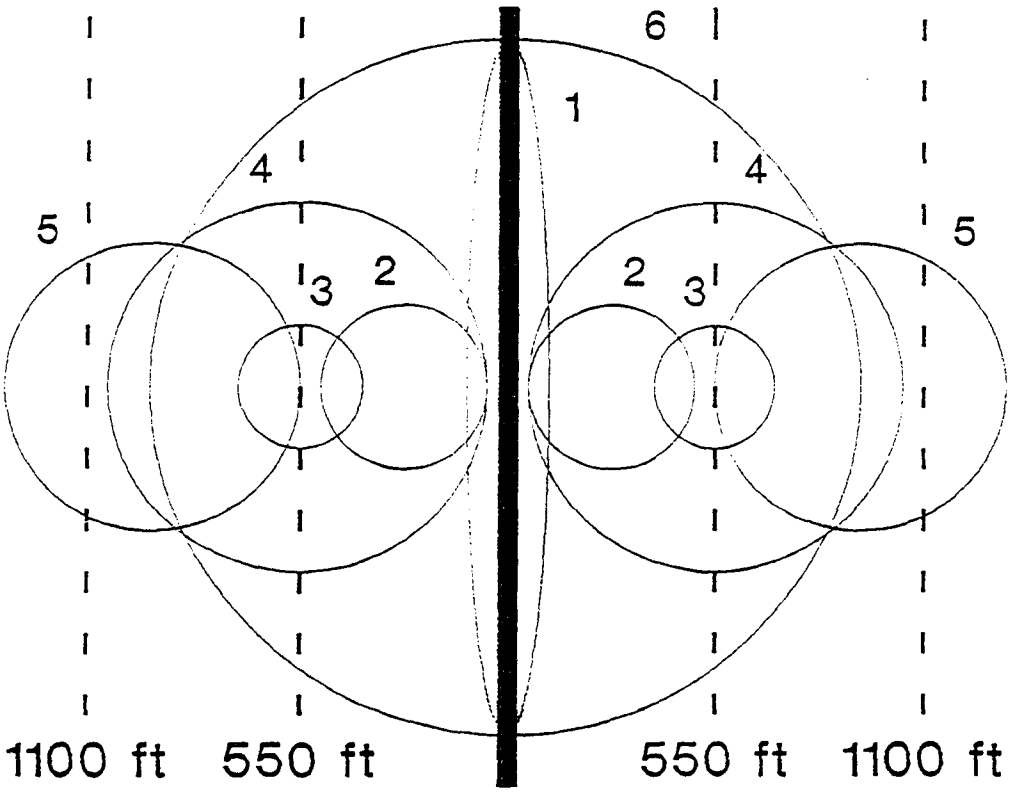


Figure 3.1. Home ranges of various wildlife species overlaid onto a schematic Econlockhatchee River Basin map featuring the 550- and 1100-foot proposed protection zone designations where:

1 = river otter (wetland species with linear home range)
2 = hooded warbler (wetland species)
3 = northern parula warbler (wetland and upland species with small home range)
4 = yellow rat snake (wetland and upland species with large home range)
5 = red-headed woodpecker (upland species)
6 = red-shouldered hawk (wetland and upland species with large home range encompassing both sides of the river)

MANAGEMENT ALTERNATIVES

Managing Natural Resources

A management and protection plan that will effectively preserve the wildlife integrity of the Econ Basin should address the issues discussed earlier in this section: habitat fragmentation, wildlife corridor misconceptions, decrease in landscape diversity, reduction in habitat quality, impacts of adjacent land use, and impacts of public recreation. Some general principles that form the basis for prudent wildlife management decisions in urbanizing areas follow.

Setting aside large areas of contiguous natural habitat as wildlife preserves is an effective and cost efficient way to maintain viable populations of many species. However, minimum viable population levels are dangerously close to extinction and should not be considered as bottom line constraints in land-use decisions. If the intent of creating preserves is to prevent extinction of species from an area, then specific standards should be set to higher, ecologically functional levels rather than minimum viable levels.

A broad, holistic perspective is more biologically sound and provides greater access to uplands than a site by site approach. The most serious problem confronting Florida's wildlife is fragmentation of natural habitat areas into small, isolated parcels that are not large enough to sustain viable populations. Growth management decisions must focus on maintaining the biotic integrity of systems by designing areas that will perpetuate functional communities and not merely token remnants. If management concerns are directed only toward endangered animals, many other species will suffer from lack of consideration and eventually will be deserving of endangered status.

Wildlife species in the Econ Basin occur in aquatic, wetland, and upland habitats. Some such as fishes and sirens are restricted to aquatic environments. Eastern mud snakes, prothonotary warblers, and marsh rabbits occur primarily in wetlands. Others including scrub jays, Bachman's sparrow and red-cockaded woodpeckers are found only in uplands. Many species use a variety of habitats to satisfy their needs. A protection plan that adequately addresses the requirements for all species in the Basin would delineate sufficient aquatic, wetland, and upland habitats to at least maintain viable populations (about 150 individuals/species).

About 35 wildlife species in the Basin occur almost exclusively in aquatic and wetland habitats. Many other species such as wading birds also are highly dependent on these habitats. A variety of flowing and isolated open water areas are found in the Basin. These species can be protected best by assuring good water quality, and maintaining natural water quantity levels and hydroperiods in the Econ River, its tributaries, and isolated wetlands in the Basin.

About 119 wildlife species occur in both wetlands and uplands. These species usually need access to aquatic and upland environments to satisfy some of their food and cover requirements. Many wetland-dependent wildlife will not be able to survive in areas where access to upland areas is not

available. They will be deprived of critical nesting and feeding resources provided by these habitats. For example, several semi-aquatic turtles need upland soils to dig their nests and to sometimes overwinter.

Spatial needs for individuals of various wetland-dependent species found in the Econ Basin were presented in Appendix C, Tables C.16 - C.18. These needs were based on home range sizes, flushing distances, minimum forest habitat widths, nest locations landward from the waterward extent of forest, and other similar data available in the literature.

In some places, wetland habitats on each side of the Econ River are generally wider than 550 feet. The length of this contiguous habitat partially compensates for the width not accommodating spatial needs of all species. This amount of wetland habitat and the availability of adjacent uplands makes it an ideal preservation area for viable populations of wetland-dependent wildlife associated with flowing water systems. Spatial needs for species associated with permanent and ephemeral isolated wetlands can be satisfied by the wetlands contained in the Econlockhatchee Swamp, and the proposed acquisition and corridor areas.

About 60 wildlife species are upland-dependent. Uplands including unique sand pine scrub habitats occur in a variety of locations throughout the Basin. The most efficient use of land for upland wildlife protection would be to locate an upland preserve adjacent to the wetland preserve. This design would: (1) help to buffer the adverse impacts of development and other human-related activities on the wetlands, (2) provide upland habitat needed by some wetland-dependent wildlife, and (3) satisfy requirements for upland-dependent wildlife. An upland conservation area along the entire main branch of the Big Econ and along the Little Econ north of University Avenue of at least 550 feet is needed to protect upland wildlife from extinction. This conservation area does not apply to the tributaries of the Econ River.

All of the scrub/sandhill habitats are rapidly disappearing in Econ Basin and consequently many wildlife species associated with these habitats are probably close to extinction in this area. Acquisition of remaining scrub areas and connectors to the Econ River preservation/conservation zones should be a high priority.

Because the recommended preservation/conservation design is relatively narrow and will somewhat restrict wildlife movements compared to occurrences in the natural landscape, several linkages between the Econ River and larger habitats to the East should be established. These wildlife corridors will allow alternate dispersal routes and a less restricted exchange of genetic material from other populations. The best locations for these linkages are along Highways 50 and 528.

There does not appear to be viable populations of black bear or panther in the Econ Basin, although several sightings have been reported. The need for wildlife corridors still exists. Safe travel is necessary to maintain high levels of variation in the gene pools and to replace animals that die from various causes. Animals do not use travel corridors the same way people use highways only to get from one place to another. Wildlife feed and seek shelter while using their corridors. Therefore, these travel lanes must contain useful resources for species and must also be wide enough to be relatively free from obstacles and disturbances. Major East-West highways such as Routes 420, 50, and 528 have divided the Basin into four large habitat blocks. These roads are serious obstacles to North-South animal movements along the Econ River. Their effectiveness as barriers increases as urban sprawl travels down

these infrastructures. Highways also are responsible for significant mortality rates of many species. Safe travel is necessary to maintain high levels of variation in the gene pools and to replace animals that die from various causes. Wildlife underpasses similar to those implemented along Alligator Alley should be designed and implemented. These underpasses should be wide enough to substantially reduce disturbances from encroaching development along the highways.

Most wildlife species depend on a diversity of vegetation types to obtain their essential requirements. Their needs and corresponding movements may change seasonally or more frequently. All areas of the Econ Basin have been altered at one time or another. There are not any pristine habitats. However, disturbance in some areas has been minimal. Other habitats have not been altered for many years and on a small scale show little signs of modification. Areas where construction has not occurred and where there are no asphalt roads and building have the potential to be reverted into natural areas. Pastures that have been intensively grazed and timber areas that have been harvested still contain much of the original seed bank and in time can grow back into the natural communities that once occupied the site. Silvicultural and agricultural practices within the delineated preserve will create large open areas that will fragment the forest canopy and reduce the amount of protection for species that are strictly forest-dwelling animals and are sensitive to disturbances of this nature.

It is easy sometimes for the nonscientific community to develop misconceptions about the status of wildlife communities. Florida and the Econ Basin are home to a variety of species. Some of these, are generalists and quite well adapted to any abrupt changes that may occur in their environment. Others are extremely sensitive to the slightest modifications. A great number of easily observed species in an area does not necessarily mean that the ecosystem is healthy and not experiencing problems. Sensitive species that are most adversely affected by development are not as obvious. Cursory surveys will not reveal their presence. Only 8 of the 21 listed species that are assumed to occur in the Econ Basin have been documented.

Allowing recreation and public use of public lands that have been set aside primarily to protect the natural resources on these lands can sometimes degrade habitats and disturb wildlife to the extent that the intended protection is lost. Designing the development of trails and other recreational facilities should be considered as part of the overall management and protection plan for the resources on the area. Human activities must be controlled so they will not adversely impact wildlife. Access to sensitive areas is not necessary for visitors to enjoy an outdoor experience.

Managing Development Impacts

Proactive comprehensive planning approaches will prevent additional development impacts from occurring in the Econ Basin. Responding to individual DRI's and negotiating reasonable compromises on a site by site basis will not achieve the level of management necessary to protect the biotic integrity of the larger system. The focus should be on the entire Basin and the time should be now.

A complete management program that will provide the best protection for the wildlife resources of the Econ Basin, and also avoid negative impacts and costly mistakes will execute the following recommendations.

1) Apply buffers (development set-backs) to all wetlands within the Basin. See Brown et al. (1990) for the methodology to determine buffers.

2) Develop and implement a management scheme (e.g. prescribed burning) that will help to maintain the best landscape diversity and habitat values.

3) Develop and implement standards for land use adjacent to this preserve that prohibit activities that are not compatible with wildlife protection objectives.

4) Develop a landscape ordinance that requires the use of plants indigenous to communities in the Basin and restricts the removal of understory vegetation so that developed areas will blend into the natural areas in the preserve.

5) Develop standards for storm water control ponds that include the use of native emergent vegetation, littoral zones, and native vegetation along the shore so that these ponds also will serve an ecological function.

6) Develop educational programs and additional incentives that will encourage pet owners to keep their cats and dogs confined to their property.

SUMMARY AND RECOMMENDATIONS

Summary and Recommendations

A management and protection plan that will effectively preserve the wildlife integrity of the Econ Basin should address the following issues: habitat fragmentation, wildlife corridor misconceptions, decrease in landscape diversity, reduction in habitat quality, impacts of adjacent land use, impacts of public recreation, impacts of cattle grazing, and impacts of silviculture. Until a plan is formalized, a moratorium on development in the Basin would assure that remaining critical habitat areas will not be lost.

Many of the habitats in the Basin already have been fragmented or reduced in size. Highways and several other land uses are interfering with wildlife movements. The corridor linkages to Lakes Jessup and Harney, the Tosohatchee State Preserve, and the Lake Conlin Swamp area have been partially severed. Installing underpasses at appropriate locations in the major highways that intersect the Basin will help to resurrect these natural travel lanes.

Important wildlife habitat areas need to be delineated and protected from the adverse impacts of future development. A broad, holistic perspective is more biologically sound and provides greater access to uplands than a site by site approach. The most serious problem confronting Florida's wildlife is fragmentation of natural habitat areas into small, isolated parcels that are not large enough to sustain viable populations. Growth management decisions must focus on maintaining the biotic integrity of systems by designing areas that will perpetuate functional communities and not merely token remnants. If management concerns are directed only toward endangered animals, many other species will suffer from lack of consideration and will eventually be deserving of endangered status.

Buffers for wildlife should be incorporated into all wetland systems. This will provide travel corridors for animals and also protect valuable habitat resources.

The primary objective for any public lands in the Basin should be the protection of the natural integrity of the Basin. Park development and accompanying human activities should be prohibited unless scientific evidence supports such decisions. Most studies reviewed in this report suggested that outdoor, nonconsumptive recreation can be extremely detrimental to wildlife. More research is desperately needed to form the basis for proper multiple use management. If the required protection is not effectively provided on private or public lands, the natural integrity of all systems will be lost. Sensitive species that need large undisturbed areas will continue to follow the path toward extinction.

Limitations and Suggestions for Further Study

The short time frame for this study did not allow a thorough assessment of the wildlife resources in the Econ Basin. The most accurate method of determining current baseline data on wildlife species within the Basin would be through systematic species' surveys. The need for this is exemplified by the fact that only 8 of the 21 listed (endangered, threatened, and special concern) species that are assumed to occur in the Basin have been documented. The cursory surveys that are conducted during DRI proposal preparation would be unlikely to document species such as the gopher frog and indigo snake. A systematic survey schedule for all classes of wildlife in different community types would take at least one year. Data obtained from these surveys would greatly reduce the assumptions upon which decisions determining the fate of the Basin's wildlife resources will be based.

During the next project phase, values will be assigned to several habitat evaluation criteria. As time allows, these values will be compiled and digitized for randomly selected vegetation communities in the Basin. A comparison of total values for each community will help to identify important wildlife habitat systems. This process will provide an objective, quantified, defensible bases for delineating wildlife preservation areas and developing an effective protection plan for the Econ Basin wildlife resources. The application of this method will provide an objective, quantitative approach to delineating a wildlife preserve system. However, several months would be required to make necessary calculations, digitize data, and produce overlays on a GIS system.

The impacts of recreation on wildlife are not well known. More specific information on the effects of various recreational activities on wildlife are needed to provide the basis of prudent multiple use decisions. Several studies have documented flushing distances of visible wildlife in open habitats. But very little is known about the effects of development and use of passive recreational facilities on wildlife that are not as obvious in a forested environment. An ideal study design to investigate this relationship would include collecting baseline data on (1) independent variables such as habitat characteristics and human activities, and (2) wildlife species composition, diversity, and density prior to park development. Periodic follow-ups will reveal any relationships between changes in the independent and dependent variables.

The wildlife habitat values of small "Conservation Areas" on development sites is unknown. A study designed to determine the benefits of various set asides would help developers and development review teams to plan more efficient uses of land. This could be accomplished by comparing wildlife survey data obtained in various set asides with independent set aside variables such size, habitat type, insularity, and quality of adjacent areas.

Highways and roads are major obstacles to wildlife movement and are primary causes of mortality for some species. The construction of underpasses has been proposed many times as a method to reduce these problems. However, no studies have determined the effectiveness of various underpass designs. This could be investigated by selecting several types of underpasses and conducting wildlife surveys at the highway underpasses. The different types of underpass designs could be analyzed as separate treatments in an analysis of the data.

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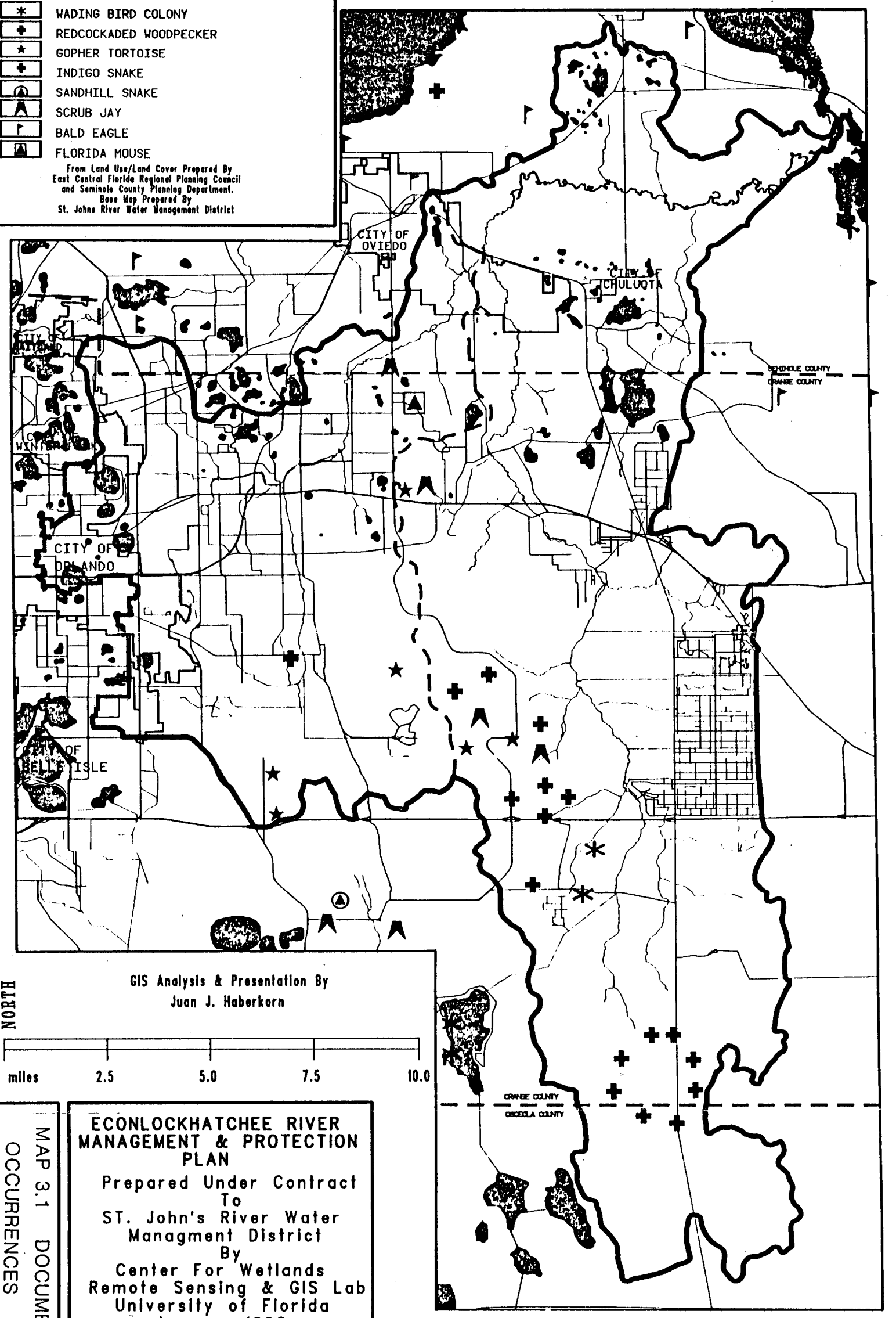
MAP LEGEND:

DOCUMENTED WILDLIFE SPECIES

- WADING BIRD COLONY
- REDCOCKADED WOODPECKER
- GOPHER TORTOISE
- INDIGO SNAKE
- SANDHILL SNAKE
- SCRUB JAY
- BALD EAGLE
- FLORIDA MOUSE

From Land Use/Land Cover Prepared By
East Central Florida Regional Planning Council
and Seminole County Planning Department.
Base Map Prepared By
St. Johns River Water Management District



GIS Analysis & Presentation By
Juan J. Haberkorn

MAP 3.1 DOCUMENTED OCCURRENCES OF LISTED WILDLIFE SPECIES

ECONLOCKHATCHEE RIVER MANAGEMENT & PROTECTION PLAN

Prepared Under Contract
To
ST. John's River Water
Managment District
By
Center For Wetlands
Remote Sensing & GIS Lab
University of Florida
January 1990

MARK T. BROWN
CENTER FOR WETLANDS
UNIVERSITY OF FLORIDA

RICHARD HAMANN/JOHN TUCKER
CENTER FOR GOVERNMENTAL
RESPONSIBILITY
UNIVERSITY OF FLORIDA

JOSEPH SCHAEFER
URBAN WILDLIFE PROGRAM
DEPT. OF WILDLIFE & RANGE SCIENCES
IFAS, UNIVERSITY OF FLORIDA

LUCY WAYNE & MARTIN DICKINSON
SOUTHARC, INC.
P.O. BOX 1702
GAINESVILLE, FL. 32602

Appendix C

WILDLIFE SPECIES LIST FOR THE ECONLOCKHATCHEE RIVER BASIN

Table C.1. **FRESHWATER FISH** of the Econlockhatchee River Basin.[1]

Lamprey Family
Sea Lamprey, (Petromyzon marinus)

Stingray Family
Atlantic Stingray, (Dasyatis sabina)

Gar Family
Longnose Gar, (Lepisosteus osseus)
Florida Gar, (Lepisosteus platyrhincus)

Herring and Shad Family
Gizzard Shad, (Dorosoma cepedianum)
Threadfin Shad, (Dorosoma pentenense)

Minnow and Carp Family
Golden Shiner, (Notemigonus crysoleucas)
Pugnose Minnow, (Notropis emiliae)
Taillight Shiner, (Notropis maculatus)
Coastal Shiner, (Notropis petersoni)

Sucker Family
Lake Chubsucker, (Erimyzon sucetta)

Freshwater Catfish Family
White Catfish, (Ictalurus catus)
Yellow Bullhead, (Ictalurus natalis)
Southern Brown Bullhead, (Ictalurus nebulosus marmoratus)
Channel Catfish, (Ictalurus punctatus)
Tadpole Madtom, (Noturus gyrinus)
Freckled Madtom, (Notorus nocturnus)

Pirate Perch Family
Pirate Perch, (Aphredoderus savanus)

Needlefish Family
Atlantic Needlefish, (Strongylura marina)

Killifish Family
Golden Topminnow, (Fundulus chrysotus)
Marsh Killifish, (Fundulus confluentus)
Seminole Killifish, (Fundulus seminolis)
Flagfish, (Jordanella floridae)
Bluefin Killifish, (Lucania goodei)
Rainwater Killifish, (Lucania parva)

Live-bearer Family
Least Killifish, (Heterandria formosa)
Sailfin Molly, (Poecilia latipinna)

Table C.1. Freshwater fish (continued).

Silverside Family
Southern Brook Silverside, (Labidesthes sicculus vanhyningi)
Inland Silverside, (Menidia beryllina)

Sunfish Family
Everglades Pigmy Sunfish, (Elassoma evergladei)
Bluespotted Sunfish, (Enneacanthus gloriosus)
Banded Sunfish, (Enneacanthus obesus)
Redbreast Sunfish, (Lepomis auritus)
Warmouth, (Lepomis gulosus)
Bluegill, (Lepomis macrochirus)
Dollar Sunfish, (Lepomis marginatus)
Reddear Sunfish, (Lepomis microlophus)
Spotted Sunfish, (Lepomis punctatus)
Florida Largemouth Bass, (Micropterus salmoides floridanus)
Black Crappie, (Pomoxis nigromaculatus)

Perch and Darter Family
Swamp Darter, (Etheostoma proeliare)
Blackbanded Darter, (Percina migrofasciata)

Temperate Bass Family
Striped Bass, (Morone saxatilis)

Sole Family
Hogchoker, (Trinectes maculatus)

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[1] It is assumed that all of the fresh water fish occur in all three counties (Seminole, Orange, and Osceola).

Table C.2. Occurrence of **AMPHIBIANS** in the Econlockhatchee River Basin by County.

Species	Counties		
	Seminole	Orange	Osceola
Toad Family			
Oak Toad, (Bufo quercicus)	x	x	
Southern Toad, (Bufo terrestris)	x	x	x
Treefrog Family			
Florida Cricket Frog, (Acris gryllus dorsalis)	x	x	x
Green Treefrog, (Hyla cinerea)	x	x	x
Southern Spring Peeper, (Hyla crucifer bartramiana)		x	
Pinewoods Treefrog, (Hyla femoralis)	x	x	x
Barking Treefrog, (Hyla gratiosa)	x	x	
Squirrel Treefrog, (Hyla squirella)	x	x	
Little Grass Frog, (Limnaoedus ocularis)	x	x	x
Florida Chorus Frog, (Pseudacris nigrita verrucosa)	x	x	
Narrowmouth Toad Family			
E. Narrowmouth Toad, (Gastrophryne carolinensis)	x	x	x
Spadefoot Toad Family			
Eastern Spadefoot Toad, (Scaphiopus holbrooki)		x	x
True Frogs			
Florida Gopher Frog, (Rana areolata aesopus)	x	x	x
Bullfrog, (Rana catesbeiana)	x	x	
Pig Frog, (Rana grylio)		x	x
Southern Leopard Frog, (Rana utricularia)	x	x	
Amphiuma Family			
Two-toed Amphiuma, (Amphiuma means)	x	x	x
Lungless Salamander Family			
Southern Dusky Salamander, (Desmognathus auriculatus)	x	x	
Dwarf Salamander, (Eurycea quadridigitata)	x	x	x
Slimy Salamander, (Plethodon glutinosus glutinosus)	x	x	
Rusty Mud Salamander, (Pseudotriton montanus floridanus)	x	x	
Newt Family			
Striped Newt, (Notophthalmus perstriatus)	x		
Peninsula Newt, (Notophthalmus viridescens piaropicola)	x	x	x
Siren Family			
Narrow-striped Dwarf Siren, (Pseudobranchus striatus axanthus)		x	
Eastern Lesser Siren, (Siren intermedia intermedia)	x	x	
Greater Siren, (Siren lacertina)		x	

Table C.3. Occurrence of **REPTILES** in the Econlockhatchee River Basin by County.

Species	Counties		
	Seminole	Orange	Osceola
Alligator Family			
American Alligator, (Alligator mississippiensis)	x	x	x
Snapping Turtle Family			
Florida Snapping Turtle, (Chelydra serpentina osceola)			x
Box and Water Turtle Family			
Florida Chicken Turtle, (Deirochelys reticularia chrysea)			x
Peninsula Cooter, (Pseudemys floridana peninsularis)	x		x
Florida Redbelly Turtle, (Pseudemys nelsoni)	x		
Florida Box Turtle, (Terrapene carolina bauri)	x	x	x
Mud and Musk Turtle Family			
Striped Mud Turtle, (Kinosternon bauri)		x	x
Florida Mud Turtle, (Kinosternon subrubrum steindachneri)		x	x
Loggerhead Musk Turtle, (Sternotherus minor)	x	x	
Stinkpot, (Sternotherus odoratus)	x	x	
Tortoise Family			
Gopher Tortoise, (Gopherus polyphemus)	x		
Softshell Turtle Family			
Florida Softshell, (Trionyx ferox)	x	x	x
Worm Lizard Family			
Florida Worm Lizard, (Rhineura floridana)		x	
Glass Lizard Family			
Eastern Slender Glass Lizard, (Ophisaurus attenuatus longicaudus)		x	
Iguanid Family			
Green Anole, (Anolis carolinensis)	x	x	x
Southern Fence Lizard, (Sceloporus undulatus undulatus)	x	x	x
Skink Family			
Peninsula Mole Skink, (Eumeces egregius onocrepis)	x	x	
Southeastern Five-lined Skink, (Eumeces inexpectatus)	x	x	x
Broadhead Skink, (Eumeces laticeps)		x	
Ground Skink, (Scincella lateralis)	x	x	x
Whiptail Family			
Six-lined Racerunner, (Cnemidophorus sexlineatus sexlineatus)		x	x

Table C.3. Reptiles by County (continued)

Species	Counties		
	Seminole	Orange	Osceola
Colubrid Family			
Florida Scarlet Snake, (Cemophora coccinea coccinea)	x	x	
Southern Black Racer, (Coluber constrictor priapus)	x	x	x
Southern Ringneck Snake, (Diadophis punctatus punctatus)	x	x	x
Eastern Indigo Snake, (Drymarchon corais couperi)	x	x	x
Corn Snake, (Elaphe guttata guttata)	x	x	
Yellow Rat Snake, (Elaphe obsoleta quadrivittata)	x		
Eastern Mud Snake, (Farancia abacura abacura)	x	x	
Eastern Hognose Snake, (Heterodon platyrhinos)	x	x	x
Kingsnake, (Lampropeltis getulus)	x	x	x
Scarlet Kingsnake, (Lampropeltis triangulum elapsoides)		x	x
Eastern Coachwhip, (Masticophis flagellum flagellum)	x	x	
Green Water Snake, (Nerodia cyclopion)		x	x
Florida Water Snake, (Nerodia fasciata pictiventris)	x	x	x
Brown Water Snake, (Nerodia taxispilata)	x	x	x
Rough Green Snake, (Opheodrys aestivus)		x	
Florida Pine Snake, (Pituophis melanoleucus mugitus)	x	x	
Striped Crayfish Snake, (Regina alleni)		x	x
Pine Woods Snake, (Rhadinaea flavilata)	x	x	x
South Florida Swamp Snake, (Seminatrix pygaea cyclas)			x
North Florida Swamp Snake, (Seminatrix pygaea pygaea)	x	x	
Short-tailed Snake, (Stilosoma extenuatum)		x	
Florida Brown Snake, (Storeria dekayi victa)	x	x	x
Central Florida Crowned Snake, (Tantilla relicta neilli)	x	x	x
Penninsula Ribbon Snake, (Thamnophis sauritus sackeni)		x	x
Eastern Garter Snake, (Thamnophis sirtalis sirtalis)	x	x	x
Coral Snake Family			
Eastern Coral Snake, (Micrurus fulvius fulvius)	x	x	x
Viper Family			
Florida Cottonmouth, (Agkistrodon piscivorus conanti)	x	x	x
Eastern Diamondback Rattlesnake, (Crotalus adamanteus)	x	x	x
Dusky Pigmy Rattlesnake, (Sistrurus miliarius barbouri)	x	x	

Table C.4. Occurrence of **BIRDS** in the Econlockhatchee River Basin by County. Species that are present only during the non-breeding season are not included.

Species	Counties		
	Seminole	Orange	Osceola
Grebe Family			
Pied-bill Grebe, (Podilymbus podiceps)	x	x	x
Cormorant Family			
Double-crested Cormorant, (Phalacrocorax auritus)	x	x	x
Darter Family			
Anhinga, (Anhinga anhinga)	x	x	x
Bittern and Heron Family			
Great Blue Heron, (Ardea herodias)	x	x	x
Cattle Egret, (Bubulcus ibis)	x	x	x
Green-backed Heron, (Butorides striatus)	x	x	x
Great Egret, (Casmerodius albus)	x	x	x
Little Blue Heron, (Egretta caerulea)	x	x	x
Snowy Egret, (Egretta thula)	x	x	x
Tricolored Heron, (Egretta tricolor)	x	x	x
American Bittern, (Botaurus lentiginosus)	x	x	x
Eastern Least Bittern, (Ixobrychus exilis exilis)		x	
Black-crowned Night Heron, (Nycticorax nycticorax)	x	x	x
Yellow-crowned Night Heron, (Nycticorax violaceus)	x	x	x
Ibis and Spoonbill Family			
White Ibis, (Eudocimus albus)	x	x	x
Stork Family			
Wood Stork, (Mycteria americana)	x	x	x
Goose and Duck Family			
Wood Duck, (Aix sponsa)	x	x	x
Mottled Duck, (Anas fulvigula)	x	x	x
Mallard Duck, (Anas platyrhynchos)	x	x	x
Ring-necked Duck, (Aythya collaris)	x	x	x
Fulvous Whistling Duck, (Dendrocygna bicolor)	x	x	x
Vulture Family			
Turkey Vulture, (Cathartes aura)	x	x	x
Black Vulture, (Coragyps atratus)	x	x	x

Table C.4. Birds by County (continued).

Species	Counties		
	Seminole	Orange	Osceola
Kite, Eagle, and Hawk Family			
Cooper's Hawk, (Accipiter cooperii)	x	x	x
Short-tailed Hawk, (Buteo brachyurus)	x	x	x
Red-tailed Hawk, (Buteo jamaicensis)	x	x	x
Red-shouldered Hawk, (Buteo lineatus)	x	x	x
Broad-winged Hawk, (Buteo platypterus)	x	x	x
Northern Harrier, (Circus cyaneus)	x	x	x
American Swallow-tailed Kite, (Elanoides forficatus)	x	x	x
Southern Bald Eagle, (Haliaeetus l. leucocephalus)	x	x	x
Osprey, (Pandion haliaetus)	x	x	x
Florida Everglade Kite, (Rostrhamus sociabilis plumbius)	x	x	x
Caracara and Falcon Family			
Southeastern American Kestrel, (Falco sparverius pavlus)	x	x	x
Crested Caracara, (Polyborus plancus)			x
Turkey and Quail Family			
Northern Bobwhite, (Colinus virginianus)	x	x	x
Wild Turkey, (Meleagris gallopavo)	x	x	x
Rail, Gallinule, and Coot Family			
American Coot, (Fulica americana)	x	x	x
Common Moorhen, (Gallinula chloropus)	x	x	x
Purple Gallinule, (Porphyrula martinica)	x	x	x
King Rail, (Rallus elegans)	x	x	x
Limpkin Family			
Limpkin, (Aramus guarauna)	x	x	x
Crane Family			
Sandhill Crane, (Grus canadensis pratensis)	x	x	x
Plover Family			
Killdeer, (Charadrius vociferus)	x	x	x
Stilt Family			
Black-necked Stilt, (Himantopus mexicanus)	x	x	x
Pigeon and Dove Family			
Common Ground Dove, (Columbina passerina)	x	x	x
Mourning Dove, (Zenaida macroura)	x	x	x

Table C.4. Birds by County (continued).

Species	Counties		
	Seminole	Orange	Osceola
Cuckoo Family			
Yellow-billed Cuckoo, (Coccyzus americanus)	x	x	x
Barn-owl Family			
Common Barn Owl, (Tyto alba)	x	x	x
Typical Owl Family			
Burrowing Owl, (Athene cunicularia)		x	x
Great Horned Owl, (Bubo virginianus)	x	x	x
Eastern Screech Owl, (Otus asio)	x	x	x
Barred Owl, (Strix varia)	x	x	x
Nightjar Family			
Chuck-will's-widow, (Caprimulgus carolinensis)	x	x	x
Common Nighthawk, (Chordeiles minor)	x	x	x
Swift Family			
Chimney Swift, (Chaetura pelagica)	x	x	x
Hummingbird Family			
Ruby-throated Hummingbird, (Archilochus colubris)	x	x	x
Kingfisher Family			
Belted Kingfisher, (Cervle alcyon)	x	x	
Woodpecker Family			
Common Flicker, (Colaptes auratus)	x	x	x
Pileated Woodpecker, (Dryocopus pileatus)	x	x	x
Red-bellied Woodpecker, (Melanerpes carloinus)	x	x	x
Red-headed Woodpecker, (Melanerpes erythocephalus)	x	x	x
Red-cockaded Woodpecker, (Picoidus borealis)	x	x	x
Downy Woodpecker, (Picoidus pubescens)	x	x	x
Hairy Woodpecker, (Picoides villosus)	x	x	x
Flycatcher Family			
Acadian Flycatcher, (Empidonax virescens)	x	x	x
Great Crested Flycatcher, (Myiarchus crinitus)	x	x	x
Eastern Kingbird, (Tyrannus tyrannus)	x	x	x
Swallow Family			
Purple Martin Swallow, (Progne subis)	x	x	x
Northern Rough-winged Swallow, (Stelgidopteryx serripennis)	x	x	x

Table C.4. Birds by County (continued).

Species	Counties		
	Seminole	Orange	Osceola
Jay and Crow Family			
Florida Scrub Jay, (Aphelocoma coerulescens coerulescens)	x	x	x
American Crow, (Corvus brachyrhynchos)	x	x	x
Fish Crow, (Corvus ossifragus)	x	x	x
Blue Jay, (Cyanocitta cristata)	x	x	x
Titmouse Family			
Tufted Titmouse, (Parus bicolor)	x	x	x
Carolina Chickadee, (Parus carolinensis)	x	x	x
Nuthatch Family			
Brown-headed Nuthatch, (Sitta pusilla)	x	x	x
Wren Family			
Carolina Wren, (Thryothorus ludovicianus)	x	x	x
Old World Warbler and Kinglet Family			
Blue-gray Gnatcatcher, (Polioptila caerulea)	x	x	x
Eastern Bluebird, (Sialia sialis)	x	x	x
Mimic Thrush Family			
Northern Mockingbird, (Mimus polyglottos)	x	x	x
Brown Thrasher, (Toxostoma rufum)	x	x	x
Shrike Family			
Loggerhead Shrike, (Lanius ludovicianus)	x	x	x
Vireo Family			
Yellow-throated Vireo, (Vireo flavifrons)	x	x	x
White-eyed Vireo, (Vireo griseus)	x	x	x
Red-eyed Vireo, (Vireo olivaceus)	x	x	x
Wood Warbler Subfamily			
Yellow-throated Warbler, (Dendroica dominica)	x	x	x
Palm Warbler, (Dendroica palmarum)	x	x	x
Pine Warbler, (Dendroica pinus)	x	x	x
Common Yellowthroat, (Geothylpis trichas)	x	x	x
Northern Parula Warbler, (Parula americana)	x	x	x
Prothonotary Warbler, (Protonotaria citrea)	x	x	
Hooded Warbler, (Wilsonia citrina)	x	x	x
Tanager Subfamily			
Summer Tanager, (Piranga rubra)	x	x	x

Table C.4. Birds by County (continued).

Species	Counties		
	Seminole	Orange	Osceola
Cardinal Subfamily			
Northern Cardinal, (Cardinalis cardinalis)	x	x	x
Blue Grosbeak, (Guiraca caerulea)	x	x	x
Painted Bunting, (Passerina ciris)	x	x	
Towhee and Sparrow Subfamily			
Bachman's Sparrow, (Aimophila aestivalis)	x	x	x
Rufous-sided Towhee, (Pipilo erythrophthalmus)	x	x	x
Blackbird and Oriole Subfamily			
Red-winged Blackbird, (Agelaius phoeniceus)	x	x	x
Orchard Oriole, (Icterus spurius)	x	x	
Brown-headed Cowbird, (Molothrus ater)	x	x	x
Boat-tailed Grackle, (Quiscalus major)	x	x	x
Common Grackle, (Quiscalus quiscula)	x	x	x
Eastern Meadowlark, (Sturnella magna)	x	x	x

Table C.5. Occurrence of MAMMALS in the Econlockhatchee River Basin by County.

Species	Counties		
	Seminole	Orange	Osceola
Opossum Family			
Opossum, (Didelphis virginiana)	x	x	x
Shrew Family			
Least Shrew, (Cryptotis parva)	x	x	x
Southeastern Shrew, (Sorex longirostris longirostris)	x	x	x
Mole Family			
Eastern Mole, (Scalopus aquaticus)	x	x	x
Twilight Bat Family			
Big Brown Bat, (Eptesicus fuscus)	x	x	x
Red Bat, (Lasiurus borealis)	x	x	x
Hoary Bat, (Lasiurus cinereus cinereus)		x	
Yellow Bat, (Lasiurus intermedius)	x	x	x
Evening Bat, (Nycticeius humeralis)	x	x	x
Eastern Pipstrelle Bat, (Pipistrellus subflavus)	x	x	x
Rafinesque's Big-eared Bat, (Plecotus rafinesquii)	x	x	x
Free-tailed Bat Family			
Brazilian Free-tailed Bat, (Tadarida brasiliensis)	x	x	x
Armadillo Family			
Nine-banded Armadillo, (Dasypus novemcinctus)	x	x	x
Rabbit Family			
Eastern Cottontail Rabbit, (Sylvilagus floridanus)	x	x	x
Marsh Rabbit, (Sylvilagus palustris)	x	x	x
Squirrel Family			
Southern Flying Squirrel, (Glaucomys volans)	x	x	x
Gray Squirrel, (Sciurus carolinensis)	x	x	x
Fox Squirrel, (Sciurus niger)	x	x	x
Sherman's Fox Squirrel, (Sciurus niger shermanii)	x	x	x
Pocket Gopher Family			
Southeastern Pocket Gopher, (Geomys floridana)	x	x	x
New World Rats, Mice, and Voles Family			
Round-tailed Muskrat, (Neofiber alleni)	x	x	x
Marsh Rice Rat, (Oryzomys palustris)	x	x	x
Florida Mouse, (Peromyscus floridanus)	x	x	x
Cotton Mouse, (Peromyscus gossypinus)	x	x	x
Hispid Cotton Rat, (Sigmodon hispidus)	x	x	x

Table C.5. Mammals by County (continued).

Species	Counties		
	Seminole	Orange	Osceola
Raccoon Family			
Raccoon, (Procvon lotor)	x	x	x
Weasel and Skunks Family			
River Otter, (Lutra canadensis)	x	x	x
Striped Skunk, (Mephitis mephitis)	x	x	x
Long-tailed Weasel, (Mustela frenata)	x	x	x
Eastern Spotted Skunk, (Spilogale putorius)	x	x	x
Foxes and Coyotes Family			
Gray Fox, (Urocvon cinereoargenteus)	x	x	x
Red Fox, (Vulpes vulpes)	x	x	x
Cat Family			
Bobcat, (Felis rufus)	x	x	x
Deer Family			
White-tailed Deer, (Odecoileus virginianus)	x	x	x
Pig Family			
Wild Boar, (Sus scrofa)	x	x	x

Table C.6. **AMPHIBIAN** use of habitats for feeding and nesting/breeding in the Econlockhatchee River Basin.

Species	Habitats						
	XS[1]	FW[2]	HH[3]	CS[4]	SH[5]	M&R[6]	EW[7]
Toad Family							
Oak Toad	f[8]	f		f	f	f	n[9]
Southern Toad	f	f	f	fn	fn	fn	n
Treefrog Family							
Florida Cricket Frog				fn	fn	fn	n
Green Treefrog		f	f	fn	fn	n	n
Southern Spring Peeper			f	n	n		n
Pinewoods Treefrog	f	f	f	f	f	f	n
Barking Treefrog	f			f	f	f	n
Squirrel Treefrog	f	f	f	f	f	f	n
Little Grass Frog		f	f	f	f		n
Florida Chorus Frog		f	f	fn	fn		n
Narrowmouth Toad Family							
E. Narrowmouth Toad	f	f	f	f	f		n
Spadefoot Toad Family							
Eastern Spadefoot Toad	f	f	f	f			n
True Frogs							
Florida Gopher Frog	f	f		f			n
Bullfrog				fn	fn	fn	
Pig Frog					fn	fn	
Southern Leopard Frog		f	f	fn	fn	fn	fn
Amphiuma Family							
Two-toed Amphiuma				fn	fn	fn	fn
Lungless Salamander Family							
Southern Dusky Salamander		f	f	fn	fn	fn	
Dwarf Salamander		f	f	fn	fn	fn	
Slimy Salamander		f	fn		fn		
Rusty Mud Salamander			f		fn		
Newt Family							
Striped Newt	f			f			fn
Peninsula Newt			f	fn	fn	fn	fn

Table C.6. Amphibians by habitat (continued).

Species	Habitats						
	XS	FW	HH	CS	SH	M&R	EW
Siren Family							
Narrow-striped Dwarf Siren				fn	fn	fn	fn
Eastern Lesser Siren				fn	fn	fn	fn
Greater Siren				fn	fn	fn	

[1] XS = Xeric Scrub

[2] FW = Flatwoods

[3] HH = Hardwood Hammock

[4] CS = Cypress Swamp

[5] SH = Swamp Hardwood

[6] M&R = Freshwater Marsh and River

[7] EW = Ephemeral Wetland

[8] f = use habitat to obtain food resources

[9] n = use habitat for nesting/breeding

Table C.7. **REPTILE** use of habitats for feeding and nesting/breeding in the Econlockhatchee River Basin.

Species	Habitats					
	XS[1]	FW[2]	HH[3]	CS[4]	SH[5]	M&R[6]
Alligator Family						
American Alligator			n[7]	f[8]n	fn	fn
Snapping Turtle Family						
Florida Snapping Turtle		n	n	f	f	f
Box and Water Turtle Family						
Florida Chicken Turtle	n	n	n	f	f	f
Peninsula Cooter	n	n	n	f	f	f
Florida Redbelly Turtle	n	n	n	f	f	f
Florida Box Turtle	fn	fn	fn			f
Mud and Musk Turtle Family						
Striped Mud Turtle	n	n	n	f	f	f
Florida Mud Turtle	n	n	n	f	f	f
Loggerhead Musk Turtle	n	n	n	f		f
Stinkpot	n	n	n	f	f	f
Tortoise Family						
Gopher Tortoise	fn	fn	fn			
Softshell Turtle Family						
Florida Softshell	n	n	n	f	f	
Worm Lizard Family						
Florida Worm Lizard	fn		fn			
Glass Lizard Family						
Eastern Slender Glass Lizard	fn		fn			
Iquanid Family						
Green Anole	fn	fn	fn	f	f	
Southern Fence Lizard	fn		fn			
Skink Family						
Peninsula Mole Skink	fn					
Southeastern Five-lined Skink	fn	fn	fn			
Broadhead Skink			fn		f	
Ground Skink	fn	fn	fn		f	
Whiptail Family						
Six-lined Racerunner	fn	fn	fn			

Table C.7. Reptiles by habitat (continued).

Species	Habitats					
	XS	FW	HH	CS	SH	M&R
Colubrid Family						
Florida Scarlet Snake	fn	fn		f	f	
Southern Black Racer	fn	fn	fn		f	
Southern Ringneck Snake		fn	fn	f	f	
Eastern Indigo Snake	fn	fn	fn		f	
Corn Snake	fn	fn	fn			
Yellow Rat Snake		fn	fn	f	f	
Eastern Mud Snake		n	n	f	f	f
Eastern Hognose Snake	fn	fn	fn			
Kingsnake	fn	fn	fn	f	f	
Scarlet Kingsnake	fn	fn	fn			
Eastern Coachwhip	fn	fn				
Green Water Snake				fn	fn	fn
Florida Water Snake						fn
Brown Water Snake				fn	fn	fn
Rough Green Snake	fn	fn	fn		f	
Florida Pine Snake	fn	fn				
Striped Crayfish Snake				fn	fn	fn
Pine Woods Snake	fn	fn				
South Florida Swamp Snake		n	n	f	f	f
North Florida Swamp Snake		n	n	f	f	f
Short-tailed Snake	fn	fn	fn			
Florida Brown Snake		fn	fn	f	f	f
Central Florida Crowned Snake	fn	fn	fn	f		
Peninsula Ribbon Snake		n	n	f	f	f
Eastern Garter Snake			fn	fn	fn	
Coral Snake Family						
Eastern Coral Snake	fn	fn	fn		f	

Table C.7. Reptiles by habitat (continued).

Species	Habitats					
	XS	FW	HH	CS	SH	M&R
Viper Family						
Florida Cottonmouth		n	n	f	f	f
Eastern Diamondback Rattlesnake	fn	fn	fn			
Dusky Pigmy Rattlesnake		fn		f	f	f

[1] XS = Xeric Scrub

[2] FW = Flatwoods

[3] HH = Hardwood Hammock

[4] CS = Cypress Swamp

[5] SH = Swamp Hardwood

[6] M&R = Freshwater Marsh and River

[7] n = use habitat for nesting/breeding

[8] f = use habitat to obtain food resources

Table C.8. **BIRD** use of habitats for feeding and nesting in the Econlockhatchee River Basin. Species that are present only during the non-breeding season are not included.

Species	Habitats						
	XS[1]	FW[2]	HH[3]	CS[4]	SH[5]	M&R[6]	EW[7]
Grebe Family							
Pied-bill Grebe						f[8]n[9]	
Cormorant Family							
Double-crested Cormorant				fn	fn	fn	
Darter Family							
Anhinga				fn	fn	fn	
Bittern and Heron Family							
Great Blue Heron		n	n	fn	fn	fn	f
Cattle Egret	f	fn	fn	n	n	n	f
Green-backed Heron				fn	fn	fn	
Great Egret		n	n	fn	fn	fn	f
Little Blue Heron		n	n	fn	fn	fn	f
Snowy Egret		n	n	fn	fn	fn	f
Tricolored Heron		n	n	fn	fn	fn	f
American Bittern						fn	
Eastern Least Bittern						fn	
Black-crowned Night Heron		n	n	fn	fn	fn	f
Yellow-crowned Night Heron		n	n	fn	fn	fn	f
Ibis and Spoonbill Family							
White Ibis		n	n	fn	fn	fn	f
Stork Family							
Wood Stork		n	n	fn	fn	f	f
Goose and Duck Family							
Wood Duck		n	n	fn	fn	f	f
Mottled Duck						fn	f
Mallard Duck						fn	f
Ring-necked Duck						fn	
Fulvous Whistling Duck						fn	
Vulture Family							
Turkey Vulture	fn	fn	fn				
Black Vulture	fn	fn	fn				

Table C.8. Birds by habitat (continued).

Species	Habitats						
	XS	FW	HH	CS	SH	M&R	EW
Kite, Eagle, and Hawk Family							
Cooper's Hawk	fn	fn	fn				
Short-tailed Hawk		fn	fn	n	n		
Red-tailed Hawk	fn	fn	fn				
Red-shouldered Hawk		f	f	fn	fn		
Broad-winged Hawk		fn	fn	fn	fn		
Northern Harrier						fn	
American Swallow-tailed Kite	fn	fn	fn	fn	fn	f	
Southern Bald Eagle	n	n	n	n	n	f	
Osprey		n	n	n	n	f	
Florida Everglade Kite						fn	
Caracara and Falcon Family							
Southeastern American Kestrel	fn	fn					
Crested Caracara		fn					
Turkey and Quail Family							
Northern Bobwhite	fn	fn	fn				
Wild Turkey	fn	fn	fn		f		
Rail, Gallinule, and Coot Family							
American Coot						fn	
Common Moorhen						fn	
Purple Gallinule						fn	
King Rail						fn	
Limpkin Family							
Limpkin				fn	fn	fn	
Crane Family							
Sandhill Crane	f	f				fn	
Plover Family							
Killdeer	fn	fn				f	
Stilt Family							
Black-necked Stilt						fn	
Pigeon and Dove Family							
Common Ground Dove	fn	fn	fn				
Mourning Dove	fn	fn	fn				

Table C.8. Birds by habitat (continued).

Species	Habitats						
	XS	FW	HH	CS	SH	M&R	EW
Cuckoo Family							
Yellow-billed Cuckoo	fn	fn	fn	fn	fn		
Barn-owl Family							
Common Barn Owl		fn	fn				
Typical Owl Family							
Burrowing Owl	fn	fn					
Great Horned Owl	fn	fn	fn		fn		
Eastern Screech Owl	fn	fn	fn	fn	fn		
Barred Owl		fn	fn	fn	fn		
Nightjar Family							
Chuck-will's-widow	fn	fn	fn				
Common Nighthawk	fn	fn	fn				
Swift Family							
Chimney Swift	fn	fn	fn	fn	fn		
Hummingbird Family							
Ruby-throated Hummingbird		fn	fn	fn	fn		
Kingfisher Family							
Belted Kingfisher	n	n	n	f		f	
Woodpecker Family							
Common Flicker	fn	fn	fn	f	f		
Pileated Woodpecker	f	f	f	fn	fn		
Red-bellied Woodpecker	fn	fn	fn	fn	fn		
Red-headed Woodpecker	fn	fn	fn				
Red-cockaded Woodpecker	fn	fn	f				
Downy Woodpecker	fn	fn	fn	fn	fn		
Hairy Woodpecker	fn	fn	fn	fn	fn		
Flycatcher Family							
Acadian Flycatcher			fn	fn	fn		
Great Crested Flycatcher	fn	fn	fn	fn	fn		
Eastern Kingbird	fn	fn					
Swallow Family							
Purple Martin Swallow	n	n	n	fn	fn	f	
Northern Rough-winged Swallow	n	n	n	f	f	f	

Table C.8. Birds by habitat (continued).

Species	Habitats						
	XS	FW	HH	CS	SH	M&R	EW
Jay and Crow Family							
Florida Scrub Jay	fn						
American Crow	fn	fn	fn				
Fish Crow		fn	fn			f	
Blue Jay	fn	fn	fn	fn	fn		
Titmouse Family							
Tufted Titmouse	fn	fn	fn	fn	fn		
Carolina Chickadee	fn	fn	fn	fn	fn		
Nuthatch Family							
Brown-headed Nuthatch		fn					
Wren Family							
Carolina Wren		fn	fn	fn	fn		
Old World Warbler and Kinglet Family							
Blue-gray Gnatcatcher		fn	fn	fn	fn		
Eastern Bluebird		fn	fn				
Mimic Thrush Family							
Northern Mockingbird	fn	fn	fn				
Brown Thrasher		fn	fn				
Shrike Family							
Loggerhead Shrike	fn	fn					
Vireo Family							
Yellow-throated Vireo			fn	fn	fn		
White-eyed Vireo	fn	fn	fn	fn	fn		
Red-eyed Vireo			fn		fn		
Wood Warbler Subfamily							
Yellow-throated Warbler		fn	fn				
Palm Warbler	fn	fn	fn	fn	fn	fn	
Pine Warbler	fn	fn					
Common Yellowthroat		fn	fn	fn		fn	
Northern Parula Warbler			fn		fn		
Prothonotary Warbler				fn	fn		
Hooded Warbler				fn	fn		

Table C.8. Birds by habitat (continued).

Species	Habitats						
	XS	FW	HH	CS	SH	M&R	EW
Tanager Subfamily							
Summer Tanager		fn	fn				
Cardinal Subfamily							
Northern Cardinal	fn	fn	fn	fn	fn		
Blue Grosbeak		fn	fn				
Painted Bunting		fn	fn				
Towhee and Sparrow Subfamily							
Bachman's Sparrow		fn					
Rufous-sided Towhee	fn	fn	fn				
Blackbird and Oriole Subfamily							
Red-winged Blackbird						fn	
Orchard Oriole		fn	fn				
Brown-headed Cowbird		fn	n	n	n		
Boat-tailed Grackle		fn			fn		
Common Grackle		fn	fn				
Eastern Meadowlark		fn					

[1] XS = Xeric Scrub

[2] FW = Flatwoods

[3] HH = Hardwood Hammock

[4] CS = Cypress Swamp

[5] SH = Swamp Hardwood

[6] M&R = Freshwater Marsh and River

[7] EW = Ephemeral Wetland

[8] f = use habitat to obtain food resources

[9] n = use habitat for nesting/breeding

Table C.9. MAMMAL use of habitats for feeding and nesting/breeding in the Econlockhatchee River Basin.

Species	Habitats						
	XS[1]	FW[2]	HH[3]	CS[4]	SH[5]	M&R[6]	
Opossum Family							
Opossum	f[7]n[8]	fn	fn	fn	fn	fn	
Shrew Family							
Least Shrew		fn				fn	
Southeastern Shrew			fn	fn	fn		
Mole Family							
Eastern Mole	fn	fn	fn				
Twilight Bat Family							
Big Brown Bat		fn	fn	fn	fn	f	
Red Bat			fn	fn	fn	f	
Hoary Bat			fn	fn	fn	f	
Yellow Bat			fn	fn	fn	f	
Evening Bat	fn	fn	fn	fn	fn	f	
Eastern Pipistrelle Bat		fn	fn	fn	fn	fn	f
Rafinesque's Big-eared Bat	fn	fn	fn	fn	fn	f	
Free-tailed Bat Family							
Brazilian Free-tailed Bat	fn	fn	fn	fn	fn	f	
Armadillo Family							
Nine-banded Armadillo	fn	fn	fn	f	f		
Rabbit Family							
Eastern Cottontail Rabbit		fn	fn				
Marsh Rabbit						fn	
Squirrel Family							
Southern Flying Squirrel	fn	fn	fn	fn	fn		
Gray Squirrel	fn	fn	fn	fn	fn		
Fox Squirrel	fn	fn					
Sherman's Fox Squirrel	fn	fn					
Pocket Gopher Family							
Southeastern Pocket Gopher	fn						
New World Rats, Mice, and Voles Family							
Round-tailed Muskrat						fn	
Marsh Rice Rat						fn	
Florida Mouse	fn	fn					
Cotton Mouse	fn	fn	fn				
Hispid Cotton Rat	fn	fn					

Table C.9. Mammals by habitat (continued).

Species	Habitats					
	XS	FW	HH	CS	SH	M&R
Raccoon Family						
Raccoon	fn	fn	fn	fn	fn	f
Weasel and Skunks Family						
River Otter				fn	fn	fn
Striped Skunk	fn	fn	fn			
Long-tailed Weasel	fn	fn	fn	f	fn	
Eastern Spotted Skunk	fn	fn	fn			
Foxes and Coyotes Family						
Gray Fox	fn	fn	fn	fn	fn	
Red Fox	fn	fn	fn			
Cat Family						
Bobcat	fn	fn	fn	f	f	
Deer Family						
White-tailed Deer	fn	fn	fn	f	f	
Pig Family						
Wild Boar	fn	fn	fn	f	f	f

[1] XS = Scrub or Sandhill

[2] FW = Flatwoods

[3] HH = Hardwood Hammock

[4] CS = Cypress Swamp

[5] SH = Swamp Hardwood

[6] M&R = Freshwater Marsh and Rivers

[7] f = use habitat to obtain food resources

[8] n = use habitat for nesting/breeding

Table C.10. Wildlife species' use of feeding and breeding zones (guilds) within the **XERIC SCRUB** habitats in the Econlockhatchee River Basin.

Guilds		
Feeding Zone	Breeding Zone	Species
Tree canopy	Tree canopy	
		Cooper's Hawk
		American Swallow-tailed Kite
		Yellow-billed Cuckoo
		Blue Jay
		Eastern Kingbird
		Pine Warbler
		Evening Bat
		Eastern Pipistrelle Bat
		Refineque's Big-eared Bat
		Brazilian Free-tailed Bat
Tree canopy	Tree bole	
		Tufted Titmouse
		Chimney Swift
		Great Crested Flycatcher
Tree canopy	Ground surface	
		Chuck-will's-widow
		Common Nighthawk
		Northern Rough-winged Swallow
Tree bole	Tree bole	
		Red-bellied Woodpecker
		Red-headed Woodpecker
		Red-cockaded Woodpecker
		Downy Woodpecker
		Hairy Woodpecker
Tree bole	Breeds in other habitat	
		Squirrel Treefrog
		Pinewoods Treefrog
		Barking Treefrog
		Pileated Woodpecker
Shrubs or grasses	Tree bole	
		Carolina Chickadee
Shrubs or grasses	Shrubs or grasses	
		White-eyed Vireo
		Palm Warbler
Shrubs or grasses	Ground surface	
		Rough Green Snake
		Green Anole
		Southern Fence Lizard
Ground surface	Tree canopy	
		Loggerhead Shrike
		American Crow
		Mourning Dove
		Great horned Owl
		Red-tailed Hawk

Ground surface	Tree bole	
		Eastern Screech Owl
		Common Flicker
		Southeastern American Kestrel
		Southern Flying Squirrel
		Gray Squirrel
		Fox Squirrel
		Sherman's Fox Squirrel
		Opossum
		Raccoon
		Gray Fox
Ground surface	Shrubs or grasses	
		Florida Scrub Jay
		Northern Mockingbird
		Northern Cardinal
Ground surface	Ground surface	
		Florida Worm Lizard
		Peninsula Mole Skink
		Six-lined Racerunner
		Short-tailed Snake
		Central Florida Crowned Snake
		Killdeer
		Wild Turkey
		Burrowing owl
		Common Ground Dove
		Rufus-sided Towhee
		Northern Bobwhite
		Eastern Coral Snake
		Cotton Mouse
		Florida Mouse
		Hispid Cotton Rat
		Eastern Mole
		Eastern Slender Glass Lizard
		Ground Skink
		SE Five-lined Skink
		Gopher Tortoise
		SE Pocket Gopher
		Nine-banded Armadillo
		Eastern Hognose Snake
		Striped Skunk
		Long-tailed Weasel
		Scarlet Kingsnake
		Florida Scarlet Snake
		Southern Black Racer
		Eastern Coachwhip
		Corn Snake
		Florida Pine Snake
		Pine woods Snake
		Kingsnake
		Eastern Diamondback Rattlesnake
		Eastern Indigo Snake
		Florida Box Turtle
		Eastern Spotted Skunk
		Bobcat

		White-tailed Deer
		Wild Boar
		Red Fox
Ground surface	Breeds in other habitat	
		Oak Toad
		Southern Toad
		Florida Gopher Frog
		Eastern Narrowmouth Toad
		Eastern Spadefoot Toad
		Striped Newt
		Cattle Egret
		Turkey Vulture
		Black Vulture
		Sandhill Crane
Feeds in other habitat	Tree canopy	Southern Bald Eagle
Feeds in other habitat	Tree bole	Purple Martin Swallow
Feeds in other habitat	Ground surface	Florida Chicken Turtle
		Peninsula Cooter
		Florida Redbelly Turtle
		Striped Mud Turtle
		Florida Mud Turtle
		Loggerhead Musk Turtle
		Stinkpot
		Florida Softshell Turtle
		Belted Kingfisher

Table C.11. Wildlife species' use of feeding and breeding zones (guilds) within the FLATWOODS habitats in the Econlockhatchee River Basin.

Guilds		
Feeding Zone	Breeding Zone	Species
Tree canopy	Tree canopy	Yellow-billed Cuckoo Orchard Oriole Summer Tanager American Swallow-tailed Kite Broad-winged Hawk Cooper's Hawk Yellow-throated Warbler Blue Jay Eastern Kingbird Pine Warbler Eastern Pipistrelle Bat Big Brown Bat Brazilian Free-tailed Bat Evening Bat Refinesque's Big-eared Bat
Tree canopy	Tree bole	Chimney Swift Tufted Titmouse Brown-headed nuthatch Great Crested Flycatcher
Tree canopy	Ground surface	Chuck-will's-widow Common Nighthawk Northern Rough-winged Swallow
Tree bole	Tree bole	Red-bellied Woodpecker Red-headed Woodpecker Red-cockaded Woodpecker Downy Woodpecker Hairy Woodpecker
Tree bole	Ground surface	Yellow Rat Snake
Tree bole	Breeds in other habitat	Green Treefrog Pinewoods Treefrog Squirrel Treefrog Pileated Woodpecker
Shrubs or grasses	Tree canopy	Blue-gray Gnatcatcher
Shrubs or grasses	Tree bole	Carolina Chickadee Carolina Wren
Shrubs or grasses	Shrubs or grasses	Blue Gosbeak

		Palm Warbler
		Painted Bunting
		White-eyed Vireo
		Ruby-throated Hummingbird
Shrubs or grasses	Ground surface	
		Common Yellowthroat
		Bachman's Sparrow
		Rough Green Snake
		Green Anole
Shrubs or grasses	Breeds in other habitat	
		Little Grass Frog
		Florida Chorus Frog
Ground surface	Tree canopy	
		Loggerhead Shrike
		Crested Caracara
		Short-tailed Hawk
		Barred Owl
		Boat-tailed Grackle
		Fish Crow
		Cattle Egret
		American Crow
		Common Grackle
		Mourning Dove
		Great horned Owl
		Red-tailed Hawk
Ground surface	Tree bole	
		Common Flicker
		Common Barn Owl
		Eastern Screech Owl
		Eastern Bluebird
		Southeastern American Kestrel
		Gray Squirrel
		Southern Flying Squirrel
		Fox Squirrel
		Sherman's Fox Squirrel
		Opossum
		Raccoon
		Gray Fox
Ground surface	Shrubs or grasses	
		Northern Mockingbird
		Brown Thrasher
		Brown-headed Cowbird
		Northern Cardinal
Ground surface	Ground surface	
		Six-lined Racerunner
		Short-tailed Snake
		Wild Turkey
		Black Vulture
		Turkey Vulture
		Common Ground Dove
		Rufus-sided Towhee
		Northern Bobwhite
		Eastern Coral Snake
		Central Florida Crowned Snake

		Florida Brown Snake
		Cotton Mouse
		Eastern Mole
		Ground Skink
		SE Five-lined Skink
		Gopher Tortoise
		Eastern Cottontail Rabbit
		Nine-banded Armadillo
		Eastern Hognose Snake
		Striped Skunk
		Long-tailed Weasel
		Scarlet Kingsnake
		Florida Scarlet Snake
		Southern Black Racer
		Southern Ringneck Snake
		Eastern Coachwhip
		Corn Snake
		Florida Pine Snake
		Pine woods Snake
		Kingsnake
		Dusky Pigmy Rattlesnake
		Eastern Diamondback Rattlesnake
		Eastern Indigo Snake
		Florida Box Turtle
		Killdeer
		Burrowing Owl
		Eastern Meadowlark
		Bobcat
		Least Shrew
		White-tailed Deer
		Florida Mouse
		Hispid Cotton Rat
		Eastern Spotted Skunk
		Wild Boar
		Red Fox
Ground surface	Breeds in other habitat	
		Oak Toad
		Southern Toad
		Eastern Narrowmouth Toad
		Eastern Spadefoot Toad
		Florida Gopher Frog
		Southern Leopard Frog
		Southern Dusky Salamander
		Dwarf Salamander
		Slimy Salamander
		Red-shouldered Hawk
		Sandhill Crane
Feeds in other habitat	Tree canopy	
		Great Blue Heron
		Great Egret
		Little Blue Heron
		Snowy Egret
		Tricolored Heron
		Black-crowned Night Heron

		Yellow-crowned Night Heron White Ibis Wood Stork Southern Bald Eagle Osprey
Feeds in other habitat	Tree bole	Wood Duck Purple Martin Swallow
Feeds in other habitat	Ground surface	Florida Snapping Turtle Florida Chicken Turtle Peninsula Cooter Florida Redbelly Turtle Striped Mud Turtle Florida Mud Turtle Loggerhead Musk Turtle Stinkpot Florida Softshell Turtle Eastern Mud Snake South Florida Swamp Snake North Florida Swamp Snake Peninsula Ribbon Snake Florida Cottonmouth Belted Kingfisher

Table C.12. Wildlife species' use of feeding and breeding zones (guilds) within the **HARDWOOD HAMMOCK** habitats in the Econlockhatchee River Basin.

Guilds		
Feeding Zone	Breeding Zone	Species
Tree canopy	Tree canopy	Cooper's Hawk Broad-winged Hawk American Swallow-tailed Kite Summer Tanager Yellow-billed Cuckoo Orchard Oriole Yellow-throated Warbler Red-eyed Vireo Acadian Flycatcher Yellow-throated Vireo Blue Jay Northern Parula Warbler Eastern Pipistrelle Bat Big Brown Bat Brazilian Free-tailed Bat Evening Bat Hoary Bat Red Bat Refinewque's Big-eared Bat Yellow Bat
Tree canopy	Tree bole	Tufted Titmouse Chimney Swift Great Crested Flycatcher
Tree canopy	Ground surface	Chuck-will's-widow Common Nighthawk Northern Rough-winged Swallow
Tree bole	Tree bole	Red-bellied Woodpecker Red-headed Woodpecker Downy Woodpecker Hairy Woodpecker
Tree bole	Ground surface	Yellow Rat Snake
Tree bole	Breeds in other habitat	Green Treefrog Pinewoods Treefrog Squirrel Treefrog Pileated Woodpecker Red-cockaded Woodpecker
Shrubs or grasses	Tree canopy	Blue-gray Gnatcatcher
Shrubs or grasses	Tree bole	

		Carolina Chickadee
		Carolina Wren
Shrubs or grasses	Shrubs or grasses	
		Blue Gosbeak
		Palm Warbler
		Painted Bunting
		White-eyed Vireo
		Ruby-throated Hummingbird
Shrubs or grasses	Ground surface	
		Common Yellow-throat
		Rough Green Snake
		Green Anole
		Southern Fence Lizard
Shrubs or grasses	Breeds in other habitat	
		Southern Spring Peeper
		Little Grass Frog
		Florida Chorus Frog
Ground surface	Tree canopy	
		Short-tailed Hawk
		Fish Crow
		Cattle Egret
		American Crow
		Common Grackle
		Mourning Dove
		Great Horned Owl
		Red-tailed Hawk
Ground surface	Tree bole	
		Common Flicker
		Eastern Screech Owl
		Common Barn Owl
		Barred Owl
		Eastern Bluebird
		Southern Flying Squirrel
		Gray Squirrel
		Opossum
		Raccoon
		Gray Fox
Ground surface	Shrubs or grasses	
		Northern Mockingbird
		Brown Thrasher
		Northern Cardinal
Ground surface	Ground surface	
		Florida Worm Lizard
		Short-tailed Snake
		Eastern Slender Glass Lizard
		Broadhead Skink
		Six-lined Racerunner
		Wild Turkey
		Black Vulture
		Turkey Vulture
		Common Ground Dove
		Rufus-sided Towhee
		Northern Bobwhite
		Eastern Coral Snake

		Central Florida Crowned Snake
		Florida Brown Snake
		Cotton Mouse
		Eastern Mole
		Ground Skink
		Slimy Salamander
		SE Five-lined Skink
		Gopher Tortoise
		SE Shrew
		Eastern Cottontail Rabbit
		Nine-banded Armadillo
		Eastern Hognose Snake
		Striped Skunk
		Long-tailed Weasel
		Eastern Garter Snake
		Scarlet Kingsnake
		Southern Black Racer
		Southern Ringneck Snake
		Corn Snake
		Kingsnake
		Eastern Diamondback Rattlesnake
		Eastern Indigo Snake
		Florida Box Turtle
		Bobcat
		Eastern Spotted Skunk
		White-tailed Deer
		Wild Boar
		Red Fox
Ground surface	Breeds in other habitat	
		Southern Toad
		Eastern Narrowmouth Toad
		Eastern Spadefoot Toad
		Southern Leopard Frog
		Southern Dusky Salamander
		Dwarf Salamander
		Rusty Mud Salamander
		Peninsula Newt
		Red-shouldered Hawk
Feeds in other habitat	Tree canopy	
		Great Blue Heron
		Great Egret
		Little Blue Heron
		Snowy Egret
		Tricolored Heron
		Black-crowned Night Heron
		Yellow-crowned Night Heron
		White Ibis
		Wood Stork
		Southern Bald Eagle
		Osprey
Feeds in other habitat	Tree bole	
		Wood Duck
		Purple Martin Swallow
Feeds in other	Shrubs or grasses	

habitat		Brown-headed Cowbird
Feeds in other habitat	Ground surface	American Alligator Florida Snapping Turtle Florida Chicken Turtle Peninsula Cooter Florida Redbelly Turtle Striped Mud Turtle Florida Mud Turtle Loggerhead Musk Turtle Stinkpot Florida Softshell Turtle Eastern Mud Snake South Florida Swamp Snake North Florida Swamp Snake Peninsula Ribbon Snake Florida Cottonmouth Belted Kingfisher

Table C.13. Wildlife species' use of feeding and breeding zones (guilds) within the CYPRESS SWAMP habitats in the Econlockhatchee River Basin.

Guilds		
Feeding Zone	Breeding Zone	Species
Tree canopy	Tree canopy	Acadian Flycatcher Broad-winged Hawk American Swallow-tailed Kite Blue Jay Yellow-billed Cuckoo Blue-gray Gnatcatcher Yellow-throated Vireo Big Brown Bat Red Bat Hoary Bat Yellow Bat Evening Bat Eastern Pipstrelle Bat Rafinesque's Big-eared Bat Brazilian Free-tailed Bat
Tree canopy	Tree bole	Chimney Swift Great Crested Flycatcher Purple Martin Swallow Tufted Titmouse
Tree canopy	Ground surface	Northern Rough-winged Swallow
Tree bole	Tree bole	Pileated Woodpecker Red-bellied Woodpecker Downy Woodpecker Hairy Woodpecker
Tree bole	Water column	Green Treefrog
Tree bole	Breeds in other habitat	Pinewoods Treefrog Barking Treefrog Squirrel Treefrog
Shrubs or grasses	Tree bole	Prothonotary Warbler Carolina Chickadee Carolina Wren
Shrubs or grasses	Shrubs or grasses	Hooded Warbler Ruby-throated Hummingbird White-eyed Vireo Palm Warbler
Shrubs or grasses	Ground surface	

		Common Yellowthroat
Shrubs or grasses	Water column	
		Southern Spring Peeper
		Florida Chorus Frog
Shrubs or grasses	Breeds in other habitat	
		Little Grass Frog
		Green Anole
Ground surface	Tree canopy	
		Red-shouldered Hawk
Ground surface	Tree bole	
		Barred Owl
		Eastern Screech Owl
		Opossum
		Southern Flying Squirrel
		Gray Squirrel
		Raccoon
		Gray Fox
Ground surface	Shrubs or grasses	
		Northern Cardinal
Ground surface	Ground surface	
		Eastern Garter Snake
		Southeastern Shrew
Ground surface	Water column	
		Southern Toad
		Florida Cricket Frog
		Bullfrog
		Southern Leopard Frog
		Southern Dusky Salamander
		Dwarf Salamander
		Peninsula Newt
Ground surface	Breeds in other habitat	
		Oak Toad
		Eastern Narrowmouth Toad
		Eastern Spadefoot Toad
		Florida Gopher Frog
		Stripped Newt
		Florida Scarlet Snake
		Southern Ringneck Snake
		Yellow Rat Snake
		Eastern Mud Snake
		Kingsnake
		South Florida Swamp Snake
		North Florida Swamp Snake
		Florida Brown Snake
		Central Florida Crowned Snake
		Peninsula Ribbon Snake
		Dusky Pigmy Rattlesnake
		Nine-banded Armadillo
		Long-tailed Weasel
		Bobcat
		White-tailed Deer
Water surface	Tree bole	
		Wood Duck

Water column	Tree canopy	
		Great Egret
		Snowy Egret
		White Ibis
		Little Blue Heron
		Great Blue Heron
		Tricolored Heron
		Black-crowned Night Heron
		Yellow-crowned Night Heron
		Wood Stork
Water column	Shrubs or grasses	
		Limpkin
		Green-backed Heron
		Anhinga
		Double-crested Cormorant
Water column	Ground surface	
		American Alligator
		Green Water Snake
		Brown Water Snake
		Striped Crayfish Snake
		River Otter
Water column	Water column	
		Two-toed Amphiuma
		Narrow-striped Dwarf Siren
		Eastern Lesser Siren
		Greater Siren
Water column	Breeds in other habitat	
		Florida Snapping Turtle
		Florida Chicken Turtle
		Peninsula Cooter
		Florida Redbelly Turtle
		Striped Mud Turtle
		Florida Mud Turtle
		Loggerhead Musk Turtle
		Stinkpot
		Florida Softshell
		Florida Cottonmouth
		Belted Kingfisher
Feeds in other habitat	Tree canopy	
		Cattle Egret
		Short-tailed Hawk
		Southern Bald Eagle
		Osprey
Feeds in other habitat	Tree bole	
		Common Flicker
Feeds in other habitat	Shrubs or grasses	
		Brown-headed Cowbird

Table C.14. Wildlife species' use of feeding and breeding zones (guilds) within the SWAMP HARDWOODS habitats in the Econlockhatchee River Basin.

Guilds		
Feeding Zone	Breeding Zone	Species
Tree canopy	Tree canopy	Acadian Flycatcher Broad-winged Hawk American Swallow-tailed Kite Yellow-billed Cuckoo Northern Parula Warbler Red-eyed Vireo Blue-gray Gnatcatcher Yellow-throated Vireo Blue Jay Big Brown Bat Red Bat Hoary Bat Yellow Bat Evening Bat Eastern Pipstrelle Bat Rafinesque's Big-eared Bat Brazilian Free-tailed Bat
Tree canopy	Tree bole	Chimney Swift Great Crested Flycatcher Purple Martin Swallow Tufted Titmouse
Tree canopy	Ground surface	Northern Rough-winged Swallow
Tree bole	Tree bole	Pileated Woodpecker Red-bellied Woodpecker Downy Woodpecker Hairy Woodpecker
Tree bole	Water column	Green Treefrog
Tree bole	Breeds in other habitat	Pinewoods Treefrog Barking Treefrog Squirrel Treefrog
Shrubs or grasses	Tree bole	Prothonotary Warbler Carolina Chickadee Carolina Wren
Shrubs or grasses	Shrubs or grasses	Hooded Warbler Ruby-throated Hummingbird White-eyed Vireo

		Palm Warbler
Shrubs or grasses	Water column	
		Southern Spring Peeper
		Florida Chorus Frog
Shrubs or grasses	Breeds in other habitat	
		Little Grass Frog
		Green Anole
		Rough Green Snake
Ground surface	Tree canopy	
		Red-shouldered Hawk
		Great Horned Owl
		Boat-tailed Grackle
Ground surface	Tree bole	
		Barred Owl
		Eastern Screech Owl
		Opossum
		Southern Flying Squirrel
		Gray Squirrel
		Raccoon
		Gray Fox
Ground surface	Shrubs or grasses	
		Northern Cardinal
Ground surface	Ground surface	
		Eastern Garter Snake
		Southeastern Shrew
		Slimy Salamander
		Rusty Mud Salamander
Ground surface	Water column	
		Southern Toad
		Florida Cricket Frog
		Bullfrog
		Southern Leopard Frog
		Southern Dusky Salamander
		Dwarf Salamander
		Peninsula Newt
		Pig Frog
Ground surface	Breeds in other habitat	
		Oak Toad
		Eastern Narrowmouth Toad
		Broadhead Skink
		Ground Skink
		Florida Scarlet Snake
		Southern Black Racer
		Eastern Indigo Snake
		Southern Ringneck Snake
		Yellow Rat Snake
		Eastern Mud Snake
		Kingsnake
		South Florida Swamp Snake
		North Florida Swamp Snake
		Florida Brown Snake
		Peninsula Ribbon Snake
		Eastern Coral Snake
		Dusky Pigmy Rattlesnake

		Wild Turkey
		Nine-banded Armadillo
		Long-tailed Weasel
		Bobcat
		White-tailed Deer
		Wild Boar
Water surface	Tree bole	
		Wood Duck
Water column	Tree canopy	
		Great Egret
		Snowy Egret
		White Ibis
		Little Blue Heron
		Great Blue Heron
		Tricolored Heron
		Black-crowned Night Heron
		Yellow-crowned Night Heron
		Wood Stork
Water column	Shrubs or grasses	
		Limpkin
		Green-backed Heron
		Anhinga
		Double-crested Cormorant
Water column	Ground surface	
		American Alligator
		Green Water Snake
		Brown Water Snake
		Striped Crayfish Snake
		River Otter
Water column	Water column	
		Two-toed Amphiuma
		Narrow-striped Dwarf Siren
		Eastern Lesser Siren
		Greater Siren
Water column	Breeds in other habitat	
		Florida Snapping Turtle
		Florida Chicken Turtle
		Peninsula Cooter
		Florida Redbelly Turtle
		Striped Mud Turtle
		Florida Mud Turtle
		Stinkpot
		Florida Softshell
		Florida Cottonmouth
Feeds in other habitat	Tree canopy	
		Cattle Egret
		Short-tailed Hawk
		Southern Bald Eagle
		Osprey
Feeds in other habitat	Tree bole	
		Common Flicker
Feeds in other habitat	Shrubs or grasses	
		Brown-headed Cowbird

Table C.15. Wildlife species' use of feeding and breeding zones (guilds) within the **FRESHWATER MARSH AND RIVER** habitats in the Econlockhatchee River Basin.

Guilds		
Feeding Zone	Breeding Zone	Species
Tree canopy	Breeds in other habitat	
		American Swallow-tailed Kite
		Purple Martin Swallow
		Northern Rough-winged Swallow
		Big Brown Bat
		Red Bat
		Hoary Bat
		Yellow Bat
		Evening Bat
		Eastern Pipstrelle Bat
		Rafinesque's Big-eared Bat
		Brazilian Free-tailed Bat
Tree bole	Breeds in other habitat	
		Pinewoods Treefrog
		Barking Treefrog
		Squirrel Treefrog
Shrubs or grasses	Shrubs or grasses	
		Palm Warbler
		Red-winged Blackbird
Shrubs or grasses	Ground surface	
		Common Yellowthroat
Ground surface	Tree bole	
		Opossum
Ground surface	Ground surface	
		Least Shrew
		Florida Box Turtle
		Northern Harrier
		Marsh Rabbit
Ground surface	Water surface	
		Sandhill Crane
Ground surface	Water column	
		Southern Toad
		Florida Cricket Frog
		Bullfrog
		Southern Leopard Frog
		Southern Dusky Salamander
		Dwarf Salamander
		Peninsula Newt
		Pig Frog
Ground surface	Breeds in other habitat	
		Oak Toad
		Eastern Mud Snake
		South Florida Swamp Snake
		North Florida Swamp Snake

		Florida Brown Snake
		Peninsula Ribbon Snake
		Dusky Pigmy Rattlesnake
		Wild Boar
		Killdeer
		Fish Crow
		Raccoon
Water surface	Water surface	
		American Bittern
		Eastern Least Bittern
		American Coot
		Common Moorhen
		Purple Gallinule
		King Rail
		Round-tailed Muskrat
		Marsh Rice Rat
Water column	Tree canopy	
		Great Egret
		Snowy Egret
		White Ibis
		Little Blue Heron
		Great Blue Heron
		Tricolored Heron
		Black-crowned Night Heron
		Yellow-crowned Night Heron
		Florida Everglade Kite
Water column	Shrubs or grasses	
		Limpkin
		Green-backed Heron
		Doubel-crested Cormorant
		Anhinga
Water column	Ground surface	
		American Alligator
		Green Water Snake
		Brown Water Snake
		Florida Water Snake
		Striped Crayfish Snake
		River Otter
		Mottled Duck
		Mallard Duck
		Ring-necked Duck
		Fulvous Whistling Duck
		Black-necked Stilt
Water column	Water surface	
		Pied-billed Grebe
Water column	Water column	
		Two-toed Amphiuma
		Narrow-striped Dwarf Siren
		Eastern Lesser Siren
		Greater Siren
Water column	Breeds in other habitat	
		Florida Snapping Turtle
		Florida Chicken Turtle
		Peninsula Cooter

		Florida Redbelly Turtle Striped Mud Turtle Loggerhead Musk Turtle Florida Mud Turtle Stinkpot Florida Cottonmouth Wood Stork Wood Duck Southern Bald Eagle Osprey Belted Kingfisher
Water bottom	Ground surface	Limpkin
Feeds in other habitat	Tree canopy	Cattle Egret
Feeds in other habitat	Water Column	Green Treefrog

Table C.16. Spatial requirements reported for wildlife species that should occur almost exclusively in WETLAND habitats in the Econlockhatchee River Basin expressed as width of land (not water) needed by one individual.

Species	Width Needed (ft)[1]	Basis of Need[2]	References
Two-toed Amphiuma	50	habits very aquatic, needs enough adjacent land to provide good quality water	A 1
Narrow-striped Dwarf Siren	50	habits very aquatic, needs enough adjacent land to provide good quality water; endemic species	A 1
Eastern Lesser Siren	50	habits very aquatic, needs enough adjacent land to provide good quality water	A 1
Greater Siren	50	habits very aquatic, needs enough adjacent land to provide good quality water	A 1
Green Water Snake	50[3]	needs land for sunning and giving birth (linear home range in and adjacent to river: mean home range for 3 species in Nerodia genus = 5.7 ha)	R 1, R 2
Florida Water Snake	50	needs land for sunning and giving birth (linear home range in and adjacent to river: mean home range for 3 species in Nerodia genus = 5.7 ha); endemic species	R 1, R 2
Brown Water Snake	50	needs land for sunning and giving birth (linear home range in and adjacent to river: mean home range for 3 species in Nerodia genus = 5.7 ha)	R 1, R 2
Striped Crayfish Snake	50	needs land for sunning and laying eggs (similar to water snakes)	R 3
Florida Cottonmouth	50	needs land for sunning and giving birth (linear home range in and adjacent to river = 0.4 - 1.2 ha);	R 1
South Florida Swamp Snake	50	needs land for sunning and laying eggs (similar to water snakes) endemic species	R 4
North Florida Swamp Snake	50	needs land for sunning and laying eggs (similar to water snakes)	R 4
Eastern Mud Snake	50	needs land for sunning and laying eggs (similar to water snakes)	R 4
Pied-billed Grebe	50	habitat requirements restricted to open water and littoral zones of marshes, needs enough adjacent land to provide good quality water	B 1
American Bittern	50	habitat requirements restricted to open water and littoral zones of marshes, needs enough adjacent land to provide good quality water	B 1

Table C.16. Spatial requirements reported for wildlife species that should occur almost exclusively in WETLAND habitats in the Econlockhatchee River Basin expressed as width of land (not water) needed by one individual (continued).

Species	Width Needed (ft)[1]	Basis of Need[2]	References
Eastern Least Bittern	50	habitat requirements restricted to open water and littoral zones of marshes, needs enough adjacent land to provide good quality water	B 1
Florida Everglades Kite	50	habitat requirements restricted to open water and littoral zones of marshes, needs enough adjacent land to provide good quality water	B 1
American Coot	50	habitat requirements restricted to open water and littoral zones of marshes, needs enough adjacent land to provide good quality water	B 1
Common Moorhen	50	habitat requirements restricted to open water and littoral zones of marshes, needs enough adjacent land to provide good quality water	B 1
Purple Gallinule	50	habitat requirements restricted to open water and littoral zones of marshes, needs enough adjacent land to provide good quality water	B 1
King Rail	50	habitat requirements restricted to open water and littoral zones of marshes, needs enough adjacent land to provide good quality water	B 1
Red-winged Blackbird	50	habitat requirements restricted to littoral zones of marshes, needs enough adjacent land to provide good quality water	B 1
Black-necked Stilt	50	habitat requirements restricted to littoral zones and open shores of marshes, needs enough adjacent land to provide good quality water	B 1
Round-tailed Muskrat	50	habitat requirements restricted to littoral zones of marshes, needs enough adjacent land to provide good quality water; endemic species	M 1, M 2
Marsh Rice Rat	50	habitat requirements restricted to littoral zones of marshes, needs enough adjacent land to provide good quality water	M 1
Mallard Duck	50	very tolerant of humans	B 1
Double-crested Cormorant	50, 30-132	minimum distance from humans tolerated while feeding, range of distances from humans tolerated while nesting	B 2, B 3
Anhinga	50, 48-141	minimum distance from humans tolerated while feeding, range of distances from humans tolerated while nesting	B 2, B 3
River Otter	100	needs land for denning (linear home range in and adjacent to river = 1.7 - 3.6 miles of linear riparian habitat); imperiled species	M 3
Mottled Duck	120	minimum distance from humans tolerated while feeding	B 2
Florida Cricket Frog	180	adults forage in upland timber areas (similar to green treefrog which were found up to 180 feet from water); endemic species	A 1

Table C.16. Spatial requirements reported for wildlife species that should occur almost exclusively in WETLAND habitats in the Econlockhatchee River Basin expressed as width of land (not water) needed by one individual (continued).

Species	Width Needed (ft)[1]	Basis of Need[2]	References
Limpkin	180, 39-165	similar to herons' tolerance to humans while feeding and nesting; listed species	B 1
Green-backed Heron	180, 39-165	similar to other herons' tolerance to humans while feeding and nesting	B 1
Ring-necked Duck	300	similar to wood duck	B 1
Fulvous Whistling Duck	300	similar to wood duck	B 1
Bullfrog	350	maximum distance found from permanent water	A 2
Pig Frog	350	similar to bullfrog	A 1
Hooded Warbler	450	minimum width of forested corridor bordered by development where species was found	B 4
Prothonotary Warbler	450	similar to hooded warbler	B 1
Marsh Rabbit	700	maximum distance found from shore	M 4

[1] Width needed values were determined by using spatial information reported in the literature including: home range (diameters were calculated), maximum distance a wetland species was found from the nearest water source, maximum distance a radio-tagged, wetland individual traveled from a water body to which it returned, minimum distance from humans tolerated, distance between captures of the same individual. If no spatial data were found for a species, width values for other species that are closely related, similar sized, found in comparable habitats, and categorized in similar guilds were used. Professional judgements also were needed to assure that the application of the literature data to determine a protection zone width was ecologically sound (e.g. alligators and otters have linear movement patterns that follow the river channel rather than circular home ranges that include extensive uplands).

[2] Information provided here includes: description of literature data or other explanation for "width needed" value; and an indication if species is endemic, imperiled, or listed.

[3] Highlighted numbers indicate that spatial data for a particular species were found in the literature.

Table C.17. Spatial requirements reported for wildlife species that should occur in both **WETLAND and UPLAND** habitats in the Econlockhatchee River Basin expressed as width of land (not water) needed by one individual.

Species	Width Needed (ft)[1]	Basis of Need[2]	References
American Alligator	50[3]	needs land for sunning and nesting (linear home range in and adjacent to river = 4.9 - 863.0 ha); listed species	R 5
Killdeer	50	needs undisturbed, open area for ground nest	B 1
Chimney Swift	50	very tolerant of humans	B 1
Purple Martin Swallow	50	very tolerant of humans	B 1
Northern Rough-wing Swallow	50	very tolerant of humans	M 6
Big Brown Bat	50	very tolerant of humans	M 5
Red Bat	50	very tolerant of humans	M 5
Hoary Bat	50	very tolerant of humans	M 5
Yellow Bat	50	very tolerant of humans	M 5
Evening Bat	50	very tolerant of humans	M 5
Eastern Pipistrelle Bat	50	very tolerant of humans	M 5
Rafinesque's Big-eared Bat	50	very tolerant of humans	M 5
Brazilian Free-tailed Bat	50	very tolerant of humans	M 5
Nine-banded Armadillo	50	very tolerant of humans	M 5
Rough Green Snake	51, 78	home range diameter (mean home range size = 0.019 ha, mean distance between captures of same marked individual = 78 feet); endemic species	R 1
Green Anole	51, 78	similar to rough green snake	R 6
Broadhead Skink	51, 78	similar to rough green snake	R 6
Ground Skink	51, 78	similar to rough green snake	R 6
Great Egret	60, 45-84	minimum distance from humans tolerated while feeding, range of distances from humans tolerated while nesting	B 2, B 3
Great Blue Heron	60, 48-144	similar to great egret, range of distances from humans tolerated while nesting	B 3
Cattle Egret	60, 33-63	similar to great egret, range of distances from humans tolerated while nesting	B 3
Osprey	60	very tolerant of humans	B 1
Ruby-throated Hummingbird	60	very tolerant of humans	B 1
Belted Kingfisher	60	very tolerant of humans	B 1

Table C.17. Spatial requirements reported for wildlife species that should occur in both WETLAND and UPLAND habitats in the Econlockhatchee River Basin expressed as width of land (not water) needed by one individual (continued).

Species	Width Needed (ft)[1]	Basis of Need[2]	References
Common Flicker	60	very tolerant of humans	B 1
Red-bellied Woodpecker	60	very tolerant of humans	B 1
Great Crested Flycatcher	60	very tolerant of humans	B 1
Fish Crow	60	very tolerant of humans	B 1
Northern Cardinal	60	very tolerant of humans	B 1
Brown-headed Cowbird	60	very tolerant of humans (thrives in open areas)	B 1
Boat-tailed Grackle	60	very tolerant of humans	B 1
Blue Jay	60	very tolerant of humans	B 1
Carolina Wren	60	very tolerant of humans	B 1
Gray Squirrel	60	very tolerant of humans	B 1
Raccoon	60	very tolerant of humans (linear home range adjacent to river, maximum length of home range = 1 mile)	M 6
Opossum	60	very tolerant of humans	M 5
Southern Flying Squirrel	60	tolerant of humans	M 5
Southeastern Shrew	60	tolerant of humans but not cats	M 5
Least Shrew	60	tolerant of humans but not cats	M 5
Florida Brown Snake	93, 177-591	diameter of home range, ranges of mean distances between captures of same marked individuals	R 1
Southern Ringneck Snake	93, 177-591	similar to Florida brown snake	R 4
Central Fl. Crowned Snake	93, 177-591	similar to Florida brown snake; endemic, imperiled species	R 4
Eastern Coral Snake	93, 177-591	similar to Florida brown snake	R 4
Southern Dusky Salamander	93, 177-591	similar to Florida brown snake	A 1
Dwarf Salamander	93, 177-591	similar to Florida brown snake	A 1
Slimy Salamander	93, 177-591	similar to Florida brown snake	A 1
Rusty Mud Salamander	93, 177-591	similar to Florida brown snake	A 1
Tufted Titmouse	166	diameter of smallest isolate forest patch in which species was found	B 5, B 6
Carolina Chickadee	166	similar to tufted titmouse	B 1
Red-eyed Vireo	180	minimum width of forested corridor bordered by development where species was found	B 4

Table C.17. Spatial requirements reported for wildlife species that should occur in both WETLAND and UPLAND habitats in the Econlockhatchee River Basin expressed as width of land (not water) needed by one individual (continued).

Species	Width Needed (ft)[1]	Basis of Need[2]	References
Green Treefrog	180	maximum distance found from water	A 3
Squirrel Treefrog	180	similar to green treefrog	A 1
Little Grass Frog	180	similar to green treefrog	A 1
Southern Toad	180	similar to green treefrog	A 1
Little Blue Heron	180, 39-63	minimum distance from humans tolerated while feeding, range of distances from humans tolerated while nesting; listed species	B 2, B 3
Black-crowned Night Heron	180, 51-69	similar to little blue heron, range of distances from humans tolerated while nesting	B 3
Yellow-crowned Night Heron	180, 51-69	similar to little blue heron and black-crowned night heron	B 1
Florida Chorus Frog	180	similar to green treefrog; endemic species	A 1
Common Yellowthroat	203-2,865	home range diameters (densities of 1.75 to 348 pair/100 ha reported)	B 7, B 8
Snowy Egret	240, 123-165	minimum distance from humans tolerated while feeding, range of distances from humans tolerated while nesting; listed species	B 2, B 3
Tricolored Heron	240, 75-141	similar to snowy egret, range of distances from humans tolerated while nesting; listed species	B 3
White Ibis	240, 38-120	minimum distance from humans tolerated while feeding, range of distances from humans tolerated while nesting	B 2, B 3
Wood Duck	300	minimum distance from humans tolerated while feeding	B 2
Penninsula Ribbon Snake	333	home range diameter	R 1
Southern Leopard Frog	350	similar to bullfrog	A 1
Dusky Pigmy Rattlesnake	368	home range diameter (home range = 0.98 ha)	R 1
Southern Black Racer	508-1,174, 336-525	range of home range diameters, ranges of mean distances between captures of same marked individuals	R 1
Acadian Flycatcher	300-600, 450	range of home range diameters, minimum width of forested corridor bordered by development where species was found	B 4
Downy Woodpecker	740	home range diameter	B 9
Hairy Woodpecker	740	similar to downy woodpecker	B 1
Yellow-billed Cuckoo	745	diameter of smallest isolated forest patch in which species was found	B 5

Table C.17. Spatial requirements reported for wildlife species that should occur in both WETLAND and UPLAND habitats in the Econlockhatchee River Basin expressed as width of land (not water) needed by one individual (continued).

Species	Width Needed (ft)[1]	Basis of Need[2]	References
Yellow Rat Snake	1,155-1,297, 525-585	range of home range diameters, ranges of mean distances between captures of same marked individuals	R 1
Fl. Scarlet Snake	1,155-1,297, 525-585	similar to yellow rat snake; endemic species	R 4
Sandhill Crane	1,200	tends to nest away from roads and other development activity, only occurs in open prairies and marshes; endemic, imperiled, and listed species	B10
Northern Parula Warbler	1,183	diameter of smallest isolated forest patch in which species was found	B 6
Palm Warbler	1,183	similar to northern parula warbler	B 1
Blue-gray Gnatcatcher	1,183	similar to northern parula warbler	B 1
Yellow-throated Vireo	1,183	similar to northern parula warbler	B 1
White-eyed Vireo	1,183	similar to northern parula warbler	B 1
Striped Mud Turtle	1,350	maximum distance a radio-tagged individual traveled round-trip from shore to uplands (needs sandy soil for nesting); endemic species	R 7
Florida Snapping Turtle	1,350	similar to striped mud turtle; endemic species	R 6, R 8
Florida Chicken Turtle	1,350	similar to striped mud turtle; endemic species	R 6
Peninsula Cooter	1,350	similar to striped mud turtle; endemic species	R 6
Florida Redbelly Turtle	1,350	similar to striped mud turtle; endemic species	R 6
Florida Mud Turtle	1,350	similar to striped mud turtle; endemic species	R 6
Loggerhead Musk Turtle	1,350	similar to striped mud turtle	R 6
Stinkpot	1,350	similar to striped mud turtle	R 6
Florida Softshell	1,350	similar to striped mud turtle	R 6
Eastern Garter Snake	333-1,403, 513-636	range of home range diameters, range of mean distances between captures of same marked individiuals	R 1
Southern Bald Eagle	1,500	restricted activity zone around nest; imperiled and listed species	B11
Wood Stork	1,500	deserve as much protection as eagles; listed species	B12
Kingsnake	1,664, 780	similar to scarlet kingsnake	R 4
Red-shld. Hawk	1,177-2,346, 2,640-2978	range of diameters of smallest isolate forest patches in which species was found, range of home range diameters	B 5, B13
Short-tailed Hawk	1,177-2,346, 2,640-2978	similar to red-shouldered hawk	B 1
Broad-wng. Hawk	1,177-2,346, 2,640-2978	similar to red-shouldered hawk	B 1

Table C.17. Spatial requirements reported for wildlife species that should occur in both **WETLAND and UPLAND** habitats in the Econlockhatchee River Basin expressed as width of land (not water) needed by one individual (continued).

Species	Width Needed (ft)[1]	Basis of Need[2]	References
Am. Sw.-tail. Kite	1,177-2,346, 2,640-2978	similar to red-shouldered hawk; imperiled species	B 1
Barred Owl	3,455-7,153	range of home range diameters	B14, B15
Great Horned Owl	3,455-7,153	similar to barred owl but prefers more opened canopy	B 1
Eastern Screech Owl	3,455-7,153	similar to barred owl	B 1
Southern Spring Peeper	4,000	maximum distance found from breeding pond	A 4
Pinewoods Treefrog	4,000	similar to spring peeper	A 1
Barking Treefrog	4,000	similar to spring peeper	A 1
E. Narrowmouth Toad	4,000	similar to spring peeper	A 1
Eastern Spadefoot Toad	4,000	similar to spring peeper	A 1
Striped Newt	4,000	similar to spring peeper; endemic and imperiled species	A 1
Peninsula Newt	4,000	similar to spring peeper; endemic species	A 1
Pileated Woodpecker	3,098-5,763, 2,419	range of home range diameters, diameter of smallest isolate forest patch in which species was found	B16, B 6
Eastern Indigo Snake	4,654	home range diameter; imperiled and listed species	R 9
Long-tailed Weasel	5,280-10,560	range of home range diameters; endemic species	M 2
Florida Box Turtle	5,280	home range diameter	R 6
Bobcat	4,710-12,638	range of home range diameters	M 7
White-tailed Deer	5,959	home range diameter	M 5
Wild Boar	5,959	similar to white-tailed deer	M 5
Florida Gopher Frog	6,336	distance between captures of same marked individual; imperiled and listed species	A 5
Oak Toad	6,336	similar to gopher frog	A 1
Gray Fox	7,084-10,708	range of home range diameters	M 8
Wild Turkey	10,472	home range diameter	B17

Table C.17. Spatial requirements reported for wildlife species that should occur in both **WETLAND and UPLAND** habitats in the Econlockhatchee River Basin expressed as width of land (not water) needed by one individual (continued).

[1] Width needed values were determined by using spatial information reported in the literature including: home range (diameters were calculated), maximum distance a wetland species was found from the nearest water source, maximum distance a radio-tagged, wetland individual traveled from a water body to which it returned, minimum distance from humans tolerated, distance between captures of the same individual. If no spatial data were found for a species, width values for other species that are closely related, similar sized, found in comparable habitats, and categorized in similar guilds were used. Professional judgements also were needed to assure that the application of the literature data to determine a protection zone width was ecologically sound (e.g. alligators and otters have linear movement patterns that follow the river channel rather than circular home ranges that include extensive uplands).

[2] Information provided here includes: description of literature data or other explanation for "width needed" value; and an indication if species is endemic, imperiled, or listed.

[3] Highlighted numbers indicate that spatial data for a particular species were found in the literature.

Table C.18. Spatial requirements reported for wildlife species that should occur almost exclusively in **UPLAND** habitats in the Econlockhatchee River Basin expressed as width of land (not water) needed by one individual (continued).

Species	Width Needed (ft)[1]	Basis of Need[2]	References
Southern Fence Lizard	51	similar to rough green snake	R 6
Peninsula Mole Skink	51	similar to rough green snake; endemic and imperiled species	R 6
Southeastern Five-lined Skink	51	similar to rough green snake	R 6
Sixlined Racerunner	51	similar to rough green snake	R 6
E. Slender Glass Lizard	51	similar to rough green snake	R 6
Eastern Kingbird	60	needs very little forest (edge species)	B 1
American Crow	60	needs very little forest (edge species)	B 1
Eastern Bluebird	60	needs very little forest (edge species)	B 1
Northern Mockingbird	60	needs very little forest (edge species)	B 1
Brown Thrasher	60	needs very little forest (edge species)	B 1
Loggerhead Shrike	60	needs very little forest (edge species)	B 1
Northern Bobwhite	60	needs very little forest (edge species)	B 1
Common Ground Dove	60	needs very little forest (edge species)	B 1
Mourning Dove	60	needs very little forest (edge species)	B 1
Blue Grosbeak	60	needs very little forest (edge species)	B 1
Painted Bunting	60	needs very little forest (edge species)	B 1
Orchard Oriole	60	needs very little forest (edge species)	B 1
Common Grackle	60	needs very little forest (edge species)	B 1
Cotton Mouse	71[3]	home range diameter	M 9
Eastern Mole	71	similar to cotton mouse	M 5
Florida Mouse	71	similar to cotton mouse; endemic and listed species	M 2
Hispid Cotton Rat	71	similar to cotton mouse	M 5
Pocket Gopher	71	similar to cotton mouse	M 5
Florida Worm Lizard	93, 177-591	similar to Florida brown snake; endemic species	R 6
Bachman's Sparrow	166	similar to tufted titmouse	B 1
Chuck-will's-widow	166	similar to tufted titmouse	B 1
Rufous-sided Towhee	166	similar to tufted titmouse	B 1
Scrub Jay	166	similar to tufted titmouse; endemic, imperiled, and listed species	B 1

Table C.18. Spatial requirements reported for wildlife species that should occur almost exclusively in UPLAND habitats in the Econlockhatchee River Basin expressed as width of land (not water) needed by one individual (continued).

Species	Width Needed (ft)[1]	Basis of Need[2]	References
Eastern Meadowlark	166	similar to tufted titmouse, requires open fields	B 1
Brown-headed Nuthatch	166	similar to tufted titmouse in pine forests	B 1
Gopher Tortoise	247	home range diameter; imperiled and listed species	R10
Summer Tanager	>450	minimum width of forested corridor bordered by development where species was found	B 4
Turkey Vulture	500	needs undisturbed forested area for nesting	B 1
Black Vulture	500	needs undisturbed forested area for nesting	B 1
Eastern Cottontail Rabbit	527	home range diameter	M 5
Eastern Hognose Snake	732	distance between captures of same individual	R 1
Red-headed Woodpecker	890	home range diameter	B18
Fox Squirrel	1,053	home range diameter	M10
Sherman's Fox Squirrel	1,053	similar to fox squirrel; endemic, imperiled, and listed species	M 2
Yellow-throated Warbler	1,183	similar to northern parula warbler	B 1
Pine Warbler	1,183	similar to northern parula warbler	B 1
Florida Pine Snake	1,155-1,297, 525-585	similar to yellow rat snake; imperiled and listed species	R 4
Pine Woods Snake	1,155-1,297, 525-585	similar to yellow rat snake	R 4
Short-tailed Snake	1,155-1,297, 525-585	similar to yellow rat snake; endemic, imperiled, and listed species	R 4
Corn Snake	1,155-1,297, 525-585	similar to yellow rat snake	R 4
Scarlet Kingsnake	1,664, 780	home range diameter, distance bewteen captures of same marked individual	R 1
Eastern Coachwhip	1,686	home range diameter	R 1
SE American Kestrel	2,622-6,627	range of home range diameters; listed species	B19, B20, B21
Common Barn Owl	2,622-6,627	similar to kestrel	B 1
Burrowing Owl	2,622-6,627	similar to kestrel; imperiled and listed species	B 1
Cooper's Hawk	5,159	home range diameter	B22
Striped Skunk	5,280-10,560	similar to long-tailed weasel	M 5
Eastern Spotted Skunk	5,280-10,560	similar to long-tailed weasel	M 5
Red-tailed Hawk	10,560	home range diameter	B23

Table C.18. Spatial requirements reported for wildlife species that should occur almost exclusively in UPLAND habitats in the Econlockhatchee River Basin expressed as width of land (not water) needed by one individual (continued).

Species	Width Needed (ft)[1]	Basis of Need[2]	References
Crested Caracara	10,560	similar to red-tailed hawk, only in open prairies and flatwoods; imperiled and listed species	B 1
Northern Harrier	10,560	similar to red-tailed hawk, only in marshes	B 1
E. Diamondback Rattlesnake	2,756	home range diameter; imperiled species	R 1
Red-cockaded Woodpecker	3,960	recommended 3/4 mile protection zone by the USFWS; imperiled and listed species	B24
Red Fox	9,113-13,544	range of home range diameters	M 8

[1] Width needed values were determined by using spatial information reported in the literature including: home range (diameters were calculated), maximum distance a wetland species was found from the nearest water source, maximum distance a radio-tagged, wetland individual traveled from a water body to which it returned, minimum distance from humans tolerated, distance between captures of the same individual. If no spatial data were found for a species, width values for other species that are closely related, similar sized, found in comparable habitats, and categorized in similar guilds were used. Professional judgements also were needed to assure that the application of the literature data to determine a protection zone width was ecologically sound (e.g. alligators and otters have linear movement patterns that follow the river channel rather than circular home ranges that include extensive uplands).

[2] Information provided here includes: description of literature data or other explanation for "width needed" value; and an indication if species is endemic, imperiled, or listed.

[3] Highlighted numbers indicate that spatial data for a particular species were found in the literature.

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FEEDING ZONE

	WB	WC	WS	GS	S/G	TB	TC	Breeds in other habitat	Total
Tree Canopy (TC)				3		3	1 10		1 16
Tree Bole (TB)						1 5		4	1 9
Shrubs/ Grasses (S/G)				1 3	2	1			1 6
Ground Surface (GS)				13 41	1 3	2 10	5	3 10	19 69
Water Surface (WS)									
Water Column (WC)									
Water Bottom (WB)									
Feeds in other habitat				5 9		1	1 1		6 11
Totals				19 56	1 5	3 20	2 16	3 13	28 111

BREEDING ZONE

Figure C-1. Guild matrix with feeding and breeding zones for wildlife species that occur in XERIC SCRUB habitats in the Econlockhatchee River Basin. The number of species using each feeding/breeding guild (center of square) and the number of species with ecological and legal statuses (endemic, imperiled, endangered, threatened, and special concern species; see Table 3.3.J in the guild (upper-right corner) are shown.

FEEDING ZONE

	WB	WC	WS	GS	S/G	TB	TC	Breeds in other habitat	Total
Tree Canopy (TC)				3		4	1 15		1 22
Tree Bole (TB)				1		1 5		4	1 10
Shrubs/ Grasses (S/G)				1 4	5	2	1	1 2	2 14
Ground Surface (GS)				11 45	4	2 12	2 12	2 11	17 84
Water Surface (WS)									
Water Column (WC)									
Water Bottom (WB)									
Feeds in other habitat				7 15		2	5 11		12 28
Totals				19 68	9	3 25	8 39	3 17	33 158

BREEDING ZONE

Figure C-2. Guild matrix with feeding and breeding zones for wildlife species that occur in FLATWOODS habitats in the Econlockhatchee River Basin. The number of species using each feeding/breeding guild (center of square) and the number of species with ecological and legal statuses (endemic, imperiled, endangered, threatened, and special concern species; see Table 3.3.) in the guild (upper-right corner) are shown.

FEEDING ZONE

	WB	WC	WS	GS	S/G	TB	TC	Breeds in other habitat	Total
Tree Canopy (TC)				3		3	1 20		1 26
Tree Bole (TB)				1		4		1 5	1 10
Shrubs/ Grasses (S/G)				1 4	5	2	1	1 3	2 15
Ground Surface (GS)				8 40	3	10	1 8	1 9	9 70
Water Surface (WS)									
Water Column (WC)									
Water Bottom (WB)									
Feeds in other habitat				8 16	1	2	5 11		13 30
Totals				17 64	9	21	7 40	3 17	27 151

BREEDING ZONE

Figure C-3. Guild matrix with feeding and breeding zones for wildlife species that occur in **HARDWOOD HAMMOCK** habitats in the Econlockhatchee River Basin. The number of species using each feeding/breeding guild (center of square) and the number of species with ecological and legal statuses (endemic, imperiled, endangered, threatened, and special concern species; see Table 3.3.) in the guild (upper-right corner) are shown.

FEEDING ZONE

	WB	WC	WS	GS	S/G	TB	TC	Breeds in other habitat	Total
Tree Canopy (TC)				1		4	1 15		1 20
Tree Bole (TB)		1				4		3	8
Shrubs/ Grasses (S/G)		1 2		1	4	3		2	1 12
Ground Surface (GS)		2 7		2	1	7	1	5 21	7 39
Water Surface (WS)						1			1
Water Column (WC)		1 4		2 5	1 4		4 9	6 11	14 33
Water Bottom (WB)									
Feeds in other habitat					1	1	2 4		2 6
Totals		4 14		2 9	1 10	20	7 29	11 37	25 119

BREEDING ZONE

Figure C-4. Guild matrix with feeding and breeding zones for wildlife species that occur in CYPRESS SWAMP habitats in the Econlockhatchee River Basin. The number of species using each feeding/breeding guild (center of square) and the number of species with ecological and legal statuses (endemic, imperiled, endangered, threatened, and special concern species; see Table 3.3.) in the guild (upper-right corner) are shown.

FEEDING ZONE

	WB	WC	WS	GS	S/G	TB	TC	Breeds in other habitat	Total
Tree Canopy (TC)				1		4	1 17		1 22
Tree Bole (TB)		1				4		3	8
Shrubs/ Grasses (S/G)		1 2			4	3		1 3	2 12
Ground Surface (GS)		2 8		4	1	7	3	5 23	8 47
Water Surface (WS)						1			1
Water Column (WC)		1 4		2 5	1 3		4 10	6 9	14 31
Water Bottom (WB)									
Feeds in other habitat					1	1	2 4		2 6
Totals		4 15		2 10	1 9	20	7 34	12 38	26 126

BREEDING ZONE

Figure C-5. Guild matrix with feeding and breeding zones for wildlife species that occur in SWAMP HARDWOOD habitats in the Econlockhatchee River Basin. The number of species using each feeding/breeding guild (center of square) and the number of species with ecological and legal statuses (endemic, imperiled, endangered, threatened, and special concern species; see Table 3.3.) in the guild (upper-right corner) are shown.

FEEDING ZONE

	WB	WC	WS	GS	S/G	TB	TC	Breeds in other habitat	Total
Tree Canopy (TC)								1 11	1 11
Tree Bole (TB)								3	3
Shrubs/ Grasses (S/G)				1	2				3
Ground Surface (GS)		2 8	1 1	1 4		1		1 11	5 25
Water Surface (WS)			1 8						1 8
Water Column (WC)		1 4	1	3 11	1 4		4 9	8 14	17 43
Water Bottom (WB)									
Feeds in other habitat		1					1		2
Totals		3 13	2 10	4 16	1 6	1	4 10	10 39	24 95

BREEDING ZONE

Figure C-6. Guild matrix with feeding and breeding zones for wildlife species that occur in **FRESHWATER MARSH AND RIVER** habitats in the Econlockhatchee River Basin. The number of species using each feeding/breeding guild (center of square) and the number of species with ecological and legal statuses (endemic, imperiled, endangered, threatened, and special concern species; see Table 3.3.) in the guild (upper-right corner) are shown.

ECONLOCKHATCHEE RIVER BASIN NATURAL RESOURCES DEVELOPMENT AND PROTECTION PLAN

Chapter 4

HISTORICAL RESOURCES OF THE ECONLOCKHATCHEE RIVER BASIN

Prepared for

St. Johns River Water Management District

October 1990

Chapter 4

HISTORICAL RESOURCES OF THE ECONLOCKHATCHEE RIVER BASIN

Lucy Wayne and Martin Dickinson
SOUTHARC, INC.
Gainesville, Florida

INTRODUCTION

Issues

In this period of rapid development and change in our environment, society has become increasingly aware of the significance and fragility of the nation's historical resources. These resources, whether archaeological sites, historic structures, or historic sites, provide a direct link to our heritage. Unlike natural resources which, given time, can often be reproduced or reestablished, historical resources are non-renewable. Once archaeological sites or historic structures are destroyed, the information they contain relevant to our history or prehistory is irretrievably lost and the physical link to the past is significantly diminished. In order to mitigate this loss, the federal and state governments have established specific procedures for historical resource management. The Econlockhatchee Basin (Econ Basin) historical resources plan presented in this document is based on these established procedures.

Three basic properties are involved in historical resource management: archaeological sites, historic structures or architecture, and historic sites. Archaeological sites consist of artifacts and other associated remains or features which provide evidence of past human occupation or utilization of the property. Sites in Florida may include ceramics, lithic (stone) artifacts, bone, shell, human burials, postmolds, storage pits, wells, foundations, or mounds. The significance of such sites is determined based on the criteria for listing in the National Register of Historic Places (NRHP). Documentation of archaeological sites allows the scholar to interpret the activities which previously occurred on the site and thus understand the way other prehistoric or historic peoples used and occupied the land. The scientific value of an archaeological site lies in its context and the comparison of the material to that of similar sites. Disturbance or destruction of this context significantly reduces the value of the sites.

Historic structures reflect the nature of their builders and the communities within which they are located. They provide a sense of place and history for the community. Often they are associated with specific landscape features and archaeological remains. Structures may also provide guidance as to successful adaptations to specific environmental characteristics of an area, or innovative uses of materials. These structures contribute to our understanding of changing life styles, economic bases, technology, and raw material availability. When combined with historic archaeology and archival records, studies of these properties provide a glimpse of the lives of those who constructed and utilized the resources.

Historic sites commemorate important events in a region's past. Such sites may also conserve features of the natural environment. In addition, historic sites frequently contain archaeological remains associated with the events which occurred at that location.

Successful stewardship of our heritage requires the combined efforts of both the public and private realms. The public realm--government agencies and preservation organizations -- provide the legal framework, guidance, and, often funding for preservation efforts. However, the private realm must support and cooperate with the public realm in order to have a successful preservation program. Implementation of an historical resource management program often requires compromise, and sometimes innovative thinking from both groups.

Historical resource management consists of several basic steps:

1) Identification of the resources. This step is intended to locate and identify the nature of the historical resources within a given area. Generally identification requires a literature search and some form of field survey. The survey may be a simple windshield survey as often used for architectural resources, or it may be a more complex subsurface examination for archaeological resources.

2) Evaluation of the resources. This step involves assessing the significance of a resource and its potential eligibility for nomination to the NRHP. An evaluation normally requires the assistance of expert consultants such as archaeologists, historians, and/or architectural historians. Significance is based on an evaluation of the property's importance at a local, regional, or national level. Significance is based on a site's integrity, uniqueness, research potential, and relationship to historic persons or events.

3) Management of the resources. Management can take many forms, ranging from simple avoidance of a site during the development process, to in-depth study of a site, to active preservation and interpretation. The simplest form of management is avoidance. However, this is not always feasible or appropriate. In addition, the condition of a property may require active steps to protect it from deterioration. If avoidance is not selected, management may consist of maintaining a site, restoration or rehabilitation, interpretation, or, in a case of imminent development or destruction, salvage of the information from the site.

An effective resource management plan for the Econ Basin must address two goals: (1) it must protect the significant historical resources within the basin; and, (2) in protecting these resources, it must not unfairly or unreasonably restrict the rights of the landowners to use their property. It must be recognized that in some cases, the only way to attain both of these goals is through public acquisition of the property containing the significant resources.

Scope of the Study

The historical resource management plan for this phase of the Econ Basin project was designed to examine existing information on the area. Due to time and budget constraints, no fieldwork was attempted. The information utilized was obtained from the files of the Florida Division of Historical Resources (FDHR), the St. Johns River Water Management District, Rollins College, Piper Archaeology, P.K. Yonge Library of Florida History, the Map Library of the University of Florida, and the files of SouthArc, Inc.

In addition, informants were consulted concerning their knowledge of the area's resources. These informants included archaeologists from FDHR, the Florida Museum of Natural History, Rollins College, and Piper Archaeology. Other informants included Ken Bosserman of the Friends of the Econ and Brian Hickman of the Orange County Historical Museum.

The existing literature on the Econ Basin ranges from Florida Master Site File forms to general syntheses of the region's cultural history. This literature is reviewed in a later section of this document. Informants provided personal knowledge of the area's resources as well as input as to resource management needs for the region. Environmental information was utilized to make preliminary assessments of the potentially sensitive areas of the basin in terms of historical resources.

In order to thoroughly document and assess the historical resources of the Econ Basin, field survey is the primary need. The area is relatively little known or documented archaeologically and historically. All too often, the development which has occurred in the region has not included historical assessments. Therefore, not only are very few sites identified or assessed for significance, but it is also difficult to make valid predictions as to which portions of the basin might be sensitive in terms of historical resource potential.

Thorough examination of both historic and recent aerial photography might also be a major aid in identifying historical resources and areas of sensitivity. Correlation of photography with topographic and soils information, field survey results, and data on known sites would allow development of a reasonably accurate model for resource sensitivity within the basin. The Map Library of the University of Florida has complete aerial coverage of the basin, although stereoscopic coverage is limited. This coverage includes 1940, 1947, and 1957 aerials of Seminole County, 1947 and 1954 aerials of Orange County, and 1944, 1952, and 1954 aerials of Osceola County.

These recommendations are discussed in greater detail in the Management Alternatives section of this document.

Definition of Terms

The terms presented in this section are commonly used within the field of historical resource management (USMC 1986; Eubanks and Adams 1986; McGimsey n.d.). This list is not meant to be all inclusive, but will assist the reader in understanding the discussions in this document. The list is based on terminology established by the federal system of historical resource management as well as terms commonly used within the profession itself.

Aboriginal -- Generally refers to Native American or Indian occupations.

Advisory Council on Historic Preservation (ACHP) -- An independent federal agency tasked with formulating cultural resources protection policy and with commenting on federal agency undertakings which affect NRHP properties.

Archaeology -- The scientific discipline responsible for studying the social and cultural past through material remains, with the goal of ordering and describing the events of the past and explaining the meaning of these events.

Archaeological Assessment -- An evaluation of the archaeological resources present in an area, their scientific significance, and the cost of protecting or properly investigating them.

Archaeological Data -- Information embodied in material remains, artifacts, structures, refuse, etc., produced purposely or accidentally by human activity and the information embodied in the spatial relationships among such remains.

Archaeological Data Recovery -- The systematic removal of a portion or all of the scientific, prehistoric, historic and/or archaeological data that qualify a property for listing on the NRHP.

Archaeological Excavation -- The scientifically controlled recovery or salvage of a site designed to yield maximum information about the life of the inhabitants, their ways of solving human problems, and of adjusting to and modifying their natural environment. Such work should be programmed during final planning stages or at least during the early stage of project construction.

Archaeological Inventory -- A presentation and summation of the data presently known concerning an area. This is called by some agencies a records check. Only in very rare instances is present information sufficient to assess adequately the archaeological resources or to estimate the cost of mitigating the impact of a proposed project on those resources.

Artifact -- A material object made or modified in whole or in part by man. Among the most common artifacts on archaeological sites are fragments of broken pottery (sherds), or stone (lithic) tools, chips (debitage), projectile points, and similar lithic debris.

Consultation -- The act of seeking and considering the opinions and recommendations of appropriate parties about undertakings which might affect NRHP properties. Appropriate parties normally include the SHPO. Consultation is very formal and procedurally oriented; correct procedures are promulgated in federal law 36CFR800.

Criteria of Effect -- Standards promulgated by ACHP (in 36CFR800) and applied to determine whether an undertaking will affect any property on the NRHP. Effect is an action that results in a change, beneficial or adverse, in the quality or characteristics that qualify a property for inclusion in the NRHP. Adverse effect results in total or partial destruction or alteration of a NRHP property or eligible property. Adverse effect may also result if a property is isolated from its surrounding environment, if neglect of the property results in the deterioration or destruction of the property, and/or if the land occupied by the property is sold or transferred, and there are no provisions in the deed or transfer agreement to provide for the preservation, maintenance, or use of the property.

Criteria for Evaluation -- Criteria established in federal law 36CFR60 to be applied in determining whether a cultural resource is eligible for listing on the NRHP.

Cultural Resource -- Any building, district, site, structure, or object of historical, archaeological, architectural, engineering, or cultural significance.

Cultural Resource Professional -- An anthropologist, archaeologist, architectural historian, historical architect, or other professional with specialized training/experience in work required to comply with cultural resources legislation.

Cultural Resources Inventory -- A detailed descriptive listing of an area's cultural resources, including evaluations of significance according to NRHP criteria.

Cultural Resources Management Plan -- Includes inventory and categorization of an area's cultural resources, serving as a basis for on-going maintenance and protection from adverse effects of a planned undertaking. Also known as a Historical Resources Management Plan.

Cultural Resources Protection -- Not always the same as preservation, protection includes (1) routine maintenance and security, (2) consideration of effects any undertaking could have on cultural resources, and (3) formal documented consultation with the SHPO.

Cultural Resources Survey -- The systematic process of locating and identifying cultural resources so as to comply with the National Historic Preservation Act Amendments of 1980. There are two types of survey, the "reconnaissance" survey and the "detailed" or "intensive" survey.

Data Recovery -- Recovery prior to destruction of information contained in archaeological resources which are significant mainly for their value in scientific study.

Debitage -- Lithic debris resulting from the manufacture of stone tools.

Determination of Eligibility -- Decision as to whether or not a property meets the criteria of eligibility for listing in the NRHP as published in 36CFR60. Although agencies or persons cooperate with the SHPO in locating properties likely to meet the criteria, only the Keeper of the NRHP is empowered to make formal determinations of eligibility.

Division of Historical Resources (DHR or FDHR) -- Florida state agency responsible for administering state and federal regulations concerning cultural or historical resources. It is a division of the Florida Department of State and is directed by the SHPO.

Eligible Property -- Any district, site, building, structure, ruin, or object that meets the NRHP Criteria for Eligibility (36CFR60.6).

Environmentally Sensitive Area -- Any location containing endangered or protected plants, animals, or historical properties.

Evaluation -- The process of applying NRHP criteria of significance to apparently eligible resources and the categorizing of resources in preparation of a cultural resource management plan.

Feature -- An area in or on the ground where evidence of past human activities can be seen or detected. Among the most frequent features on archaeological sites are fire pits, storage pits, burial pits, hard-packed house floors, foundations, and postholes.

Historic District -- A geographically definable area which has a concentration of cultural/historical resources.

Historic Site -- A location where a significant event took place or where a significant cultural resource is now or used to be situated.

Intensive Archaeological Reconnaissance -- An on-the-ground surface survey and subsurface testing of an area sufficient to permit determination of the number and extent of the resources present, their scientific importance, and the time factors and cost of preserving them or otherwise mitigating any adverse effects on them. This level of investigation is most appropriate once a

specific region or area to be affected has been determined or the choice has been narrowed to one of a few prime locations.

Keeper of the NRHP -- National Park Service official formally responsible for maintaining and publishing the list of cultural resources that meet NRHP criteria for eligibilty and for determining additions to or deletions from the NRHP.

Lithic -- Stone

Memorandum of Agreement (MOA) -- A written agreement among the agency, the SHPO, and the ACHP that stipulates how an undertaking will be carried out so as to avoid or mitigate adverse effects and otherwise to protect cultural resources.

Midden -- Archaeological refuse deposit.

Mitigation -- Planning activities or procedures that are intended to minimize the impact to cultural resources.

Mitigation by Excavation -- Archaeological excavation sufficient to recover data necessary to mitigate the adverse effect(s) of the proposed project on an archaeological site determined eligible for listing on the NRHP.

Multiple Resource Area -- A NRHP listing composed of individual properties or a combination of properties and districts within a specific geographical area. Within the Multiple Resource Area, only the lands occupied by each property and/or district are subject to the benefits and protections accorded by the National Historic Preservation Act.

National Historic Landmark -- A property designated by the Secretary of the Interior as having exceptional significance in the nation's history. National Historic Landmarks are automatically listed on the NRHP and subject to all preservation requirements.

National Register Criteria -- The criteria established in 36CFR60.6 by the Secretary of the Interior to evaluate properties for inclusion in the NRHP. Archaeological sites are generally considered if they have yielded, or may yield, information or data important for understanding the prehistory or history of the area.

National Register of Historic Places (NRHP) -- The federal government's official list, maintained by the Secretary of the Interior, of all sites, buildings, districts, structures, and objects of significance in American history, architecture, archaeology, engineering, and culture.

National Register Property -- Any cultural resource listed or eligible for listing on the NRHP.

Nomination -- Formal notification to the Keeper of the NRHP that a property appears to meet criteria of eligibility.

Paleobotanical Remains -- Plant remains in an archaeological context.

Prehistoric -- Prior to written history. Generally used in the U.S. to refer to occupations prior to European exploration and settlement.

Preliminary Archaeological Reconnaissance -- As defined in 36CFR66, a detailed on-the-ground surface examination of selected portions representing a statistical sample of the area to be affected, adequate to assess the general nature of the archaeological resources probably present, project this assessment to the entire area, assess the probable impact of a project, and estimate the cost of mitigating the impact. This level of investigation is appropriate to preliminary planning decisions.

Recordation or Documentation -- Drawings, photographs, and other formats permanently recording resources that must be destroyed or substantially altered.

Salvage Archaeology -- The systematic collection of surface and subsurface cultural remains by professional archaeologists from an area to be damaged or destroyed.

Section 106 Action -- Action to comply with Section 106 of the National Historic Preservation Act of 1966, which requires that an agency (1) consider effects of its undertakings on NRHP properties, and (2) afford the ACHP an opportunity to comment on undertakings that are likely to affect NRHP properties. This action applies to any federally funded, licensed, permitted, or assisted activity.

Sherd -- Fragment of ceramic or glass.

Significance -- Significance of cultural resources as evaluated in terms of NRHP criteria as provided in 36CFR60.

Site -- Any area or location occupied as a residence or utilized by humans a sufficient length of time to construct features, or deposit a number of artifacts.

State Historic Preservation Officer (SHPO) -- Official appointed by the governor of each state or U.S. territory, responsible for administering cultural resource programs.

Survey -- Initial assessment level for historical and archaeological sites; discovers and identifies sites within chronological and geographical framework; data usually not of sufficient detail to determine NRHP eligibility. Generally involves field inspection or reconnaissance level work.

Intensive survey includes subsurface testing. Windshield survey is a cursory examination of an area.

Technical Assistance -- A sharing by cultural resource specialists of their knowledge about cultural resource laws, regulations, guidelines, and instructions, their interpretation, and their practical application.

Testing -- Archaeological sampling or excavations sufficient to define the spatial extent, nature, and cultural significance of an archaeological site and determine NRHP eligibility. Sometimes referred to as secondary testing.

Zooarchaeological Remains -- Animal food remains in an archaeological context.

Common Abbreviations

ACHP	Advisory Council on Historic Preservation
CFR	Code of Federal Regulations
COE	U.S. Army Corps of Engineers
CRM	Cultural Resource Management
DRI	Development of Regional Impact
EA/EIS	Environmental Assessment/Environmental Impact Statement
FAC	Florida Archaeological Council
FDHR	Florida Division of Historical Resources
HPP	Historic Preservation Plan
MOA	Memorandum of Agreement
NRHP	National Register of Historic Places
SCS	Soil Conservation Service
SHPO	State Historic Preservation Office
SOPA	Society for Professional Archeologists
USGS	U.S. Geological Survey

Review of Existing Literature

Archaeologists have divided Florida into a number of cultural regions based on differences in prehistoric archaeological site types and artifactual evidence. Seminole, Orange, and Osceola counties are considered to be part of the East and Central Lake District (Milanich and Fairbanks 1980). By comparison to other regions of the state, this district is relatively little known archaeologically and has received only limited attention from the profession. Although Milanich's and Fairbanks' synthesis of Florida archaeology includes this region, the majority of their discussion centers on the St. Johns River Basin and coastal portion of the district. Earlier works by John Goggin (1952) and Irving Rouse (1951) touch on the area but also focus on the major drainages of the St. Johns River Basin and the Indian River.

Actual archaeological research in the Econ Basin is also very limited. Although a number of early explorers, anthropologists and archaeologists visited the area and recorded sites on the St. Johns and Indian rivers, no information on the Econ Basin is available from these sources . These explorers included the Bartrams, Daniel G. Brinton of the University of Pennsylvania, Jeffries Wyman of Harvard, the engineer and cartographer J. Francis LeBaron, Cyrus Thomas of the Smithsonian, and Andrew E. Douglass of New York. The works of C.B. Moore provide the first documentation for the Econ Basin. Moore identified and excavated portions of the Palmer-Taylor Mound (8Se18), Tozzer Mound (8Se20), and Buzzards Roost or Heffer Mound (8Se21) during his late 19th century trips to Florida (Rouse 1951).

No further research was conducted in the Econ Basin until the winter of 1940-41, when the Excavators' Club of Cambridge Massachusetts dug at the Palmer-Taylor Mound site. Their research was completed in 1947 by the Anthropology Society of Harvard's Peabody Museum. The Excavators' Club also made surface collections at Cabin Mound (8Se19), the Tozzer Mound, and the Buzzards Roost Mound (Rouse 1951). This research documented the stratigraphy and contents of the excavated mound as well as the locations and artifacts of the other mounds.

During the past 20 years, environmental legislation at both the federal and state level has led to an increase in archaeological research throughout the nation. As a result there have been cultural resource surveys conducted in portions of the Econ Basin. Unfortunately, all too often development within the Basin has either not been at a level requiring consideration of the resource base, or the projects have been exempted from meeting the requirements.

Although there have been a number of Developments of Regional Impact (DRIs) within the vicinity of the Econ Basin, only a few have resulted in cultural resource surveys. These include the Huckleberry project in Orange County (Stewart et al. 1982), Hunters Creek in Orange County (Stewart and Weiss 1983; 1984; Stewart 1987), Primera in Seminole County (Stewart 1984a), the Central Florida Research Park in Orange County (Austin and Ballo 1987), and Martin Marietta Aerospace in Orange County (Austin and Ballo 1986).

Additional surveys in the region were completed for various public services, utility, and transportation projects, including the East Orlando 201 Plan (Swindell et al. 1977), Spring Hammock Park (Stewart and Dreves 1980), the Stanton Energy Center (Daniel and Gordon 1981), the Shingle

Creek Water Control Project (Stewart n.d.), the Tosohatchee State Preserve (Stewart 1982), the Duval-Poinsett 500 kV Transmission Line Right-of-Way (Hardin and Piper 1983), Tiger Creek Preserve (Stewart 1984b), the Upper St. Johns River Flood Control Project (Campbell et al. 1984), and the Orlando-Orange County Expressway Extension (White and Horvath 1985). In addition, knowledgeable area residents are aware of undocumented sites within the Basin (Bosserman 1989).

It must be noted, however, that many of these projects were limited in nature and that large portions of the study area remain unsurveyed. In 1985, Daniel proposed a model for hunter-gatherer settlement in central Florida based on the data from these surveys and research from the west coast of the state. If Daniels' model is correct, there should be significant early prehistoric sites in the central Florida upland areas. The model remains largely untested with the exception of Stewart's ongoing research at the Hunters Creek site (1987).

Description of Resource Characteristics

The following sections will present a regional cultural history applicable to the Econ Basin and then identify the presently known historical resources within the study area. A preliminary projection of areas which may contain historical resources is also presented. It must be cautioned that this projection is based on a very limited and incomplete data base, rather than systematic testing and documentation. Therefore, it can only be used at a very broad level of preliminary planning.

Regional Cultural History

Florida has been divided into a number of prehistoric cultural regions based on differences in the nature of the sites and artifacts within each region. The Econ Basin lies within the East and Central Lake Region defined by Milanich and Fairbanks (1980). Although their discussion of this region emphasizes the eastern area within the St. Johns River Basin and the coastal zone, the basic cultural sequence for the Central Lake area is believed to be similar to that to the east, based on the few excavations and sites identified within the area. In addition, the areas share similar environmental characteristics and their proximity and ready access via the many streams would facilitate diffusion of both cultural traits and people.

Paleo-Indian Period, 12,000-8,000 B.C.

The Paleo-Indians are generally described as migratory hunters of the now extinct megafauna such as the mammoth and giant ground sloth. During this period, Florida was much cooler and moister, with the shorelines extending many miles further out from the present coast as a result of lower sea levels. These Indians were believed to live in small bands or family groups which followed the migrations of the megafauna on which they depended. The majority of the known sites have been interpreted as "kill sites" located at springs or river crossings where the animals congregated. Sites are identified by the presence of the distinctive fluted, lanceolate projectile points such as the Clovis or Suwannee.

Recently Daniel (1985) has proposed a slightly different model for Paleo-Indian life. He bases his model on Binford's (1980) discussion of hunter-gatherer subsistence strategies. Using this discussion, Daniel postulates that Paleo-Indians fit the "collector" strategy which moves "goods to consumers with generally fewer residential moves" (Binford 1980:15). Collectors are responding to "a spatial or temporal incongruence of resources" (Daniel 1985:261) in which they move near a major resource and send special parties out to exploit other resources. Collectors may also store food for part of the year. Thus, collectors may have residential sites, extractive location sites, field camps, hunting stations, and caches. Daniel believes that Paleo-Indian occupation would have been tied to permanent water sources within territories oriented along east-west drainage basins. At the present time Daniel's model has not been tested in the East and Central Lake District due to a lack of known Paleo-Indian sites.

The nearest Paleo-Indian sites to the project area are located in Vero Beach, Melbourne, Marion County, and Warm Mineral Springs. No sites from this period are known in the immediate vicinity of the Econ Basin. If sites exist, it is probable that they would be located at stream crossings or in proximity to springs.

Archaic Period, 8,000-2,000 B.C.

The Archaic Indians have traditionally been described as hunter-gatherers who exploited a wider range of resources than their predecessors. They were believed to migrate seasonally, although they were thought to have been somewhat more sedentary than Paleo-Indians. Archaic Period sites are characterized by a wide range of tools made from stone, shell, bone, and wood. The lithics from this period appear to be more crudely made than the finely crafted Paleo-Indian points, however, they display a greater variety of forms. The distinctive projectile points for this period are large, stemmed types.

The environment during the Archaic Period had become much more like that of today, with warmer, drier conditions and a rise in sea level to near present heights. The megafauna of the Paleo-Indian period had either become extinct or shifted their range to the north, leaving fauna typical of present-day Florida. During this time, it appears that exploitation of freshwater shellfish became increasingly important, as indicated by the extensive shell middens associated with riverine and coastal

sites of the period. The Mt. Taylor type shell midden sites of the Late Archaic are characterized by the presence of freshwater snails (*Viviparus georgianus*), apple snails (*Pomacea paludosa*), and bivalve molluscs (*Elliptio* spp.). Cemeteries and associated burial goods began to appear during the Late Archaic which indicates an increased emphasis on burial ceremonialism.

Daniel (1985) has also proposed a somewhat different model for Archaic Period occupation. Again, using Binford's analysis of hunter-gather subsistence strategies, he defines Archaic Indians as foragers who "move consumers to goods with frequent residential moves" (Binford 1980:15). Foragers are responding "to homogeneous or largely undifferentiated ecological areas of resources" (Daniel 1985:261). Foragers would have two types of sites, base camps and extractive locations. Further, Daniel suggests that Archaic Indians practiced a territorial occupation pattern along natural drainages. During the warm spring and summer months, the bands dispersed into small groups of foragers to exploit lacustrine and coastal resources. During the cooler fall and winter months, these groups coalesced into bands which shifted to a collector pattern of occupation in the uplands to exploit deer and nut resources.

Presently, with the exception of Stewart's ongoing research at Hunters Creek (1987), Daniel's model has not been tested in the East and Central Lake District.

Orange Period, 2,000-1,000 B.C.

The Orange Period represents the first appearance of ceramics in the southeast. These first ceramics were primarily slab construction and tempered with plant fibers. Decoration includes incising and punctation. Other than the ceramics, the artifact assemblages for this period are quite similar to the preceding Late Archaic/Mt. Taylor Period.

Subsistence patterns during this period show an increase in or shift towards exploitation of coastal resources, particularly the coquina (*Donax variabilis*) found in coastal lagoons. Sites are distinguished by extensive coquina shell middens containing fiber tempered ceramics.

Transitional Period, 1,000-500 B.C.

The Transitional Period marks the beginning of distinctive regional cultural groups in Florida. It also marks the change from slab construction fiber tempered ceramics to coil construction and sand tempering. The most common ceramic for this period in the East and Central Lake District is the chalky St. Johns Incised ware. It is believed that this period represents a gradual shift from a hunter-gatherer subsistence pattern to a more sedentary pattern which may have been based on exploitation of cultigens.

St. Johns I, 500 B.C.-A.D. 800

Daniel neatly summarizes the St. Johns Period as "a pottery using, mound building, semi-sedentary complex that probably utilized agriculture. The St. Johns Tradition is divided into two archaeological periods and several subperiods, and is noted for its chalky ware ceramics" (Daniel 1981:25). The presence of mound burial indicates an increasingly complex society, probably based on chiefdoms. It also implies a rather sedentary existance and larger populations to provide the necessary labor for such construction. The various subperiods are identified based on variations in the artifact assemblages and site characteristics.

The St. Johns I Period is subdivided into St. Johns I, Ia, and Ib. The St. Johns I subperiod (500 B.C.-A.D. 100) is characterized by the presence of plain and incised St. Johns ceramics in the village areas. However, burial mounds may contain Deptford pottery characteristic of cultural groups to the north and west. This implies an exchange of goods and perhaps ideas between the two groups. The Deptford wares represented in mounds include Deptford Linear Check Stamped, Deptford Bold Check Stamped, and Deptford Simple Stamped. The St. Johns type known as Dunns Creek Red is also present in burial mounds.

During the St. Johns Ia subperiod (A.D. 100-500) evidence of the Hopewellian-Yent complex characteristic of societies to the northwest begins to appear in burial mounds. This complex evidences increased burial ceremonialism with the presence of elbow pipes, cut mica, galena, shell gorgets, and copper ornaments, many of these trade goods from the north and central United States. Village pottery remains dominated by St. Johns Plain, but mounds contain Dunns Creek Red, Deptford, Swift Creek, and, during the latter part of the subperiod, Weeden Island types.

St. Johns Ib (A.D. 500-800) is marked by the appearance of Weeden Island influences from the west, although the village pottery remained St. Johns Plain. The total number of sites which can be identified with this subperiod represents an increase over previous subperiods suggesting a large population increase during this time.

St. Johns II, A.D. 800-1565

The St. Johns II Period is marked by the appearance of check stamped pottery. Like the previous period, St. Johns II has been divided into three subperiods based on changes in the artifact types.

St. Johns IIa (A.D. 800-1300) is marked by an increased use of burial mounds and the presence of the distinctive St. Johns Check Stamped pottery. Weeden Island pottery continues to appear in mounds and some mounds contain caches of ceramics.

St. Johns IIb (A.D. 1300-1513) sites begin to display Mississippian influences with the presence of Southeastern Ceremonial Cult copper items in the mounds. Although Check Stamped pottery dominates the sites, there are some Fort Walton and Safety Harbor ceramics represented, indicating contact with the west coast of Florida. Mounds became larger and more complex during this period,

indicating an increasingly sedentary and stratified society. The Indians of this period were probably organized in hereditary chiefdoms and priesthoods.

St. Johns IIc (A.D. 1513-1565) is the final prehistoric stage in Florida during which European contact occurred. Although St. Johns Check Stamped ceramics and burial mounds are still present, European artifacts began to appear in the sites. The population of this period suffered severe reductions as a result of the introduction of European diseases.

In general, the St. Johns II period represents a continuance of the subsistence patterns of previous periods, with a heavy dependence on marine and estuarine resources, particularly coquina (*Donax variabilis*), oyster (*Crassostrea virginica*) and clam (*Mercenaria mercenaria*). Some shell middens along the coast were over 25 feet high, indicating the presence of large populations.

At the time of European contact, the Indians of the study area were described as the Freshwater (or Agua Dulce) and Acuera groups of the Timucuan people. These are probably the least known of the Timucuan groups due to limited contact with the early Spanish settlers. They were described as agriculturists who grew corn, beans, and tobacco, but also relied heavily on hunting, fishing, and gathering wild plant foods. Social organization was based on ranked clans headed by chiefs. Polygamy was common. The people were described as tall and often tatooed. Extensive rituals were practiced in association with warfare and burials.

St. Augustine Period, A.D. 1650-1750

European contact would result in the virtual destruction and elimination of the native Indians of Florida within a hundred-year period, primarily through the introduction of European diseases. Native ways of life were altered through the introduction of European goods and agricultural practices. The native religious practices were largely supplanted by the introduction of Catholicism through the Spanish mission system. Ceramics of the contact period also reflect European influences, particularly in their shapes. These ceramics are known as San Marcos types in eastern Florida.

The English raids of the early 18th century led to the final extermination of the Timucua and their culture. After 1715, the Spaniards encouraged Creek Indians from Georgia and Alabama to migrate to Florida, where they became known as the Seminole.

Historic Period, A.D. 1750 to present

After the decimation of the native Indians, the Creek Indians moved into northern Florida during the period described by Fairbanks (1978) as Colonization, 1716-1763. The Creeks in Florida appear to have abandoned the Creek town pattern with its central square in favor of a more dispersed pattern of separate farmsteads. This may reflect their increasing dependence on exploitation of the cattle herds introduced by the Spaniards. Seminole sites in north Florida are marked by the presence of Chattahoochee Brushed ceramics as well as European trade goods. Although the Seminole traded with the Spaniards, there was little additional contact and apparently no attempt to reintroduce the mission system.

Fairbanks (1978) characterizes the period from 1763 to 1790 as Separation. The British acquisition of Florida in 1763 led to a well-defined Indian policy which centered on increasing attempts to control the Indians. The Indians, in turn, extended their isolation from their homeland to an attempt at isolation from the British. This isolation was accompanied by increasing hostility towards the British. At the same time, the Seminole were harboring runaway slaves from Georgia and the Carolinas which promoted their distrust of white settlers as well as hostility on the part of those settlers. The British did establish a number of trading posts among the Seminole, thus increasing the presence of European goods on Indian sites.

The third Seminole period is characterized as Resistance and Removal, 1790-1840. This was the period of the First and Second Seminole Wars. After the Spaniards regained Florida, they allowed the British and Americans to continue to trade with the Seminoles. Perhaps as a result of increasing frontier tensions, Seminole sites became even more dispersed. After the Creek Indian War, large numbers of Indians migrated to Florida, increasing the Seminole population. At the same time, American settlers continued to move into the same areas, resulting in increased friction between the two groups. This led to the First Seminole War of 1818. Although this war was rather limited and brief, it did influence the cession of Florida to the United States in 1819. The 1823 Treaty of Moultrie Creek attempted to confine the Seminole to the area south of Ocala. This led to the Seminole presence in the Central Lakes area of Florida, but also to increased friction between the two groups.

The new Seminole reservation area did not offer the same resource base as the area previously occupied. At the same time, the increased friction between Indians and American settlers had resulted in reduced access to trade goods. In 1830, this friction erupted into the Second Seminole War. During this war, a number of military outposts and highways were established in Central Florida, including Fort Christmas, Fort Mellon, Fort Lane, Fort McNeil, Fort Gatlin, and Fort Taylor in the region of the St. Johns and Econ Basins (Davidson 1835-37). At least one battle occurred in the Econ Basin, at an Indian crossing on the river. Although the Indians were dispersed, the American army suffered losses, including a wound to its commander, Major General Jesup (Jesup 1838).

The end of the Second Seminole War brought the fourth stage of the Seminole Period, Withdrawal, 1840-1880 (Fairbanks 1978). At this time, the Seminole who remained in Florida withdrew into the reaches of the Everglades of South Florida, leaving north and central Florida open to American settlement. The Armed Occupation Act, offering homestead rights to settlers, led to an increased movement into the state. However, until the present time, the Econ Basin has remained lightly

populated, with most of the area utilized for forestry and agriculture. Small settlements were established tied to the citrus, cattle, and logging industries.

With the growth of Orlando in the late 19th century, homesteading increased and large tracts of land were acquired for potential development. The largest landowner was Hamilton Disston, who owned thousands of acres after 1881. At this time, the communities of Maitland, Oviedo, and Sanford were also established (Wells 1977). The 1940s aerials show a pattern of small farmsteads in the better drained areas west of the St. Johns River flood basin. The farmsteads include row crops, pasture, and citrus. These farms continue up the river to Bithlo on the Econ and Delorme on the Little Econ. From there, land use shifts to selective logging and range land; this land use continues on to the south of the basin.

The recent growth and development of the Orlando area has led to increased pressure on the Econ Basin and its historical resources. With planned transportation expansions, it is almost certain that development will continue to spread to the east of Orlando.

Econlockhatchee River Basin Historical Resources

This discussion will address only those sites listed in the Florida Master Site File for the Econ Basin. While other sites certainly exist and may have been identified (Bosserman 1989), they are not currently documented at FDHR. Historic sites for which only archival information is available are not mapped. Figure 4-1 shows the locations of the known sites.

Seminole County

8Se18 -- Palmer-Taylor and Shapfeld Mounds. This site was homesteaded in the late 19th century and planted with grapefruit. The Palmer-Taylor house appears to have been located on the mound. The mound is located about 300 yards north of the Econ bank. The site was first identified by C. B. Moore in the 1890s, who excavated two pits in the mound. A later owner, John Clark Bills, excavated a large trench and other pits across portions of the site. In 1940-41, the Excavators Club placed a number of units in the Palmer-Taylor Mound as well as a test pit in the smaller Shapfeld Mound. The mound is a sand and shell structure which contains both animal and human remains. Ceramics include both Orange and St. Johns types, as well as the Belle Glade types characteristic of South Florida. Rouse (1951) described the site as dating to the Orange-Malabar sequence, which would correspond to Orange/St. Johns. The presence of St. Johns Check Stamped ceramics indicates a long period of repeated occupation for this site. Soils are described as "made land" and Delray fine sand in a hardwood hammock.

8Se19 -- Cabin Mound. This shell mound was located approximately 0.4 mile northwest of the Palmer-Taylor Mound. This site is also located on Delray fine sand in hardwood hammock.

Although a surface collection was made by the Excavators Club in 1940-41, no excavations were conducted due to the presence of the cabin on the mound as well as the active cultivation of the site. The site appears to be a low midden with animal bone and St. Johns ceramics. Rouse (1951) designated the site as dating to the Malabar II period which corresponds with St. Johns II.

8Se20 -- Tozzer Mound. This site lies approximately 0.5 mile west of the Palmer-Taylor Mound in the same soil and vegetation type environment. It is also a shell mound, first identified by Moore and later surface collected by the Excavators Club. It is a crescent-shaped midden approximately 200 feet long and 5 feet high. The site contains animal bone and St. Johns ceramics which date to the same period as the Cabin Mound site (Rouse 1951).

8Se21 -- Buzzards Roost or Heffer Mound. This midden lies south and east of the Palmer-Taylor Mound. It was identified by the Excavators Club in 1940 between the Econ and Puzzle Lake. The lake apparently comes up to the edge of the site during periods of high water. Moore also identified and excavated this mound. It is best described as a shell-heap hammock situated in a marsh. Surface collections recovered animal bone, St. Johns and Glades ceramics, and lithics. The occupation of this site appears to correspond to that of the Palmer-Taylor Mound, ranging from Orange to St. Johns II (Rouse 1951).

Orange County

8Or254 --Laughlin Hunting Lodge. This site consists of the remains of an early 20th century hunting lodge built by James Laughlin, Jr. of Pittsburgh, Pennsylvania (Deibler 1981). The lodge is located on the north side of a sandy oak ridge in the flatwoods.

8Or255 -- Econlockhatchee South 1. This site was located during the Stanton Energy Center survey in 1981. The site lies on a sand ridge in the flatwoods adjacent to a cypress swamp. The soils are Immokalee types. The site was identified by the location of one piece of lithic debitage (Daniel and Gordon 1981).

8Or256 -- Econlockhatchee South 2. This site was also located during the Stanton Energy Center survey. The site was also an isolated piece of lithic debitage found along a sand ridge road in the scrub oak portion of the property adjacent to the cypress swamp (Daniel and Gordon 1981). Soils at this site are Pomello sands.

8Or257 -- Econlockhatchee South 3. This site was found along a drainage ditch during the Stanton Energy Center survey. The site consisted of a collection of lithic debitage along the banks of a ditch south of a small cypress dome. The soil is Leon fine sand (Daniel and Gordon 1981).

8Or383 -- Econlockhatchee South 4. This site also lies within the Stanton Energy Center tract. It consists of a single broken projectile point, possibly a Newnan type found along a road in the pine flatwoods on Leon fine sand. The find probably dates to the Middle Archaic Period (5,000-3,000 B.C.) (Daniel and Gordon 1981).

8Or384 -- unnamed site. This site consists of another isolated broken projectile point found in the Stanton tract. It was located in the same area of flatwoods as 8Or383. The soil type is Leon fine sand. Daniel indicates that it may be a Middle Archaic Culbreath point (Daniel and Gordon 1981).

8Or479 -- Lake Telfer site. This site was identified during the Orlando-Orange County Expressway Extension survey. The site consists of 1 projectile point fragment and 1 piece of lithic debitage found on a ridge slope adjacent to a marsh (White and Horvath 1985). The site is on Blanton soils in an oak hammock.

8Or480 -- No information available.

8Or481 -- Green Bottle site. This site consists of a deposit of late 19th to early 20th century refuse and 1 piece of lithic debitage. The site is located on a ridge slope adjacent to Lake Telfer. The site lies on Blanton soil in an area of oaks with evidence of recent historic use. The site was located during the Expressway survey (White and Horvath 1985).

8Or482 -- Pawn Shop site. This is another historic refuse scatter identified adjacent to Lake Telfer during the Expressway survey. This site is located on Leon fine sand on relatively high ground. The site dates to the period between 1880 and 1930 (White and Horvath 1985).

8Or511 -- Aerospace 1 site. This site was located during the Martin Marietta DRI survey. The site is described as a lithic scatter located on a low rise adjacent to a cypress swamp (Austin 1986). The site lies on Leon fine sand in a flatwoods area between a creek and a bayhead.

8Or512 -- Aerospace 2 site. This site consists of a single lithic artifact found on a low rise adjacent to a cypress swamp. Like 8Or511 it lies on Leon fine sand in the flatwoods between the creek and bayhead. The site was also identified during the Martin Marietta survey (Austin 1986).

8Or514 -- Alafaya Trail site. This site was located during the Central Florida Research Park DRI survey. The site is described as a scatter of St. Johns Plain ceramics and lithics located on a ridge slope near an unnamed pond and Lake Rouse (Austin 1987). The site is located on St. Lucie soils in an area of well drained oaks adjacent to the lake.

In general, the located sites are either prominent mound sites in proximity to the St. Johns River Basin or small sites identified through surface inspection of roads. It appears that little or no systematic subsurface archaeological survey has been conducted within the Econ Basin. Analysis of the known sites indicate that they appear to occur in four situations or environments within the Basin; these areas would be considered high potential areas for historical resources:

1) **Flatwoods at the headwaters of the Basin.** Three types of flatwoods sites appear to occur. The first type of site is located on the ecotone between the extensive flatwoods areas and well-drained oak hammocks. These special use sites may not necessarily be closely associated with a water source; access to some other resource such as lithics may be the determining factor. The second type is located on relatively high ground at the point at which a creek begins to form a channel and drain a forested wetland. The third type is located at constrictions of forested wetlands with creeks, forming an easy crossing or access to water.

2) **Hills and lakes area in the mid-section of the River Basin.** Sites in this area are located on relatively high ground close to the water sources. Examples would be low hills or ridges with well-drained soils next to the water resource.

3) **Deep river channel area.** There is no site information available for the area where the river drops into a well-defined channel. However, based on experience with the resource potential in similar environments, there should be sites along this channel where there is relatively high ground which provides access to the river and is not frequently flooded.

4) **St. Johns River floodplain.** Sites have been located in this area are located on relatively high ground with an elevation of at least 10 feet or more. Although frequently found at the mouths of tributary rivers like the Econ, sites are also located along the St. Johns itself.

One source also indicates that site indicators include rapid rises in topography, reasonable distance to water, location of the upland or depositional side of the river, and the presence of live oaks (Bosserman 1989). Coupled with the presence of well-drained soils, these are probably reasonable site indicators.

Other areas of the Basin may be considered to have a medium potential for site location. This means that sites will be less likely to be found and may be smaller and fewer in number. These areas include sandhills not associated with a water source or steeper slopes (5% or more slope) along a creek or river. Areas ranging from 200 to 500 meters from a water source would also be considered medium potential, depending on other environmental factors such as soils and topography.

Areas of the Basin which are least likely to contain sites may be designated as low potential. However, this does not rule out the possibility of sites occurring in those areas. It merely means that based on present information, very few sites are anticipated. This would include gallberry/pine flatwood areas with no water sources or the low prairies. In general, the more poorly drained the soil, the less likely an area is to contain sites.

MANAGEMENT ALTERNATIVES

This section will present the general principles of historical or cultural resource management followed by guidance as to management of development impacts within the Econ Basin.

Principles of Historical Resource Management

Cultural resource management has three major sets of objectives: management, descriptive, and explanatory.

> Management objectives are those concerned with obtaining and evaluating sufficient data to determine the significance of sites and plan for their preservation directly, or indirectly. Descriptive objectives provide an empirical data base for future researchers to understand and re-evaluate the sites. Explanatory objectives place the sites in a chronological and cultural historical framework, and then take those empirical data and place them within current research paradigms or models (Eubanks and Adams 1986:14).

Management Objectives

Management of historical resources requires sufficient data to evaluate the sites within a given area and thus make an informed decision as to each site's fate. This can be an irrevocable decision, since a site which is not considered eligible for the NRHP is no longer subject to protection and can thus be destroyed or obliterated. On the other hand, it is not feasible to protect all sites adequately; therefore, it is necessary to make a choice as to which sites merit protection.

Unless the number and type of sites within an area are known, the historical resources cannot be adequately protected. Thus the first management objective is identification of the resources. This is generally accomplished through a combination of field survey and archival research. Archaeologists have divided the site identification and assessment program into three steps:

Phase I -- This step consists of a survey to locate the sites and make a preliminary evaluation of them. Phase I surveys provide managers with knowledge of the site's existence as well as information on its approximate size, depth, and cultural associations.

Phase II -- During this step sites which appear to be potentially eligible for the NRHP are evaluated as to their significance. This evaluation has very specific goals: (1) determination of the site size and configuration, including its extent, shape, artifact density, and variation within the site; (2)

definition of site depth and stratigraphy; (3) determination of the site's complexity, including the density and variation of features, and the number of cultural occupations represented; and, (4) identification of the site chronology and cultural associations, i.e., who lived there and when was it occupied. Based on this data, the site can be evaluated in terms of its potential to yield significant research information, as well as the extent and nature of potential impacts to the site.

Phase III -- This step involves mitigation of adverse affects to a site which is deemed eligible for the NRHP. Archaeological mitigation generally involves data recovery or excavation. The goal is to recover that information which makes the site significant and eligible for the NRHP. Data recovery should be problem-oriented in order to provide an empirical data base for future researchers. The basic objective is the recovery of sufficient data to provide an analog for the site after it has been destroyed. This is done through detailed documentation of the mitigation process.

Descriptive Objectives

Descriptive objectives provide the record of the research and of the data recovered. Based on this record of the research design, methodology, and results, the reader should obtain a clear understanding of how and why the research was accomplished. Site reports must not only provide a permanent record of the data recovery, but must also attempt to explain and interpret that data within a scholarly framework.

Explanatory Objectives

Archaeologists must go beyond mere description and present their data in two other ways: (1) comparison with data from adjacent sites and regions, and (2) explanation in terms which will present a view of life in that locality through time. In order to explain the sites, it is necessary to address certain historical objectives which may take the form of research questions:

1) Who lived at the site?
2) When did each represented group occupy the site?
3) Where did they live in terms of the environmental features?
4) What are the physical remains at the site?
5) How did people live at this site?
6) Why did people live as they did at this site?
7) How can the changes or continuity of lifestyle at this site be explained?

These general research questions can be further refined into hypotheses which can be tested with the data available from the site. Such hypotheses generally fall into three broad topics: settlement, subsistence, and technology. An example of this type of hypothesis for the Central Florida District

would be Daniel's model for Paleo-Indian/Archaic settlement patterns described earlier in this document (Daniel 1985).

Once all three objectives have been met for an area, then the cultural or historical management plan can be considered to have been successfully implemented. It should be noted that while the previous discussion primarily addresses archaeological resources, a similar process would be required for architectural or historical sites.

Management of Development Impacts

The FDHR has provided the following excellent discussion concerning interfacing development with historical resource management:

> Inherent in the philosophy underlying Florida's historic preservation program is the belief that an environment in which elements of our prehistoric and historic heritage blend harmoniously with new land uses and construction is the best in which to live and work. At the same time, this philosophy recognizes that pure preservation of every historic property is unrealistic and not in the public interest.
>
> Thus, federal and state historic preservation procedures do not insist on preservation in every case. The solution resulting from the historic preservation compliance review process can range from purest preservation to unmitigated loss of a property, depending upon its significance, location, size and physical characteristics. However, an agency's or project developer's decision about how to treat historic properties MUST have resulted from meaningful consideration of cultural and historic values, and the options available to preserve them. In short, the compliance review process ensures that historic preservation is weighed along with costs and other factors in determining the projected tangible and intangible benefits of the completed project.
>
> Another factor which must be considered is timing. Consideration of historic properties must occur very early in the project planning stage so that preservation concerns can receive open, positive, and balanced consideration as the project is planned. Early project review also permits modification of project plans, if necessary, to accomodate preservation or the scheduling of data recovery to mitigate project impacts while they are relatively easy to accomplish. This reduces the potential for conflict and delay, and has positive economic benefits (FDHR 1988:11).

In summary, what FDHR is saying is that historical resource management and development can coexist, but careful planning at an early stage is necessary for successful coexistance. When a development project is first under consideration or in the planning stage, a survey should be undertaken to determine whether there are any historical resources within the development area, and, if so, what the impacts of the development will be on those resources. Once the resources are located, they can then be evaluated and intelligent decisions can be made as to their management. Management may take the

form of avoidance, protection, documentation, rehabilitation, or data recovery depending upon the nature and significance of the resource. If a resource is not considered to be significant, development can proceed without further consideration.

SUMMARY AND RECOMMENDATIONS

The historical resources of the Econ Basin are poorly documented by comparison with other areas of the state. Only 17 sites have been recorded within the entire study area, and only four of these are significant sites. The major reason for this lack of information is the limited amount and level of survey which has been completed within the Basin. The majority of the recorded surveys consist primarily of surface inspections along roads, ditches, and streams. Little systematic subsurface testing has been completed. As a result of this lack of basic data and lack of data collected in a consistent manner, it is extremely difficult to make valid predictions as to the potential for historical resources within a given area of the Basin. These recommendations, therefore, are based on this limited level of information.

First, it is recommended that consideration be given to implementing a project to develop a better predictive model for historical resource location within the Basin. Such a project would require additional archival research, aerial photography interpretation, coordination of environmental/map data, and limited subsurface sampling of all represented environmental zones within the basin. A model development project for the Basin could probably be completed for approximately $20,000 to $30,000.

Second, it is recommended that future development within the basin be required to complete cultural resource assessments according to state guidelines (FDHR 1988). Methodologies for all assessments should be comparable so that the data could be used to refine the model of the Basin. However, the level of effort for the assessments could be stratified based on the presently known potential for resource location. Stratification can be tied to the preservation and conservation zones recommended by this management plan as follows:

1) Areas designated as Preservation Zone (the Econ and its associated wetlands). Since no impacts will be permitted in this zone, no cultural resource assessment should be necessary. It should be noted, however, that this zone contains the most significant known resources in the Basin, the mound sites at the junction with the St. Johns. Therefore, this is probably the most sensitive archaeological zone.

2) Areas designated as Conservation Zone (within the 100 year-floodplain). This zone contains portions of the high potential historical resource areas based on the existing information for the Basin. Cultural resource assessments should be required prior to any ground disturbance in this zone, including development of forested wetland water retention areas. This assessment should include subsurface testing at intervals not greater than 30 meters, as well as extensive surface inspection.

3) All other portions of the Basin. Cultural resource assessments in all other portions of the Basin should be stratified based on the presently known potential for historical resources as described earlier in this document under the title Econlockhatchee River Basin Historical Resources. Those areas considered to have a high potential for locating resources should be assessed with subsurface testing at an interval no greater than 30 meters, as well as extensive surface inspection. Areas of medium potential should be subsurface tested at a greater interval, perhaps 50 or 60 meters, as well as surface

inspected. All other areas should be surface inspected with subsurface testing on a judgmental basis. All assessments should include archival research, aerial photography interpretation, and evaluation of topographic and soils maps. The exception to this recommendation would be areas of known extensive ground disturbance such as heavily developed zones, or land which has been deeply excavated for ditches, sand mines, or drainage basins. If this disturbance is well documented, no assessment should be necessary.

It should be stressed that if new information is obtained which alters the presently known pattern for site location within the Basin (i.e., if sites are identified in areas not now considered to have a high potential), then the recommended assessment stratification should be changed to correspond with this information. In other words, new high potential areas should be delineated and the corresponding methodologies implemented.

If archaeological sites are located, management should also follow state guidelines (FDHR 1988). The initial step is normally to determine whether the site is significant and eligible for the NRHP. If a site is significant, preservation is typically the preferred management alternative. However, if preservation is not feasible, mitigation of impacts in the form of data recovery can be implemented. The one exception to this would be a site containing human remains (such as a burial mound). Under present state laws concerning human remains, preservation is probably the least costly and certainly the simplest alternative. Sites containing human remains can be excavated if absolutely essential to implement proposed development. Such excavation would require very close coordination with the State Archaeologist and possibly the Governor's Council on Indian Affairs.

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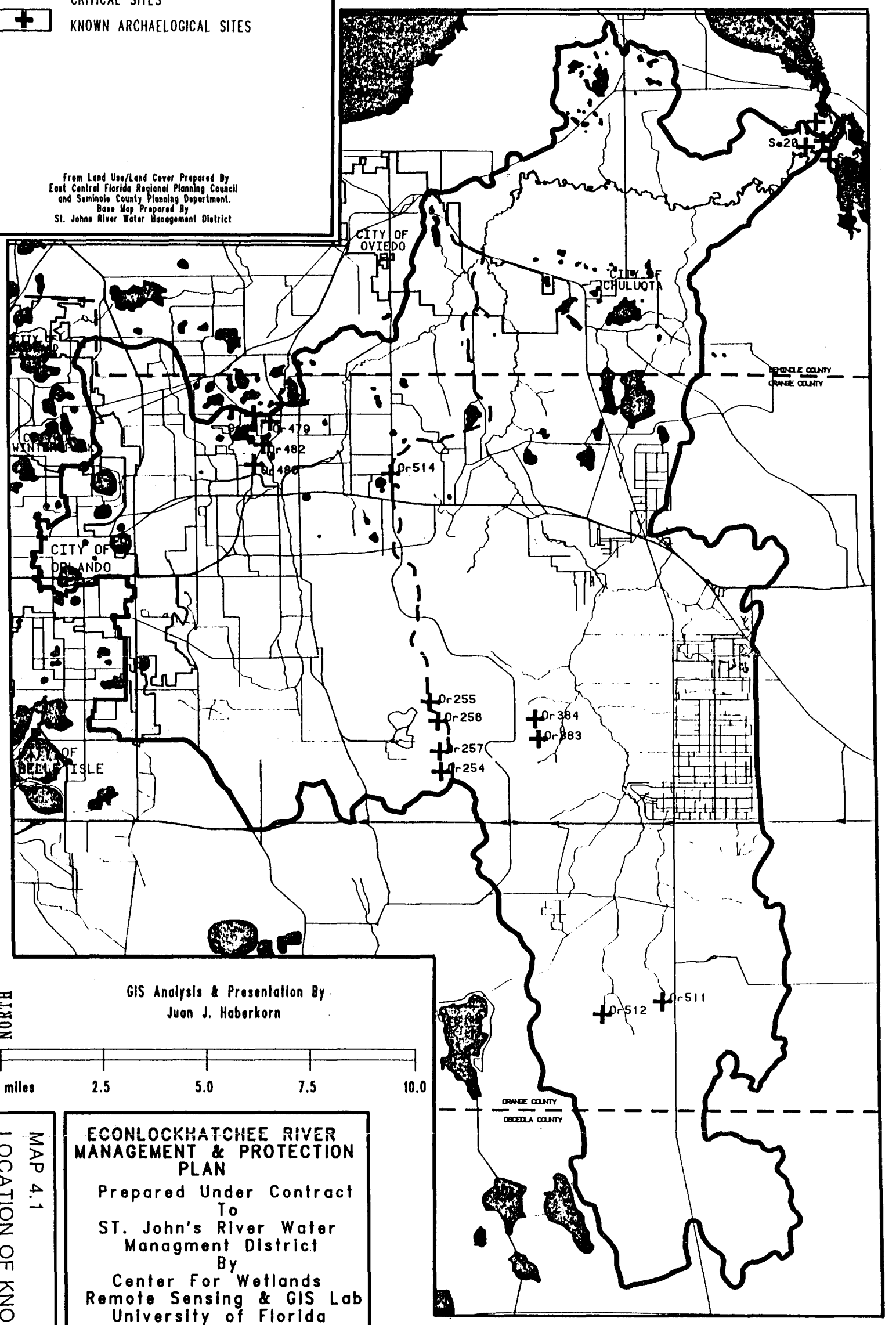
MAP LEGEND:

CRITICAL SITES

KNOWN ARCHAELOGICAL SITES

From Land Use/Land Cover Prepared By
East Central Florida Regional Planning Council
and Seminole County Planning Department.
Base Map Prepared By
St. Johns River Water Management District



MAP 4.1
LOCATION OF KNOWN
ARCHAEOLOGICAL SITES

ECONLOCKHATCHEE RIVER MANAGEMENT & PROTECTION PLAN

Prepared Under Contract
To
ST. John's River Water
Managment District
By
Center For Wetlands
Remote Sensing & GIS Lab
University of Florida
January 1990

MARK T. BROWN
CENTER FOR WETLANDS
UNIVERSITY OF FLORIDA

RICHARD HAMANN/JOHN TUCKER
CENTER FOR GOVERNMENTAL
RESPONSIBILITY
UNIVERSITY OF FLORIDA

JOSEPH SCHAEFER
URBAN WILDLIFE PROGRAM
DEPT. OF WILDLIFE & RANGE SCIENCES
IFAS, UNIVERSITY OF FLORIDA

LUCY WAYNE & MARTIN DICKINSON
SOUTHARC, INC.
P.O. BOX 1702
GAINESVILLE, FL. 32602

ECONLOCKHATCHEE RIVER BASIN NATURAL RESOURCES DEVELOPMENT AND PROTECTION PLAN

VOLUME II
REGULATORY FRAMEWORK OF THE ECONLOCKHATCHEE RIVER

Final Report to
St. Johns River Water Management District

by

Mark T. Brown and Charles S. Luthin
Center for Wetlands
University of Florida

John Tucker and Richard Hamann
Center for Governmental Responsibility
University of Florida

Joseph Schaefer
Urban Wildlife Program
Department of Wildlife and Range Sciences
Institute of Food and Agricultural Sciences
University of Florida

Lucy Wayne and Martin Dickinson
SouthArc Inc.
Gainesville, Florida

October 1990

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ACKNOWLEDGMENTS

We are grateful to Tom Ziegler and the staff of the St. Johns River Water Management District in Palatka, including John Hendrickson, Hal Wilkening, Lataine Donelin, and Librarian Judith Hunter, for unfailing attention to and friendly assistance on the project. We are particularly indebted to Colleen Logan (Seminole County Planning Department) and Sherry Hooper (Orange County Planning Department) for their special help in providing useful resource information for the Econlockhatchee River Basin Natural Resources Development and Protection Plan project.

We acknowledge the following individuals for sharing information and materials for preparation of this report:

Wes Biggs (Florida Audubon Society, Maitland)
Ken Bosserman (Friends of the Econ, Winter Park)
Jim Bradner (Department Environmental Regulation, Orlando)
Greg Brock (Florida Department of Natural Resources, Tallahassee)
Jim Crall (Orlando Utilities Commisision, Orlando)
Fred Cross (Florida Game and Fresh Water Fish Commission, Melbourne)
Jay Davoll (Florida Department of Transportation, Winter Park)
Michael Dennis (Breedlove, Dennis and Associates, Orlando)
Jim Farr (Department of Community Affairs, Tallahassee)
Richard Fowler (Florida Department of Transportation, Deland)
Chris Frye (Osceola County Planning Department)
Albert Gregory (Florida Department of Natural Resources, Tallahassee)
Michael Gilbrook and other staff, (East Central Florida Regional Planning Council, Winter Park)
Ellen Hemmert (East Central Florida Regional Planning Council, Winter Park)
Jim Hulbert (Florida Department of Environmental Regulation, Orlando)
Linda Jennings (Orange County Environmental Protection Department, Orlando)
Herb Kale (Florida Audubon Society, Maitland)
Dainne Kramer (Oviedo Planning Department)
David Kriz (USDA Soil Conservation Service, Orange County)
Roland Magyar (Orlando Planning and Development Department)
Bill Masi (Orange County Engineering Department, Orlando
Donald McIntosh (Donald W. McIntosh Associates, Inc., Orlando)
Rick Smith (Office of the Governor, Tallahassee)
Jack Stout (University of Central Florida, Orlando)
Henry Whittier (University of Central Florida, Orlando)

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VOLUME II
REGULATORY FRAMEWORK FOR THE ECONLOCKHATCHEE RIVER BASIN

John Tucker and Richard Hamann

EXECUTIVE SUMMARY

Regulatory Framework for the Econlockhatchee River

This volume (Volume II) of the Econlockhatchee (Econ) River Basin Natural Resources Development and Protection Plan describes existing planning and regulatory mechanisms in the Econ River Basin and evaluates whether they are adequate to protect the water, wetland, wildlife, and historical and cultural resources of the basin. This volume and Volume I (Resource Inventories) provide the basis for the specific regulatory and policy initiatives contained in Volume III (Critical Areas Management and Protection Plan) of the plan.

The primary conclusion of this volume is that existing planning and regulatory mechanisms will not adequately protect the natural resource values of the Econ River. Current regulations are inadequate to protect aquatic, wetland-dependent, and upland species of wildlife because the regulations do not provide for protection of upland habitat adjacent to watercourses and wetlands. Uplands provide essential habitat for wetland-dependent and upland species of wildlife. In addition, uplands perform important functions such as filtering nutrients and other pollutants from runoff and buffering wildlife from noise and physical encroachment.

Analysis of the existing regulatory framework in the Econ Basin identifies a compelling need for development of additional regulations and assignment of these regulations to various existing governmental entities. The findings of this report are supported by positions taken by regulatory entities and language in existing and draft local government comprehensive plans with regulatory jurisdiction within the Econ River Basin.

The need for comprehensive management and use of buffers to protect the river ecosystem has been clearly identified and either mandated or endorsed by most governmental entities with regulatory jurisdiction within the Econ Basin. The Office of the Governor recognizes the need for protection of the Econ River ecosystem and endorses the concept of protection buffers along the river. The Department of Environmental Regulation also recognizes the need for protection of the river and endorses the concept of protection zones and reclassification of the river to an Outstanding Florida Water. The Department of Community Affairs, pursuant to Chapter 163, Part II, Florida Statutes, requires local governments to adopt comprehensive plans which conserve and protect existing fisheries,

wildlife habitats, rivers, floodplains, wetlands, freshwater beaches and shores, and their natural functions. The Florida Game and Fresh Water Fish Commission has developed a model conservation element which recommends that local governments maintain upland buffers along waterways and wetlands to provide upland wildlife habitat and corridors, prevent erosion, retard runoff, and preserve natural aesthetics.

Similarly, the East Central Florida Regional Planning Council (Planning Council) recommends that local governments establish buffers along waterways and wetlands to provide wildlife habitat and protect water quality. The Planning Council recently funded a study which found that 550-foot buffers where needed to protect wildlife habitat along rivers in central Florida. The St. Johns River Water Management District Governing Board identified the Econ River Basin as an ecosystem needing comprehensive management and protection. The Governing Board, in response to this study, has directed the district staff to begin drafting rules to protect the Econ River ecosystem.

Local governments within the Econ River Basin have also recognized the need to provide special protection for the river ecosystem. Seminole County, in its existing comprehensive plan, states that the counties' policy is to preserve and maintain water body littoral zones through the use of buffers and setbacks and to develop standards for maintaining heavily wooded areas adjacent to water bodies and wetlands. Seminole Counties' draft comprehensive plan goes further and specifically recommends establishing (1) land development regulations similar to those within the Wekiva River Hydrologic Basin for the entire Econ River Basin, and (2) wetland and upland buffers for development within the basin. Orange County's existing comprehensive plan directs the county to protect shoreline vegetation.

Like Seminole County, the Orange County draft conservation element identifies the Econ River System as worthy of special protection, stating that "[c]ounty action is warranted because the current level of protection does not ensure the long-term maintenance of the river's character." In addition, the draft element states that wildlife corridors should be protected and preserved from fragmentation and destruction. The draft conservation element of Osceola County states that wetland buffers and criteria for adjacent upland development should be adopted to protect wetlands, to protect surface waters, to control land clearing, to protect the natural functions of the 100-year floodplain, and to protect wildlife. Finally, the Econ River Task Force, a committee with representatives from many interest groups, specifically recommended the adoption of protection zones adjacent to (1) the river, (2) many of its tributaries, and (3) isolated wetlands.

Despite the overwhelming authority requiring and supporting establishment of special protection zones along the river and wetlands, to date none are in place. While draft local government comprehensive plans indicate that local governments in the Econ Basin recognize the need to provide upland habitat adjacent to riverine systems, the draft comprehensive plans are presently either incomplete or un-adopted. Adoption of new comprehensive plans and implementation of the plans through land development regulations will take considerable time. Accordingly, it is unclear whether local governments will adequately protect the Econ River ecosystem without a legislative directive.

Similarly, although the St. Johns River Water Management has begun drafting preliminary rules for the Econ Basin, it is unlikely that the Water Management District alone can provide adequate protection for the entire river ecosystem. Fortunately, effective protection of the Econ can be

accomplished through existing regulatory entities. Specific regulatory and policy initiatives are contained in Volume III of the Critical Areas Management and Protection Plan.

The following is a summary of abbreviated findings and recommendations from this volume of the Econlockhatchee (Econ) River Basin National Resources Development and Protection Plan.

Findings and Recommendations
Land Use Planning and Regulations

A. State Planning Criteria

1. Chapter 163, Part II, Florida Statutes and Rule 9J-5 require local governments to adopt conservation elements which protect natural resources, but these documents do not include sufficient specificity to ensure that local governments provide uniform and comprehensive protection for the entire Econ River Basin.
2. The East Central Florida Regional Planning Council (Planning Council) Regional Policy Plan contains detailed policy guidelines which could provide significant protection for the Econ River and Basin if implemented by local governments. In addition, the Planning Council has funded a study which provides a scientific basis for adoption of wildlife buffers. Local governments should utilize the Planning Council Regional Policy Plan and Buffer Study to help develop appropriate river and basin protection regulations for the Econ Basin.
3. Development of Regional Impact (DRI) thresholds should be lowered within the Econ River Basin so that more developments will go through the rigorous DRI review process. Residential DRI thresholds within the Econ Basin are 750 dwelling units for Osceola County, 2000 dwelling units for Seminole County, and 3000 dwelling units for Orange County.

B. Local Government Comprehensive Plans

1. Existing future land use, conservation, and recreation and open space elements of political jurisdictions within the Econ Basin do not provide for sufficient protection of Econ River or Basin because they do not provide for adequate protection of wildlife, riparian habitat, uplands, water quality, or water quantity.
2. The draft conservation element for Seminole County identifies the Econ River as a unique and sensitive area and recommends (1) establishing land development regulations similar to those within the Wekiva River Basin, (2) developing wetland and upland buffers for development within the basin, (3) maintaining the rural character of the basin, and (4) using innovative preservation and acquisition measures such as off-site mitigation, transfer of development rights, and land banking. Adoption and

implementation of provisions contained in the Seminole County draft conservation element could provide considerable protection for the Econ River and Basin.

3. The draft conservation element for Orange County identifies the Econ River as a sensitive riverine system which could benefit from comprehensive protection. The element states that the current level of protection does not ensure the long-term maintenance of the river's character. The element recommends adopting land development regulations which (1) require upland buffers adjacent to riverine systems, (2) protect identified wildlife corridors, (3) include cluster developments, transfer of development rights, buffering sensitive areas, and discourage fragmentation of wildlife corridors. Adoption and implementation of provisions contained in the Orange County draft conservation element could provide considerable protection for the Econ River and Basin.

4. The draft element for Osceola County provides general mandates for protection of natural resources, including wetland buffers, criteria for adjacent upland development, prohibitions against dredging and filling, and protecting wildlife. However, the element does not identify the headwater swamp of the Big Econ River as a sensitive area worthy of special protection. Osceola County should include specific criteria for protection of the headwaters of the Big Econ River in the conservation element.

5. Draft conservation elements for Orlando and Oviedo are currently unavailable.

6. Substantial adverse development of the Econ Basin could occur before new comprehensive and land development regulations are adopted. Updated comprehensive plans are due on the following dates: (1) Seminole County - April 1, 1991; (2) Orange County - Dec. 1, 1990; (3) Osceola County, July 1, 1990; (4) Orlando - Jan 1, 1991; and (5) Oviedo - April 1, 1991. Land development regulations are not due until one year after the comprehensive plans are due. Intense development pressure in the Econ Basin necessitates interim protection measures. Local governments should consider adopting interim development regulations or moratoriums for the Econ Basin, particularly in riparian areas.

7. None of the political jurisdictions within the Econ Basin have optional historic and scenic preservation elements in their current or draft comprehensive plans. Local governments could better identify and protect archaeological artifacts by adoption of scenic and historical preservation elements.

C. Local Government Land Development Regulations

1. Local government land development regulations are inadequate to protect natural resources of the Econ River Basin because the regulations do not provide for adequate protection of uplands and wildlife.

2. Local government land development regulations are inadequate to protect wildlife resources of the Econ Basin and River because the regulations do not provide for protection of wildlife corridors or prevent fragmentation of wildlife habitat.
3. Local government land development regulations are inadequate to protect natural resources of the Econ Basin and River because the regulations do not provide buffers to protect rivers and wetlands.
4. Local government wetland, stormwater, and dredge and fill regulations rarely provide more protection than regional, state, or federal regulations. Local government wetlands regulations allow development of many small isolated wetlands which provide essential functions for certain species of wildlife.

Environmental Regulations

1. St. Johns River Water Management District (Water Management District) Management and Storage of Surface Waters (MSSW) regulations do not adequately protect wildlife resources of the Econ River and Basin because the rule does not protect wildlife habitat by requiring setbacks or buffers from the river or from wetlands.
2. Water Management District MSSW regulations do not adequately protect wildlife resources of the Econ River and Basin because the rules do not provide for consideration of upland species of wildlife.
3. Water Management District MSSW regulations do not adequately protect the water quantity and base flow of the Econ River and Basin because the rules allow lowering of groundwater levels.
4. Water Management District MSSW regulations do not adequately protect water quality of the Econ River and Basin because the rules do not ensure that all characteristics of post-development runoff are similar to pre-development runoff characteristics.
5. Water Management District MSSW regulations do not adequately protect wildlife resources of the Econ River and Basin because the rules do not adequately protect small ephemeral wetlands which are essential to certain species of wildlife.
6. Some additional protection could be obtained by lowering MSSW permitting thresholds for the Econ Basin, thereby requiring more projects to meet MSSW permitting criteria.
7. Water Management District stormwater regulations do not adequately protect the natural resources of the Econ River and downstream St. Johns River because the rule does not consider the effect of constructing stormwater systems on wildlife habitat.
8. Water Management District stormwater regulations do not adequately protect the natural resources of the Econ River and downstream St. Johns River because lack of compliance and enforcement are a significant problem.

9. Water Management District stormwater regulations do not adequately protect the water quality of the Econ River and downstream St. Johns River because the rule allows construction of detention with filtration systems, a treatment design which is ineffective in areas with high water tables.
10. Water Management District stormwater regulations do not adequately protect the water quality of the Econ River and downstream St. Johns River because the nutrient standard is inadequate and the assimilative capacity of the water bodies is unknown.
11. There are no environmental regulations which protect upland habitat and wildlife other than endangered and threatened species.

Significant Development, Structures, and Activities

1. The portion of the Econ Basin surrounding the Little Econ River is highly developed. Most other portions of the basin are relatively undeveloped.
2. Much of the Econ Basin is currently under intense development pressure. Many acres of land within the basin have already been committed to development. Recent submittals propose development of substantial portions of land near the Big Econ River.

Special Protection of Florida Rivers

Special regulations have been or are being developed for the Wekiva, Myakka, and Suwannee Rivers because citizens and regulatory entities determined that existing regulations did not provide adequate protection for the river ecosystems.

Wekiva

1. The Florida Legislature mandated that specific protection mechanisms be developed for the Wekiva River. State agencies, the regional planning council, the water management district, and local governments have adopted special regulations to protect the Wekiva River Basin.
2. The legislature directed the Department of Natural Resources (DNR) to pursue acquisition of recreation and conservation lands within the Wekiva Basin.
3. Thresholds for residential Developments of Regional Impact (DRIs) have been lowered by 50% within the Wekiva Basin.

4. The East Central Florida Regional Planning Council adopted policy recommendations supporting establishment of protection zones by the St. Johns River Water Management District and local governments.
5. The St. Johns River Water Management District adopted a riparian habitat protection zone for the Wekiva River and its major tributaries which strongly discourages any development within 550 feet of the river or within 50 feet of wetlands which are adjacent to the river.
6. The Water Management District adopted a water quality protection zone extending one half mile from the Wekiva River and many of its tributaries and one quarter mile from any abutting wetland.
7. The Water Management District adopted a water quantity protection zone extending 300 feet landward from wetlands abutting the Wekiva River and many of its tributaries.
8. Local governments adopted comprehensive plan amendments and land development regulations which protect natural resource values in the Wekiva Basin, including building and clearing setbacks from the Wekiva River and density and intensity restrictions for the entire basin.

Myakka

1. The Myakka River Management Coordinating Council has adopted a management plan (Plan) for the Myakka River which identifies development activities near the river as the primary threat to the river system.
2. The Plan recommends protection of three areas:
   (a) The river and adjoining wetlands
   (b) A zone extending 220 feet from the river and wetlands
   (c) The remaining watershed
3. The Plan recommends that the Department of Natural Resources (DNR) regulate the river and adjoining wetlands, and that local governments regulate the remaining protection areas. The plan recommends that the legislature give DNR the authority to take over regulation of the 220-foot zone if local governments fail to adequately manage the zone.
4. The Plan recommends that agencies acquire headwater lands, wetlands, tributaries, and lands bordering the Myakka River.
5. The Plan recommends that the South West Florida Water Management District establish resource-based water quality and quantity standards for the river.
6. The Florida Legislature has approved amendments to the Myakka River Wild and Scenic Designation and Preservation Act which include recommendations from the Plan.
7. DNR is drafting a rule to implement some of the Plan's recommendations.

Suwannee

The Suwannee River Task Force, created by Governor Martinez, reported their findings in November of 1989.

1. The Suwannee River Task Force found that existing regulatory mechanisms, such as the Surface Water Improvement and Management (SWIM) program and the local government comprehensive planning process should be able to adequately protect the Suwannee River.
2. The Task Force recommended the local governments adopt setbacks from the river of 75 feet or greater to protect wildlife habitat and the aesthetic quality of the river.
3. The Task Force recommended that development of regional impact thresholds be lowered by 50% within the 100-year floodplains.
4. The Task Force recommended that development within the 100-year floodplain be discouraged, and be low intensity or density when allowed.
5. The Task Force recommended that there be no further degradation of water quality in the river or its tributaries.
6. The Task Force recommended that all septic tanks, private wells, and central wastewater facilities be prohibited within the 10-year floodplain.

Conclusions

1. Of the three efforts at river protection which were examined, the approach taken for the Wekiva River Basin appears to provide the most comprehensive protection for the river and the entire basin because: (1) assigning a regional agency, the St. Johns River Water Management District, as the agency responsible for administering the protection zones ensures consistent and comprehensive application of protection measures; (2) the Water Management District was able to incorporate protection criteria into the existing MSSW regulatory program, thereby eliminating the need to create new regulatory entities or to greatly expand the duties of other agencies; (3) the plan provides for protection of water quality, water quantity, and aquatic and wetland-dependent wildlife habitat; (4) local governments are required to meet certain protection criteria when making land use decisions; and (5) the protection program was specifically mandated by the Florida Legislature.
2. Some limitations of the Wekiva approach are that: (1) the legislation did not provide the Water Management District with authority to regulate for the benefit of upland species of wildlife; and (2) the legislation did not provide detailed criteria to guide local governments, such as minimum setback distances from the river and minimum density requirements, thereby leading to inconsistent criteria being adopted by the local governments.

3. The approach taken for the Myakka River is similar to that taken in the Wekiva but it relies on local governments to implement the protection zone adjacent to the river and requires the Department of Natural Resources to regulate portions of the basin.
4. The approach taken for the Suwannee River is not appropriate for the Econ River Basin because development is occurring too rapidly in the Econ Basin for the local government comprehensive planning and land development regulation process to effectively deal with the development. In addition, the Econ River has not been identified as an area requiring protection and restoration under the SWIM program.
5. An approach similar to that taken for the Wekiva which incorporates findings of this report (Econlockhatchee River Basin Natural Resources Development and Protection Plan) would be appropriate for the Econ River Basin and would provide comprehensive and consistent protection of its natural resources.

Historical Resources

1. A variety of state and federal laws provide for consideration and protection of historical resources.
2. Historical resources are poorly documented in the Econ River Basin because most of the basin has not been surveyed (see chapter 4, Volume I of this report).
3. Currently, none of the political jurisdictions within the Econ River Basin have historical and scenic preservation elements in their comprehensive plans.
4. Historical resources could be better protected if local governments would adopt historical and scenic preservation elements requiring future development within the basin to complete cultural resource assessments (see chapter 4, Volume I of this report).

REGULATORY FRAMEWORK FOR THE ECONLOCKHATCHEE RIVER BASIN

John Tucker and Richard Hamann

INTRODUCTION

The resources of the Econlockhatchee River Basin are subject to regulation by a number of political entities at the local, regional, state, and federal levels of government. Three counties--Orange, Seminole and Osceola--and several cities have comprehensive planning and land use regulatory authority over the basin. Their comprehensive plans are being revised and will be reviewed by the East Central Florida Regional Planning Council and the Florida Department of Community Affairs. The comprehensive plans must then be implemented through land development regulations. Meanwhile, land use is regulated by existing comprehensive plans and land development regulations. Certain large-scale developments (Developments of Regional Impact or DRIs) are subject to special review by local governments, the regional planning council, the Department of Community Affairs and, if appealed, the Governor and Cabinet.

Environmental quality is regulated through a variety of permitting programs. The discharge of domestic and industrial waste through point sources is primarily regulated by the Florida Department of Environmental Regulation and the U.S. Environmental Protection Agency (EPA). The St. Johns River Water Management District (Water Management District) regulates the construction and operation of surface water management systems. The Florida Department of Environmental Regulation's (DER) stormwater rule is also implemented by the Water Management District. The effects of surface water management systems on wetlands and wildlife are considered by the Water Management District. In addition, the Water Management District, DER, the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency regulate activities in wetlands under varying jurisdictional and permitting criteria. The effects of wetlands development on wildlife is considered by both state and federal agencies with the assistance of the Florida Game and Freshwater Fish Commission and the U.S. Fish and Wildlife Service. Special protection for endangered and threatened species and their habitat is provided for by state and federal laws. The effect of consumptive water use on both ground and surface waters and associated resources is regulated exclusively by the Water Management District.

The planning and regulatory system is thus extraordinarily complex. The purpose of this section is to briefly describe the most important programs and assess their potential for protecting the resources of the Econ. This evaluation will provide a basis for recommending ways to implement the management recommendations of Volume I.

LAND USE PLANNING AND REGULATIONS

I. Political Jurisdictions

Map 1 depicts the political jurisdictions within the Econ Basin. Seminole, Orange, and Osceola counties and the cities of Orlando, Oviedo, Winter Park, Maitland, and Casselberry have regulatory authority over portions of the Econ Basin. At the time of this writing the cities of Winter Park, Maitland, and Casselberry appear to have relatively insignificant impacts on the Econ Basin, and have been excluded from this report due to time constraints. However, the regulatory structure and growth management disposition of these cities should be examined in the future.

The headwaters of the Big Econ lie in an undeveloped portion of north Osceola County. The Big Econ then flows in a northerly direction through Orange County for about 18 miles. The Little Econ originates in Orange County on the East side of the city of Orlando and flows in a north easterly direction for approximately 13 miles. The Big and Little Econ cross into Seminole County and join together in the city of Oviedo to form the Econ river. The river then turns east and flows for about 13 miles through undeveloped areas of Seminole County and ultimately discharges into the St. Johns River.

II. Comprehensive Plans

Chapter 163 Part II of the Florida Statutes (Local Government Comprehensive Planning and Land Development Regulation Act)[1] requires that local governments devise comprehensive planning programs to guide and control future development. Comprehensive plans are long range policy documents which provide guidance for local government regulatory activities. Local government comprehensive plans must address a number of required elements, most of which have some bearing on the nature and intensity of development in the Econ Basin. Comprehensive plan elements must be consistent with guidelines in regional and state comprehensive plans.[2]

An in-depth examination of each comprehensive plan element is beyond the scope of this report. This discussion will thus focus on the elements most critical to the control of development affecting the Econ Basin, which are the future land use, conservation, and recreation and open space elements of each local government's comprehensive plan.

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1. Fla. Stat. §§ 163.3161 - 163.3243 (1989).

2. Id. § 163.3177(10)(a).

Chapter 163 Part II requires that the future land use element designate the future distribution, location, and extent of private and public land uses.[3] The element must include standards for control and distribution of population densities and building intensities for each land use category.[4] Local governments must create future land use maps which depict the proposed future distribution, location, and extent of land uses.[5] The conservation element must provide for the "conservation, use, and protection of natural resources in the area, including ... water, water recharge areas, wetlands, waterwells ... soils ... shores, floodplains, rivers ... lakes ... forests, fisheries and wildlife ... and other natural and environmental resources."[6] The recreation and open space element must provide for a comprehensive system of public and private sites for recreation, including natural reservations, parks, and open spaces.[7]

Local governments must incorporate state and regional goals and objectives into their local comprehensive plans and land development regulations. The Department of Community Affairs and the East Central Florida Regional Planning Council review and assist in development of plans and regulations by local governments within the Econ Basin.

A. State Planning Criteria

The Department of Community Affairs (DCA) is responsible for ensuring that local governments and regional councils abide by the policy guidelines of the state comprehensive plan.[8] Rule 9J-5 was adopted by DCA and establishes minimum criteria for revising local comprehensive plans.[9] Rule 9J-5 requires that local government comprehensive plans include future land use, conservation, and recreation and open space elements. The state comprehensive plan provides additional policy guidelines for water resources, natural systems, recreational lands, and land use.[10]

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3. Fla. Stat. § 163.3177(6)(a) (1989).

4. Id.

5. Id.

6. Id. § 163.3177(6)(d).

7. Id. § 163.3177(6)(e).

8. Fla. Stat. § 163.3167(2), ch. 187 (1989).

9. Fla. Admin. Code ch. 9J-5 (Dec., 1986).

10. Fla. Stat. §§ 187.201(8),(10),(16) (1989).

Future Land Use Elements

Local government future land use elements must show generalized land uses and natural resources on existing land use maps.[11] The maps must include natural resources such as shores, rivers, lakes, floodplains, wetlands, minerals, and soils.[12] The elements must include general densities or intensities of use for gross land areas within each use category.[13] The element must also include an analysis of the availability of services and facilities to serve existing uses, the character and magnitude of existing undeveloped land to determine its suitability for use, the amount of land needed to accommodate the projected population, and the suitability of development and redevelopment of flood-prone areas.[14]

Future land use elements must include objectives which protect natural and historic resources, discourage urban sprawl, and encourage use of innovative land development regulations such as planned unit developments.[15] In addition, the elements must include policies to ensure: (1) development approval is conditioned upon the availability of adequate levels of service, (2) management of drainage and stormwater, and (3) protection of environmentally sensitive lands.[16] The elements must also include a future land use map which shows natural resources and the proposed distribution, extent, and location of generalized land uses.[17]

Conservation Elements

Local government conservation elements must identify and analyze rivers, wetlands, floodplains, fisheries, wildlife, and vegetative communities including forests.[18] Local governments must then create goals and policies to protect these natural resources.[19] These goals and policies must (1) conserve and protect native vegetative communities, including forests, from destruction by development activities, (2) conserve and protect existing soils, fisheries, wildlife habitats, rivers, lakes,

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11. Fla. Admin. Code § 9J-5.006(1)(a),(b) (Dec., 1989).

12. Id.

13. Id. § 9J-5.006(1)(c).

14. Id. § 9J-5.006(2).

15. Id. § 9J-5.006(3)(b).

16. Id. § 9J-5.006(3)(c).

17. Id. § 9J-5.006(4).

18. Fla. Admin. Code § 9J-5.013(1) (Dec., 1986).

19. Id. § 9J-5.013(2).

floodplains, wetlands, freshwater beaches and shores, and their natural functions, (3) protect waterwells and water recharge areas, (4) encourage cooperation with other local governments to conserve "unique vegetative communities located within more than one local jurisdiction," and (5) designate environmentally sensitive lands for protection.[20]

The Florida Game and Fresh Water Fish Commission (GFC) has created a model conservation element for local governments to use for guidance.[21] The document includes selected provisions from the State Comprehensive Plan and the State Land Development Plan which relate to fish and wildlife resources. In addition, the GFC recommends a number of policies, many of which could, if adopted and implemented by local governments, provide significant protection in the Econ Basin. Many of the GFC recommendations are consistent with recommendations contained in this report, including the following provisions:

> Conserve forests, wetlands, fish ... and wildlife to maintain their environmental, economic, aesthetic, and recreational values.
>
> Develop and implement a comprehensive planning, management and acquisition program to ensure the integrity of Florida's river systems.
>
> Emphasize the acquisition and maintenance of ecologically intact systems in all land and water planning, management and regulation.
>
> Prevent water management and development projects that may alter or disrupt the natural function of significant natural systems.
>
> [Develop a] critical habitat map ... to delineate specific locations of sensitive natural resources ... [including] high quality and/or unique natural plant communities (ie., ... longleaf pine wiregrass, ... xeric oak and sand pine scrubs) ... and corridor areas such as strips of undeveloped habitat separating existing conservation reserves, or transitional zones along major floodplains.
>
> Maintain the local government's current complement of wildlife species [and natural plant communities] through preservation of diverse and viable habitats.
>
> Encourage and promote the protection of viable tracts of sensitive or high quality natural plant communities within developments.
>
> Require detailed inventories and assessments of the impacts of development on environmentally significant systems.
>
> Maintain upland buffers along the local government's waterways to provide wildlife habitat and corridors, prevent erosion, retard runoff and preserve natural aesthetics.
>
> Protect, restore, or create wetland areas to provide wildlife habitat, prevent water quality degradation, aid water storage and recharge the aquifer.
>
> Incorporate upland preservation in and around preserved wetlands to provide habitat diversity, enhance edge effect, and promote wildlife conservation.

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20. Id. § 9J-5.013(2).

21. Florida Game and Fresh Water Fish Commission, Model Local Government Comprehensive Plan Conservation Element (August, 1987).

Promote the long-term maintenance of natural systems through such instruments as deed restrictions, covenants, easements, transfer of development rights, mitigation banks, zoning and acquisition.

Promote the establishment of wildlife corridors in order to help maintain regional species viability and diversity.[22]

A more complete list of the GFC policy recommendations is contained in Appendix A.

Recreation and Open Space Elements

The recreation and open space element must provide guidance for the creation of public and private recreational facilities and open space sites.[23] Rule 9J-5 directs local governments to assess existing recreation and open space sites and to project future needs in this area.[24] Local governments must create policies which ensure that future public and private development provides adequate open space and recreation lands to accommodate existing and future recreation demands.[25]

Rule 9J-5 directs local governments to "ensure public access to identified recreation sites ... including freshwater beaches and shores."[26] This provision is directed toward "recreation" sites, and should not be interpreted to mean that all public lands should be open to intense public use. Areas defined as conservation or environmentally sensitive may require special criteria limiting the intensity and types of public use in order to preserve the natural character of these areas.

B. Regional Comprehensive Plan

The East Central Florida Regional Planning Council (Planning Council) is responsible for reviewing the comprehensive plans of local governments having regulatory authority within the Econ Basin for consistency with regional policies.[27] The conservation element of the Comprehensive Regional Policy Plan includes a number of policy guidelines which are important to the protection of the

22. Id.

23. Fla. Admin. Code § 9J-5.014 (Dec., 1986).

24. Id. § 9J-5.014(2).

25. Id. § 9J-5.014(3).

26. Id. § 9J-5.5014(3)(b)1. (Dec., 1986).

27. Id. § 29F-11.001 (Sept., 1989).

Econ Basin.[28] Several of the most important policies are discussed here, and a more complete list is contained in Appendix B.

The Planning Council Comprehensive Regional Policy Plan recommends that vegetative communities and wildlife habitat be protected by preserving ecologically viable upland plant communities.[29] Semi-aquatic and wetland-dependent species of wildlife should be protected through the use of buffer zones of native upland vegetation adjacent to wetlands.[30] In addition, habitat corridors should be identified and protected.[31] Transportation agencies should avoid new construction or improvements which would adversely affect wildlife corridors, and should create "wildlife underpasses" whenever construction cannot be avoided.[32]

With respect to water quality and aquatic systems, the Planning Council recommends that: (1) stormwater management systems which use natural wetlands as detention reservoirs should provide for diversion of the first flush prior to discharging into natural wetlands, to protect the wetland from the adverse effects of stormwater pollution;[33] (2) isolated wetlands should be incorporated into stormwater treatment systems, as long as the first flush is diverted before discharge into the wetland, rather than destroying the wetland through dredging or filling;[34] (3) flood control regulations should limit the placement of fill in the 100-year floodplain and, when filling is allowed, should require compensating storage in adjacent uplands rather than within the floodplain;[35] (4) wastewater treatment plant effluent impacts should be evaluated by considering the cumulative effects of point and nonpoint sources, and impacts should be reduced by more effective monitoring and enforcement, and through the use of alternative methods of disposal;[36] and (5) septic tanks should be discouraged whenever central sewage facilities exist and when lands are unsuitable.[37]

In addition, the Planning Council participates in review of Developments of Regional Impact (DRI or DRIs). A DRI is a development which, "because of its character, magnitude, or location,

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28. Id. § 29F-19.001 (Sept., 1989) (Incorporating by reference the East Central Florida Regional Planning Council Regional Policy Plan, which may be obtained at the Council offices located at 1011 Wymore Road, Suite 105, Winter Park, Fla.).

29. East Central Florida Regional Planning Council Regional Policy Plan, policy 43.3 (Sept., 1989).

30. Id. at policy 43.8.

31. Id. at policies 43.5,43.6.

32. Id. at policy 43.6.

33. Id. at policy 38.5.

34. Id. at policy 39.7.

35. Id. at policy 39.10.

36. Id. at policy 38.8.

37. Id. at policy 38.9.

would have a substantial effect upon the ... citizens of more than one county."[38] DRIs are identified, however, through the application of numerical thresholds adopted by the Governor and Cabinet.[39] Residential DRI thresholds for Seminole, Orange, and Osceola counties are contained in Table 1.

TABLE 1

RESIDENTIAL DRI THRESHOLDS IN THE ECON BASIN[40]

County*	Dwelling Units
Seminole	2000
Orange	3000
Osceola	750

* Any residential development located within two miles of a county line is subject to the threshold of the least populous county.

The Governor and Cabinet can recommend that applicable thresholds be increased or decreased by up to 50%.[41] Changes in DRI thresholds do not become effective unless adopted by the Florida Legislature.[42] The regional comprehensive plan is used by the Planning Council in reviewing DRIs and in deciding whether to appeal local development orders for DRIs.

38. Fla. Stat. § 380.06(1) (1989).

39. Fla. Admin. Code Rule 28-24 (August, 1989).

40. Id. § 28-24.010.

41. Fla. Stat. § 380.06(3)(c) (1989). See, e.g., Rule 28-24.014(4), Fla. Admin. Code (reducing thresholds by 50 percent in the Wekiva River Protection Area).

42. Fla. Stat. § 380.06(3)(e) (1989).

C. Local Government Comprehensive Plans

Local governments within the Econ Basin are currently using growth management plans developed to satisfy the Local Government Comprehensive Planning Act of 1975. These local governments are developing new comprehensive plans designed to satisfy the more stringent requirements of the Local Government Comprehensive Planning and Land Development Regulation Act and Rule 9J-5.[43] Therefore, each local government within the Econ Basin has an existing comprehensive plan which is currently being used to guide policy and regulatory decisions, and a draft comprehensive plan which will be adopted sometime in the next two years. Local governments must submit draft comprehensive plans to the Department of Community Affairs by late 1990 or 1991, and corresponding land development regulations are due a year later.[44] Some local governments have already incorporated portions of their draft conservation element into existing regulatory programs. Table 2 illustrates when comprehensive plans are due for local governments within the Econ Basin.

TABLE 2

LOCAL GOVERNMENT COMPREHENSIVE PLAN DUE DATES

Political Jurisdiction	Due Date
Osceola County	July 1, 1990
Orange County	Dec. 1, 1990
Orlando	Jan. 1, 1991
Seminole County	April 1, 1991
Oviedo	April 1, 1991

43. Rule 9J-5, Fla. Admin. Code, provides minimum criteria for review of local government comprehensive plans and determination of compliance with the Local Government Comprehensive Planning and Land Development Regulation Act.

44. Fla. Admin. Code § 9J-12.007(1),(6),(7),(10) (Aug., 1988).

The following discussion examines currently adopted and draft comprehensive plan elements of local governments within the Econ Basin. Review of existing comprehensive plan elements is limited to future land use, conservation, and recreation and open space elements. Review of draft comprehensive plan elements is limited to conservation elements. In addition, the discussion identifies the presence or absence of optional comprehensive plan elements which are important to the future management of the Econ Basin, such as historical and scenic preservation elements.

1. Seminole County

a. Existing Comprehensive Plan

The currently adopted Seminole County Comprehensive plan includes future land use, conservation, and recreation and open space elements. The plan does not contain a historical and scenic preservation element.

Future Land Use Element

The future land use element contains several broad policy statements indicating that riverine systems such as the Econ should be protected. The future land use element states the policy of Seminole county is to "preserve and maintain water body littoral zones through the use of buffers, setbacks and drainage and water conservation easements,"[45] and to "develop criteria and standards for maintaining or re-vegetating heavily wooded areas ... adjacent to conservation areas."[46] The element also encourages planned developments and clustering to preserve open space and conservation areas.[47]

The future land use element directs Seminole County to adopt the Future Land Map as a guide for future development and to require that all development be consistent with land use classifications and specific policies.[48] The Seminole County Future Land Use Map designates most land which is immediately adjacent to the Econ River as Conservation land.[49] Only wetlands or lands within the 100-year floodplain are designated as conservation.[50]

45. Seminole County, Fla., Seminole County Comprehensive Plan VI-A1 (July 11, 1989).

46. Id.

47. Id. at VI-A1,4.

48. Id. at VI-A3.

49. Seminole County, Fla., Seminole County Future Land Use Map (Dec. 8, 1987).

50. Seminole County, Fla., Seminole County Comprehensive Plan VI-A17 (July 11, 1989).

The general policies of the future land use element encourage uses in conservation areas which maintain natural flood storage and nutrient assimilation capability of wetlands and floodplains.[51] The future land use element designates the following uses as appropriate for conservation areas:

(1) publicly owned open space, recreation and water management areas;

(2) public and private game preserves and wildlife management;

(3) private development open space, recreation, and water management areas; and

(4) livestock grazing and short-term crop production.[52]

However, the zoning regulations which implement the future land use element may allow a variety of uses on conservation lands, including dairy farms, poultry production, groves, and residences.[53] Conservation lands in Seminole County are subject to the wetlands overlay zoning classification or the flood-prone zoning classification, or both. However, many of these uses may satisfy the requirements of the flood-prone classification,[54] although it is unlikely that they would be allowed within wetlands.[55]

Land designated as Conservation may be zoned Agricultural Development and Conservation District[56] or Agricultural.[57] Permitted uses within the Agriculture zoning district are characterized as being appropriate for rural areas where urban services are non-existent or limited, and are similar to uses

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51. Id.

52. Id. at VI-A17.

53. Seminole County, Fla., Seminole County Land Development Code § 5.82 (April, 1989).

54. See discussion of Seminole County Floodplain regulations contained in this report.

55. See discussion of Seminole County Wetland regulations contained in this report.

56. Permitted uses within the Agricultural Development and Conservation District may include: Groves and farms for the cultivation and propagation of citrus, vegetables, fruits, berries, nuts, grass sod, and trees; Pastures and grasslands for the cultivation and propagation of livestock, excluding commercial raising of swine; Plant nurseries and greenhouses not involved with retail sales to the general public; Poultry production; Dairy farms; Fish hatcheries; Bait production; Public-owned and/or - controlled parks and recreation areas; Stables, barns, sheds, silos, granaries, windmills, and related agriculture structures; Home occupations; Single-family dwelling and customary accessory uses, including docks and boat houses; and Guest houses.

Conditional uses within the Agriculture Development and Conservation District include: Cemeteries; Kennels, including the commercial raising or breeding of dogs; Sawmills; Public utility and service structures; Borrow operations; Country and golf clubs, fishing clubs, fishing camps, marinas, gun clubs when located on lands comprising ten (10) acres or more and making use of the land in its predominantly natural state; Riding stables when located on lands of ten (10) acres or more; Commercial raising of swine; Tenant dwellings, one- and two-family, where the land use is for bona fide agricultural purposes; Mobile homes and customary accessory uses; and Adult congregate living facilities and group homes. Seminole County, Fla., Seminole County Land Development Code §§ 5.82,5.83 (April, 1989).

57. Seminole County, Fla., Seminole County Future Land Use Map (Dec. 8, 1987).

allowed in the Agricultural Development and Conservation District.[58] The minimum building site area for single-family dwellings in the Agriculture District is one dwelling unit per acre.[59]

The minimum building site area for single-family dwellings in the Agricultural Development and Conservation District areas is 1 dwelling unit per 5 acres.[60] Most of the other unincorporated land in Seminole County which is within the Econ Basin is located northeast of the city of Oviedo, and is designated as general rural or suburban estates.[61] General rural and suburban estates designations

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58. Permitted uses within the Agriculture zoning district include: Citrus or other fruit crops cultivation, production, and horticulture; Truck farms; Plant nurseries and greenhouses not involved with retail sales to the general public; Poultry and livestock production, excluding commercial swine raising, except as otherwise provided within the district; Grazing and pasturing of animals; Home occupations wherein products sold shall have been produced in major part by the permanent occupants thereof; Roadside stands for the sale of fruits, vegetable, and similar products produced on the premises; Governmental-owned or -operated building or use excluding public utility and service structures; Fish hatcheries or fish pools; Publicly owned and/or controlled parks and recreation areas; Bait production; Stables, barns, sheds, silos, granaries, windmills, and related agricultural structures; Dairies; Apiculture; Silviculture including timber production; Single-family dwelling and customary accessory uses including docks and boat houses; Neighborhood recreation areas, when approved as part of a subdivision plat; and Churches and structures appurtenant thereto.

Conditional uses in the Agriculture zoning district include: Cemeteries, mausoleums; Kennels including the commercial raising or breeding of dogs; Hospitals, sanitariums, convalescent homes, veterinary clinics, adult congregate living facilities, and group homes; Private nursery schools, kindergartens, primary schools, secondary schools, and colleges; Temporary asphalt plants for purpose of specific public road construction; Sawmills; Public utility and service structures; Fraternal clubs; Borrow operations; Country and golf clubs, fishing clubs, fishing camps, marinas, gun clubs, or similar enterprises or clubs making use of land in its predominantly natural state; Privately owned and operated recreation facilities open to the paying public, such as, athletic fields, stadiums, race-tracks, and speedways; Golf driving ranges; Riding stables; Airplane landing fields and helicopter ports and accessory facilities; Commercial raising of swine; Sewage disposal plants, water plants, and sanitary landfill operations; Antenna farms; Off-street parking lots; Tenant dwellings; Mobil homes [one per lot]; Retail nurseries; and Slaughter of livestock and meat cutting and processing operations. Seminole County Fla., Seminole County Land Development Code §§ 5.102, 5.104 (April, 1989).

59. Id. § 5.107.

60. Seminole County, Fla., Land Development Code § 5.85 (April, 1989).

61. Seminole County, Fla., Seminole County Future Land Use Map (Dec. 8, 1987).

allow a maximum of 1 dwelling unit per net buildable acre.[62] Lands in the Econ Basin which are located south of Oviedo receive a variety of designations.[63]

Conservation Element

The conservation element of the existing Seminole County Comprehensive Plan contains numerous policy guidelines which, if implemented, could offer significant protection to the Econ Basin. The element identifies floodplains, wetlands, and upland communities as ecological systems which are sensitive to development impacts and should be protected.[64] The element directs Seminole County to establish development review guidelines and standards to provide for consideration of open space, tree protection, scenic corridors, and wildlife habitat.[65]

The conservation element directs that all buildings be set back at least fifty feet from the ordinary high water mark of water bodies.[66] In addition, the element directs that surface water management guidelines be adopted which include special criteria for wild and scenic rivers.[67]

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62. Id. The general rural land use designation permits the following zoning designations: Agricultural Development and Conservation; Agriculture; Public Lands and Institutions; and Travel Trailer Park and Campsites. The suburban estates land use designation permits the following zoning districts: Agricultural Development and Conservation; Agriculture; Country Homes District; and Public lands and Institutions. (Seminole County, Fla., Seminole County Land Development Code ch. 5 (April, 1989). Allowable uses for each zoning district are contained in the Seminole County Land Development Code. Id.

63. Seminole County, Fla., Seminole County Future Land Use Map (Dec. 8, 1987). Most of the land immediately adjacent to the Little and Big Econ Rivers and south of Oviedo is designated Conservation. Land use designations for the remaining lands within the Basin and south of Oviedo include Suburban Estates (maximum of 1 dwelling unit per acre), Low Density Residential (maximum of 4 dwelling units per acre), Medium Density Residential (maximum of 10 dwelling units per acre), High Density Residential (Greater than 10 dwelling units per acre), Planned Development, Higher Intensity Planned Development, Public and Quasi-Public, Commercial, and Industrial (Id.). Allowable zoning districts and uses for each land use designation are contained in the Seminole County Land Development Code (Seminole County, Fla., Seminole County Land Development Code ch. 5 (April, 1989)).

64. Seminole County, Fla., Seminole County Comprehensive Plan VI-C1,2 (July 11, 1989).

65. Id. at VI-C2.

66. Id. at VI-C4.

67. Id. at VI-C5.

Recreation and Open Space Element

The recreation and open space element of the Seminole County comprehensive plan states that "major environmental areas such as the ... Econlockhatchee River"[68] should be preserved through development regulations or land acquisition. The element directs that unique environmentally sensitive areas, scenic areas, and wildlife corridors should be identified and programs should be developed to preserve these areas.[69] The element encourages the use of protection devices such as building and development setbacks, retention and replanting of native vegetation, and land dedication and acquisition.[70]

Future land use, conservation, and recreation and open space elements of the existing Seminole County Comprehensive Plan contain substantial policies and directives which could be used to protect the ecologically sensitive Econ Basin.

b. Draft Conservation Element

The draft conservation element of the Seminole County comprehensive plan[71], which is being prepared to satisfy the Local Government Comprehensive Planning and Land Development Regulation Act, recognizes the Lower Econlockhatchee River system as one of the "most natural settings in Central Florida."[72] It describes the Lower Econlockhatchee River system as consisting of about fifteen miles of river and "pristine bottomland hardwood forest ... surrounded by watershed of undisturbed ranchlands,"[73] located between the city of Oviedo and the St. Johns River.

The draft conservation element identifies the Lower Econlockhatchee River system as a unique system which should be preserved and recommends specific actions to accomplish its preservation.[74] The draft element makes the following recommendations for the entire Econ River Basin:

1) Seminole County should pass a resolution in support of the CARL [Conservation and Recreational Lands] and SJRWMD [St. Johns River Water Management District] purchase proposals,

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68. Id. at VI-J3.

69. Id.

70. Id.

71. Seminole County, Fla., Draft Conservation Element of the Seminole County Comprehensive Plan (October 1988).

72. Id. at 36.

73. Id.

74. Id. at 37.

2) **Establish land development regulations similar to those within the Wekiva River Hydrologic Basin,**

3) Encourage the rural character within the basin through maintaining rural estate, suburban estate, and conservation land uses. [sic]

4) **Develop wetland and upland buffers** for development within the basin. [sic]

5) The County should consider the feasibility to [sic] alternative open space-preservation-acquisition measures that include off-site mitigation, transfer of development rights, land banking and contributions to acquisition funds.[75]

The draft conservation element also identifies the Geneva lens, an isolated upland recharge area of the Florida aquifer completely surrounded by saline water, as a sensitive area requiring special protection.[76] About one half of the Geneva lens is located within the Econ Basin. The draft conservation element recommends that the Geneva lens be protected by preserving the rural character of the area.[77] The element recommends protection of recharge areas through open space requirements, percolation of stormwater, and preservation of upland habitat.[78] Finally, the element recommends regulating potable water supply wells which are exempt from Water Management District regulations.[79]

Policy directives in the draft conservation element, if adopted and implemented, could provide significant protection for portions of the Econ Basin located in Seminole County. However, the draft conservation element has not been formally adopted at the present time. Furthermore, the policies contained in the comprehensive plan must be implemented through effective land use regulations.

2. Orange County

a. Existing Comprehensive Plan

The overall goals of the existing Orange County Comprehensive Plan[80] are to:

1) [P]romote the orderly economic development of Orange County....

2) Encourage the maintenance of an agricultural sector in the Orange County economy.

3) Protect and manage the diverse and valuable land, water, and air resources of Orange County for the use and enjoyment of present and future generations.

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75. Id. at 37-38 (emphasis added).

76. Id. at 41-43.

77. Id. at 43.

78. Id.

79. Id.

80. Orange County, Fla., Orange County Growth Management Policy (August 11, 1986).

4) [P]romote and maintain a balanced ecological system in the County in the context of area-wide problems and solutions, and to develop methods that will enable County residents to continue the physical development of the area without damaging the environment.[81]

The plan directs that Orange County be divided into the Urban and Rural Service Areas, based upon density and intensity of development, availability of services, environmental factors, and land use compatibility.[82]

The Urban Service Area is that portion of the county, excluding conservation areas, in which urban services already exist or are planned to be available by the year 2005.[83] The Rural Service Area consists of portions of the county not designated as conservation or which are not within the Urban Service Area.[84] The Urban Service Area within the Econ Basin is illustrated in Figure 3. Generally, development in the Rural Service Area is limited to densities less than or equal to one dwelling unit per 2.0 gross acres.[85] The plan states that the "rural character" of the area is to be reinforced through application of land development regulations and the provision of services.[86] The plan discourages extension of urban services to the Rural Service Area on a piecemeal basis.[87]

Future Land Use Element

The future land use element of the Orange County Comprehensive Plan contains the following general goals:

1) Encourage the Cluster Development Pattern, which builds upon existing urban development in a contiguous fashion, provides adequate space for future development, and encourages and supports rural life styles and agricultural pursuits.
2) Ensure that future development is directed in a harmonious pattern with existing development and the natural environment.

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81. Id. at II-13.

82. Id. at II-15.

83. Id. at II-10.

84. Id.

85. Id. at II-11,24. Densities in agricultural areas and areas zoned Rural Country Estate may not exceed 1 dwelling unit per 5 acres. Id. at VI-8,55.

86. Id. at II-24.

87. Id. at II-24.

3) Provide for orderly future development, with adequate community facilities and services that are compatible with the surroundings.[88]

Generally, the plan directs the county to establish greater compatibility between the land development process and the natural environment by preserving sensitive areas and directing development to areas which are better able to absorb development impacts.[89] The availability of services, the sensitivity of land to development, and the use of clustering techniques should be considered when making land use decisions.[90]

The future land use element contains specific policies for residential, commercial, industrial, institutional, agricultural, conservation, and recreation and open space land uses. The element identifies the Big Econ River as a system which is

> in a relatively natural state ... [and which has] not been severely impacted by development and, therefore, provide[s] high quality waters and [is one of] the most desirable recreational and scenic areas and natural resources in the County.[91]

Conservation Element

Policies for the conservation land use designation direct the county to establish and protect areas which are sensitive to development (conservation areas).[92] Conservation areas are identified based on an analysis of soils, vegetation, topography, and flood hazard.[93] The plan directs the county to develop and adopt regulations[94] for conservation areas which limit encroachment,[95] encourage cluster development, and provide for density transfers.[96]

The conservation element of the Orange County Comprehensive Plan contains much of the same information which is contained in the Conservation Land Use section of the future land use element. In addition, the conservation element provides additional criteria to be included in regulations. The objectives of the conservation element are to: (1) define and protect conservation areas, (2) identify

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88. Id. at VI-1.

89. Id. at VI-2.

90. Id. at VI-2.

91. Id. at VI-59.

92. Id. at VI-61.

93. Id. at VI-56. To date, wetlands are the only habitat type identified as conservation areas by Orange County.

94. Id. at VI-68,69.

95. Id. at VI-67.

96. Id. at VI-68,69.

and protect prime recharge areas and ground water supplies, (3) identify and abate sources of surface water pollution, (4) identify and reduce sources of air pollution, and (5) ensure future development is constructed on appropriate soils.[97] The element identifies urbanization and the corresponding increase in runoff as the major nonpoint source of pollutants in Orange County.[98] Channelization of natural streams and wetlands have reduced stream assimilative capacity and caused erosion problems.[99]

The conservation element directs the county to create the Comprehensive Conservation Ordinance,[100] which must satisfy the requirements of the conservation land use designation in the future land use element. Conservation areas are to be incorporated into development proposals in a manner which allows the continued productive functioning of the conservation area.[101] In addition, the Ordinance should determine the types of development, if any, which will be allowed in conservation areas.[102]

The conservation element directs Orange County to establish monitoring and regulatory programs to protect the five natural resource functions identified as the objectives of the conservation element.[103] Specific policies direct the county to: (1) eliminate malfunctioning drainage wells and septic tanks; (2) develop water quality standards which maintain or improve existing water quality; (3) identify and minimize stormwater runoff from agricultural areas and paved surfaces; (4) identify and reduce the harmful effects of all point and nonpoint sources of water pollution; (5) establish a comprehensive program to protect shoreline vegetation; (6) require stormwater retention and detention systems to be designed to prevent degradation of surface waters to the fullest extent possible; and (7) require that land uses be compatible with the soil's suitability for development.[104]

Recreation and Open Space Element

The goals of the Recreation and Open Space element of the Orange County Comprehensive Plan are to:

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97. Id. at III-2.

98. Id. at III-10.

99. Id. at III-11.

100. Id. at III-18. The Orange County Conservation Ordinance was created to satisfy this directive and is discussed supra p. 46.

101. Id. at III-18.

102. Id. at III-18.

103. See note 276 and accompanying text.

104. Orange County, Fla., Orange County Growth Management Policy III-18,19,20 (August 11, 1988).

1) Recognize the intrinsic value of open space and work to preserve and manage sufficient open space to enhance the total quality of life in the County.

2) Preserve and provide areas with recreation potential for the current and future needs of the County.

3) Encourage future development patterns which take the unique natural and agricultural features of the County into consideration.[105]

Open space should be used as buffers between incompatible land uses and to protect unique environmental systems.[106] The element encourages the use of conservation areas for active or passive recreation if such uses would not cause significant adverse environmental impact.[107] The element also encourages the creation of a long-range parks acquisition program.[108]

Future land use, conservation, and recreation and open space elements of the existing Orange County Comprehensive Plan contain goals and policies which provide some protection for the Econ Basin. However, existing comprehensive plan elements do not adequately provide for protection of upland wildlife habitat, creation of wildlife corridors, or establishment of construction setbacks from water bodies.

b. Draft Conservation Element

The draft conservation element of the Orange County Comprehensive Plan,[109] which is being developed to satisfy the Local Government Comprehensive Planning and Land Development Regulation Act, states as its overall goal that:

> Orange County shall conserve and protect all natural resources, including air, surface water, groundwater, environmentally sensitive lands and endangered species, to ensure that these resources are preserved for the benefit of present and future generations.[110]

Included in the draft element are a number of specific policies which could provide greater protection to the Econ Basin. The draft element directs Orange County to abate water pollution by (1) identifying all point and nonpoint sources of water pollution and creating and expanding regulatory programs to reduce the impacts of these pollutants, (2) developing basin specific criteria for the protection of river systems, and (3) adopting development regulations which will preserve significant surface waters.[111]

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105. Id. at XII-1.

106. Id. at XII-2.

107. Id. at XII-2.

108. Id.

109. Orange County, Fla., Draft Conservation Element of Orange County Comprehensive Plan (July 1989).

110. Id. at Appendix B, Goal 1.

111. Id. at Appendix B, policies 1.2.2, 1.2.6, 1.2.8.

In addition, the draft element directs Orange County to protect the natural functions of floodplains and flood zone areas so as to "maintain flood-carrying and flood storage capacities, existing wildlife habitat, and wildlife corridors where identified."[112] These objectives should be accomplished through the Orange County floodplain regulations, land acquisition, and the use of clustering and planned developments.

Wetland functions and rare and endangered wildlife are to be identified and protected through the Orange County Conservation Ordinance, and by requiring "upland buffer areas adjacent to major riverine wetland systems in order to protect water quality, preserve natural wetland functions, and preserve endangered and rare wildlife."[113] The draft conservation element also indicates the need for protection of groundwater and wellfields.[114]

A particularly significant objective in the draft element states that "all ecological communities and wildlife, especially endangered and rare species, shall be identified, managed and protected."[115] This should be accomplished by

> adopt[ing] land development regulations that **provide protection and preservation** of scarce ecological communities and **identified wildlife corridors**. Such regulations may **include cluster developments, transfer of development rights, buffering sensitive areas and discouraging the fragmentation of identified wildlife corridors.** At a minimum, developments which are located in scarce natural ecosystems shall be required to develop as Planned Developments or under the appropriate Cluster Zoning District.[116]

In addition, the element states that uplands, wetlands, and wildlife corridors should be purchased whenever possible and provided with buffers to minimize adverse impacts from adjacent activities.[117]

The Orange County draft conservation element, like that of Seminole County, identifies the Econ River as a sensitive area which is being threatened by development pressure.[118] Orange County staff recognized the inadequacy of current regulations and articulated the need to manage the Econ River as one integrated system:

> The Econlockhatchee River is an example of another natural riverine system that could **benefit from comprehensive protection.** This river system ... represents a unique opportunity to conserve a resource before extensive development pressure occurs.

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112. Id. at Appendix B, Objective 1.3.

113. Id. at Appendix B, policy 1.4.3.

114. Id. at Appendix B, objective 1.5.

115. Id. at Appendix B, Objective 1.8.

116. Id. at Appendix B, Policy 1.8.4. (Emphasis added).

117. Id. at Appendix B, policy 1.8.5, objective 1.9.

118. Id. at 4, 37.

County action is warranted because the current level of protection does not ensure the long-term maintenance of the river's character.[119]

The element recommends implementing some form of upland buffer adjacent to wetlands associated with the Econ River.[120]

The draft Orange County conservation elements contains policies and recommendations which could lead to considerable protection of the Econ River. However, as with other comprehensive plans, the element's provisions must be adopted and effectively implemented before the resources at issue are lost.

3. Osceola County

In reviewing Osceola County comprehensive plan elements it is important to know that Osceola County contains the headwater swamp to the Econ River and that no identifiable river channel exists within the county.

a. Existing Comprehensive Plan

The current Osceola County Comprehensive Plan contains future land use, conservation, and recreation and open space elements.[121] The Plan does not contain an historical and scenic preservation element.

Future Land Use Element

The future land use element directs the county to adopt a future land use map, which designates the Econ Basin as a rural area.[122] Allowable uses in the rural area include low density residential (one dwelling unit per five acres maximum density), commercial retail-office, public-institutional, and agricultural.[123] The future land use element also contains some general language stating that adverse environmental impacts of development should be minimized and open space should be conserved.[124]

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119. Id. at 7. (Emphasis added).

120. Id.

121. Osceola County, Fla., Osceola County Comprehensive Plan (April 3, 1989).

122. Id. at policy 1.2.4; Interview with Chris Frye, Planner, Osceola County Planning Department (Oct., 1989).

123. Osceola County, Fla., Osceola County Comprehensive Plan 8,19 (April 3, 1989).

124. Id. at 35-36.

Conservation Element

The conservation element of the Osceola County Comprehensive Plan directs the county to prepare a conservation land use map identifying resources of regional importance.[125] The element contains general language discouraging development in wetlands which would result in detriment to natural drainage patterns.[126] Endangered species are also to receive special consideration in the development review process.[127] The element also states that all surface water bodies are resources of special concern and their water quality should be protected and improved.[128] The element directs that development regulations should be revised to protect and enhance surface water through devices such as lot coverage setback requirements.[129]

Recreation and Open Space Element

The recreation and open space element of the Osceola County Comprehensive Plan encourages the preservation of open space and recreation lands for future generations.[130] Wetlands are considered to be open space.[131] However the element does not provide policy guidelines to ensure that the natural character, vegetation, and wildlife of these lands is protected.[132]

The existing Osceola County Comprehensive Plan does not provide sufficient policy guidelines to adequately protect the portion of the Econ Basin located within Osceola county. The plan does not identify the need to provide for protection of wetlands or uplands through county regulations and does not identify the Econ River Swamp as an environmentally sensitive area of regional significance.

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125. Id. at 71, obj. 1.2.0.

126. Id. at 74, policy 1.6.3

127. Id. at 74, policy 1.6.2.

128. Id. at 79-80, obj. 1.12.0.

129. Id. at 80, policy 1.12.2.

130. Id. at 86, goal 2.00.

131. Id. at 86, policy 2.1.1.

132. Id. at 82-87.

b. Draft Conservation Element

The draft conservation element of the Osceola County Comprehensive Plan,[133] if adopted and implemented, should provide substantial improvements over existing guidelines. Most notably, the draft element directs the county to adopt rules to: (1) protect wetlands and surface waters, including wetland setbacks or buffers, criteria for adjacent upland development, and prohibitions against ditching, dredging and filling, and channelization;[134] (2) manage stormwater;[135] (3) control land clearing and landscaping;[136] (4) protect the natural functions of the 100-year floodplain;[137] (5) inventory and protect wildlife;[138] and (6) regulate forestry practices to protect environmental systems.[139]

The draft conservation element of the Osceola County Comprehensive Plan could provide significant protection to the Econ Basin if implemented properly. However, as with the other counties involved, it will take considerable time to complete the adoption and implementation of the element.

4. Oviedo

a. Existing Comprehensive Plan

Land Use Element

The land use element of the Oviedo Comprehensive Plan[140] provides some general guidelines for future land use. Objectives of the element include providing adequate open space and preserving "areas of critical environmental importance, areas of high ecological sensitivity, and areas with unique natural features."[141] Future development should be orderly and contingent upon availability of services.[142] The element directs that future residential development fall within the category of (1)

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133. Osceola County, Fla., Draft Conservation Element of Osceola Comprehensive Plan (June 15, 1989).

134. Id. at 101-102, obj. 13.1,13.2,13.7,13.9, policy 13.1.

135. Id. at 101, 103, policies 13.2, 13.13, 13.14.

136. Id. at 101, policy 13.3.

137. Id. at 103, policy 13.13.

138. Id. at 105, obj. 13.6, policy 13.24.

139. Id. at 111, obj. 13.10.

140. Oviedo, Fla., Oviedo Comprehensive Plan (1977).

141. Id. at II-2.

142. Id. § II-10.

rural density (0.0 - 1.0 dwelling units per acre), (2) low density (1.1 - 5.0 dwelling units per acre), or (3) medium density (5.1 - 12.0 dwelling units per acre).[143] The element limits the gross average density of future residential development to 5 units per acre.[144] The element directs that the pollution effects of industrial development be controlled and that loss of agricultural lands be minimized.[145]

Conservation Element

The stated purpose of the natural resources or conservation element of Oviedo is to "protect the basic natural land, air, water and wildlife resources...."[146] Objectives of the element include (1) encouraging a development pattern that reflects that land is a limited resource, (2) preserving areas of critical environmental importance, ecological sensitivity, and unique natural features, and (3) safely disposing of wastewater.[147] The element contains the following policies for natural resources: (1) the city shall develop a city-wide natural resource plan; (2) stormwater runoff must be treated; (3) environmentally sensitive areas shall be determined by identification of vegetation, soils, and the 100-year floodplain; (4) environmentally sensitive areas shall be protected by encouraging land use measures such as agricultural zoning, green belts, conservation and preservation zoning, scenic, recreation and conservation easements, and tax incentives; (5) vegetation and wildlife shall be protected through an arbor ordinance; and (6) surface water criteria shall be established to prevent pollution during construction and to prevent downstream pollution.[148]

Recreation and Open Space Element

The Oviedo comprehensive plan parks and recreation element states that some parks should be "reserved exclusively for beautification or passive forms of recreation."[149] The element directs that guidelines be established for maintaining environmentally sensitive areas in their natural condition,[150]

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143. Id. § II-11.

144. Id.

145. Id. at II-13.

146. Id. at III-1.

147. Id.

148. Id. at III-4 - III-8.

149. Id. at V-B1.

150. Id. at V-B5.

and that new subdivisions and planned unit developments be required to dedicate land for recreational purposes.[151]

The land use, conservation, and parks and recreation elements of the Oviedo Comprehensive Plan provide some guidance for preservation of natural resources. However, the plan does not provide for comprehensive protection of important natural resources such as wetlands, uplands, and wildlife. In addition, the city of Oviedo has grown dramatically since the plan was adopted, and has annexed portions of the Little Econ, Big Econ, and Econ Rivers. The current plan does not identify the Econ River as an area of special environmental concern and is inadequate to protect the natural resources of the Econ Basin.

City of Oviedo planning staff indicate that conservation provisions in the existing comprehensive plan are outdated and have been augmented by conservation oriented provisions in the current Oviedo land development regulations. These regulations are discussed in part III.D of this volume.

b. Draft Conservation Element

The draft conservation element of the city of Oviedo is not presently available.

5. Orlando

a. Existing Comprehensive Plan

The city of Orlando comprehensive plan is broken down into six regional Growth Management Plans. The Northeast and Southeast Growth Management Area Plans address areas within the Econ Basin. The plans contain similar provisions with respect to environmental resources and only the Northeast plan is discussed here.

The Northeast plan[152] identifies wetlands as valuable areas which should be protected. Wetlands must be identified on the zoning map through a resource protection overlay to be included in the Orlando Land Development Code. The plan establishes a point system whereby the value of wetlands is determined by examining factors such as size, linkage, landscape diversity, quality of the surrounding landscape, intactness, uniqueness, habitat, water quality, and vegetation.[153] Wetlands with low value, primarily those which have already been altered by urbanization (altered wetlands), may be developed.[154] Wetlands with intermediate value, primarily wetlands which are changing from an aquatic to a terrestrial state (transitional wetlands), may be developed as long as the wetlands are

151. Id. at V-B4.

152. Orlando Fla., Northeast Growth Management Area Plan (May 1989).

153. Id. at 101-102.

154. Id. at 99.

protected to the extent that they continue to function as viable wetlands.[155] Wetlands of high value, primarily wetlands which regional, state, or federal agencies identify as protected (protected wetlands), are developable to the extent allowed by these agencies.[156]

The Northeast plan also limits the total filled area in altered and transitional wetlands to 10% of the wetland within the property boundaries.[157] However, the land development regulations indicate that while protected wetlands must retain 100% of the wetland as undeveloped area, transitional wetlands must retain only 60%, and altered wetlands 0%.[158]

The Northeast plan states that trees are valuable and should be protected by (1) establishing a point system to protect existing woodlands and to encourage renewal of woodlands, (2) establishing standards to protect the roots of trees, and (3) establishing standards for buffering and screening between different uses.[159] Additionally, the Northeast plan directs the city to adopt standards to protect floodplains,[160] and to protect surface waters through the use of stormwater regulations.[161] Development must retain a 50-foot undisturbed vegetative zone around lakes and wetlands.[162] The zone helps to prevent soil erosion and to decrease stormwater runoff rates.[163]

b. Draft Conservation Element

The draft conservation element of the city of Orlando is not presently available.

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155. Id.

156. Id. at 100.

157. Id. at 100, policy 3.

158. Orlando Fla, Orlando Illustrated Land Development Code 58-384 (June 1985, amended June 1988).

159. Id. at 103.

160. Id. at 103, 104.

161. Id. at 134, 135.

162. Id. at 105.

163. Id.

III. Local Government Regulations

Chapter 163 Part II requires local governments to create land development regulations that implement and enforce the objectives of the comprehensive plan.[164] Land development regulations must: (1) regulate use of land and water; (2) ensure compatibility of adjacent uses; (3) provide for open space; (4) provide for protection of potable water wellfields; (5) regulate areas subject to seasonal and periodic flooding; (6) provide for drainage and stormwater management; and (7) ensure the protection of environmentally sensitive lands designated in the comprehensive plan.[165]

Local governments typically attempt to implement the conservation and related elements of their comprehensive plans through ordinances addressing wetlands, floodplains, shorelines, stormwater, and dredge and fill. The following discussion examines conservation oriented land development regulations of local governments within the Econ Basin. Table 3 illustrates environmental resources which are regulated by local governments in the Econ Basin.

TABLE 3

SUMMARY OF LOCAL GOVERNMENT ENVIRONMENTAL REGULATIONS IN ECON BASIN

	-------Water-------		----------Wildlife----------			----------Habitat----------		
Regulator	Quality	Quantity	Wetland	Endanger-ed	Other	Wetlands	Flood-plain	Uplands
Seminole	R	R	R	R	N	R	R	N
Orange	R	R	R	R	N	R	R	N
Osceola	N	R	N	R	N	N	R	N
Oviedo	R	R	N	R	N	N	R	N
Orlando	R	R	R	R	N	R	R	N

R = Regulation N = No Regulation

[164] Id. § 163.3202(1).

[165] Id. § 163.3202(2).

Table 4 illustrates isolated wetlands permitting thresholds for local governments within the Econ Basin.

TABLE 4

LOCAL GOVERNMENT ISOLATED WETLANDS PERMITTING THRESHOLDS IN THE ECON BASIN

Regulatory Entity	Acres
Seminole County	5.0
Orange County	0.0
Osceola County	NA*
Oviedo	NA*
Orlando	0.0

* NA = No Wetlands Regulation

A. Seminole County

1. Wetlands

The Seminole County Wetlands Ordinance[166] regulates activities within wetlands and their adjacent areas, except for isolated wetlands encompassing less than 5 acres.[167] "Adjacent area" is defined as the transition zone between wetlands and upland communities which has a direct ground or

[166]Seminole County, Fla., Land Development Code ch. 5, art. XLI (April 1989).

[167]Id. § 5.821.

surface water influence on wetlands.[168] The following development activities may be regulated in the "adjacent area": bulkheading (impounding, interrupting, or diverting surface water); drainage ditches; dredging; filling; hazardous materials (storage, use, or disposal of any hazardous materials); solid waste disposal; and stormwater retention basins.[169] If insufficient information exists to determine the adjacent area, the area is defined as including 300 feet from the wetland boundary.[170] Policy guidelines for implementing the ordinance dictate that a natural buffer strip 50 feet wide must be maintained between cleared areas and natural surface water bodies.[171]

The ordinance provides for county staff determination of the wetland type, significance, and compatibility for development activity.[172] Wetland significance is determined by evaluating the following factors:

1) Size (large wetlands are considered to have greater significance than small wetlands)[173]
2) Connectedness (wetlands connected to major wetlands or aquatic systems are considered to have greater significance than isolated wetlands)[174]
3) Landscape diversity (wetlands surrounded by several types of plant communities are considered to be more significant than wetlands surrounded by one plant community)[175]
4) Intactness (wetlands which are undisturbed or have minor alterations are considered to have greater significance than wetlands which have major alterations)[176]
5) Uniqueness (scarce or uncommon wetlands are considered to have greater significance than common wetlands)[177]

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[168]Id. § 5.823(a).

[169]Id.

[170]Id.

[171]Seminole County, Fla., Planning Guidelines for Natural Resources (Feb. 1987).

[172]Seminole County, Fla., Land Development Code § 5.827 (April, 1989).

[173]Seminole County, Fla., Planning Guidelines for Natural Resources 30 (Feb. 1987).

[174]Id. at 31.

[175]Id. at 32.

[176]Id. at 33.

[177]Id. at 34.

6) Quality of the adjacent area (wetlands which are surrounded by land which is undisturbed or has minor disturbance are considered to have greater significance than adjacent land which has major alterations)[178]

Development activities are evaluated to determine whether the activities are compatible with wetland functions.[179] Wetland type and significance are used to help determine to what extent a wetland can accept development activities without diminishing the wetland's functions.[180] The compatibility of the development activity is determined by comparing the effects of the activity on wetland functions for each wetland type.[181] Development activities are categorized as:

1) Compatible: Development activities which have nominal affects on wetland functions are encouraged but not required to satisfy performance standards.[182]

2) Compatible subject to performance standards: Development activities which adversely affect the physical and biological functions of wetlands are required to comply with performance standards.[183]

3) Incompatible: Development activities which adversely affect at least two wetland functions are prohibited. These are uses that "can disrupt the normal functioning of wetlands and can cause an increase in pollution of surface and groundwaters, increase flooding risk, diminish fish and wildlife habitat, and increase erosion and subsequent downstream sedimentation."[184]

The ordinance provides guidelines which are designed to minimize the adverse affects of development activities on wetland functions.[185] In most instances, guidelines allow destruction of no more than 10% of a wetland.[186] Additionally, a conservation easement to the county may be required for the remaining 90% of intact wetland.[187]

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[178]Id. at 35.

[179]Id. at 38.

[180]Id.

[181]Id.

[182]Id. at 38.

[183]Id.

[184]Id.

[185]Id. at 44.

[186]Seminole County, Fla., Planning Guidelines for Natural Resources 44 (Feb., 1987); Seminole County, Fla., Land Development Code Appendix B, ch. 3 (April 1989).

[187]Seminole County, Fla., Land Development Code § 6.41(c) (April, 1989). This provision is contained in the subdivision regulations of Seminole County and it is unclear whether the provision applies to other types of development.

The staff may consider mitigation or compensation on a site specific basis "where site conditions preclude the use of performance standards and where opportunities exist to enhance wetland or environmental benefits."[188] However, the ordinance does not provide any additional guidance concerning what type or how much mitigation to require.

The Seminole County Wetlands Ordinance protects many of the wetlands along the Econ River. The definition of wetlands includes surface waters and therefore the ordinance applies to the Econ River, wetlands which are hydrologically connected to the Econ River, and "adjacent area[s]" to the Econ River and its wetlands. The inclusion of adjacent areas in the definition provides some protection for transitional habitat. However, most of the performance standards for adjacent areas address water quality and quantity values and not habitat values. Accordingly, the performance standards for adjacent areas do not adequately consider the impacts of development activities on wildlife.

Furthermore, adjacent areas, as defined in the ordinance, may not be wide enough to provide adequate habitat for aquatic and wetland-dependent species.[189] Studies indicate that a minimum 550-foot, undisturbed vegetative zone adjacent to the river is needed to satisfy the habitat needs of aquatic and wetland-dependent species of wildlife.[190] The required 50-foot buffer between clearings and surface water bodies does ensure protection of a narrow strip of land along the river. Policy guidelines for implementing the wetland regulations, however, state specifically that clearing in areas adjacent to wetlands is acceptable as long as the clearing is done in conjunction with a permitted structure or activity.[191]

The Ordinance excludes most isolated wetlands smaller than 5 acres from regulation. However, studies indicate that small ephemeral wetlands provide essential habitat for certain species of wildlife.[192] Small isolated wetlands are important components of the Econ Basin and should be protected.

In conclusion, the Seminole County Wetlands Ordinance does not provide sufficient protection for the Econ River. The Ordinance applies to wetlands and their adjacent areas, but does not apply to uplands and other types of habitat critical to preservation of the riverine ecosystem. Although the

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[188]Id. § 5.826(c).

[189]The adjacent area is the area between wetlands and upland communities which has a "direct groundwater or surface water influence on the wetland [and] where development activities may have an adverse impact on wetlands." If insufficient information exists to determine the width of the adjacent area, the area is defined as "all property within three hundred feet of the wetland functions." Accordingly, the adjacent area along portions of the Econ River with high banks and narrow floodplains might often be defined as much narrower than the three hundred foot width.

[190]Brown, M.T., J.M. Schaefer, and K. Brant, Buffer Zones for Water, Wetlands and Wildlife in the East Central Florida Region, Center for Wetlands, University of Florida, publication no. 89-07 (1990) (report submitted to the East Central Florida Regional Planning Council).

[191]Seminole County, Fla., Planning Guidelines for Natural Resources 50 (Feb., 1987).

[192]Brown, M.T., J.M. Schaefer, and K. Brant, supra note 190. See also, note 438 and accompanying text.

ordinance could be applied in limited instances to create wetland conservation areas, its use could not provide adequate protection for the Econ River.

2. Floodplains

Federal floodplain regulations require local governments to adopt floodplain regulations in order to qualify for federal flood insurance.[193] Floodplain regulations are designed to retain the natural flood storage capacity of natural systems to prevent excessive flooding and protect human life and property. Floodplain regulations typically prevent alterations of flood prone areas which would reduce the overall flood storage capacity of the area. The regulations may prohibit construction in certain areas, allow construction if compensating storage is provided, and require elevation of structures.[194]

Protection of environmentally sensitive habitat and wildlife is an additional purpose of floodplain regulations. Although floodplain regulations are usually designed primarily to protect human life and property, the regulations may provide the additional benefit of preserving sensitive lands from development. Accordingly, for purposes of this report, review of local government floodplain regulations will focus on ancillary benefits which the regulations may provide with regard to protection of habitat, and will not attempt to assess the effectiveness of the regulations in preventing flood damage.

The Seminole County Floodplain Ordinance[195] requires that most structures within the floodplain be elevated one foot above the base flood elevation.[196] Additionally, if the development activity decreases the flood storage capacity of the floodplain, the developer must provide compensating storage at a one to one ratio.[197]

Local government floodplain ordinances usually prohibit encroachments within the floodways of rivers. A floodway is the channel of a river plus any adjacent floodplain area that must be kept free of encroachment in order that the 100-year flood may be carried without raising flood heights more than one foot.[198] Accordingly, the Seminole County regulations prohibit encroachments within floodways that could cause an increase in flood levels.[199] However, floodways have not been designated for the Econ River. Seminole County regulations provide that, in the absence of designated floodways, encroachments shall be located within a distance of the stream bank equal to five times the width of the

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[193]42 U.S.C. § 4022 (1988).

[194]Hamann, R., Floodplain Regulation, 4 Rohan, Zoning and Land Use Controls § 18.02[2] (1988).

[195]Seminole County, Fla., Land Development Code ch. 5, art. XL (April 1989).

[196]Id. § 5.785(e),(f),(g).

[197]Id. § 5.785(c),(d).

[198]Id. § 5.782(l).

[199]Id. § 5.785(h)(1).

stream at the top of the bank or twenty feet each side from top of bank, whichever is greater, unless an engineer certifies the encroachment will not result in increases of flood levels.[200]

The Seminole County regulations prohibit or discourage some development in the floodplain area. The provision addressing floodways could prevent some development within areas immediately adjacent to the river. If actual floodways were designated, most development would be prohibited in the zone. Floodways are currently being delineated for the Econ River by the U.S. Army Corps of Engineers. When this information is available it should be analyzed to determine whether it provides any significant environmental protection of lands adjacent to the Econ River.

3. Uplands/Sensitive Lands

Seminole County has no ordinance providing for comprehensive preservation of uplands or other sensitive lands other than wetlands. However, the Seminole County Arbor Ordinance does provide some protection for trees in unincorporated areas of the county.[201] No person may remove or destroy a tree without first obtaining a permit from the county.[202] Trees smaller than 3 inches in diameter measured three feet from the base of the tree and which normally reach a minimum height of fifteen feet are excluded from regulation under the ordinance.[203]

The ordinance applies to the following areas:

a) All vacant and undeveloped property;

b) All property to be redeveloped;

c) All property where there is to be any addition or alteration, except developed single-family lots;

d) The yard areas of all developed property, except developed single-family lots; and

e) All rights-of way, public or private.[204]

Permits may be granted for removal of trees: (1) which are located in areas where a permit application has been filed for a structure or improvement; (2) which unreasonably restrict the permitted use of the property; or (3) which are diseased, injured, interfere with utility services, or are otherwise hazardous.[205] Applicants may be required to relocate or replace trees as a condition of granting a permit.[206] The ordinance also contains criteria to protect trees during development and construction.[207]

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[200] Id. § 5.786(a).

[201] Id. § 8.3.

[202] Id. § 8.21.

[203] Id. § 8.2.

[204] Id. § 8.3.

[205] Id. § 8.22(d).

[206] Id. § 8.22(e).

Tree removal from single-family lots of 5 acres or less are exempt from the ordinance.[208] In addition, agricultural and silvicultural lands may also be exempt.[209] Trees planted for harvest are exempt from the ordinance.[210] Although some silvicultural activities may be exempt, the ordinance provides special criteria for "bona fide logging operations."[211] Persons planning to engage in bona fide logging operations must first obtain a permit from the land management office.[212] The county may attach permit conditions to prevent environmental detriment from the non-exempt logging operations.[213] However, bona fide logging operations which existed in 1973 may not be required to obtain a permit, although they must abide by certain minimum criteria.[214]

The Seminole County Arbor Ordinance provides some protection for existing trees. However, the ordinance does not apply to most agricultural and silvicultural operations. The ordinance does not provide for any buffers around wetlands or prevent the harvesting of trees within wetlands. In addition, most understory vegetation is also exempt from regulation. In conclusion, the Arbor Ordinance does not provide comprehensive protection for wildlife and wildlife habitat.

4. Stormwater/Surface Water Management Standards

Seminole County stormwater regulations are similar to Water Management District stormwater regulations. Stormwater facilities utilizing retention or detention systems with a positive outfall must be capable of treating runoff from a 25-year, 24-hour design storm.[215] Facilities utilizing retention or

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[207]Id. § 8.4.

[208]Id. §§ 8.1, 8.3.

[209]Id. § 8.5(c). To be exempt the lands must be zoned for agricultural or silvicultural uses, be agriculturally classified for tax purposes, and be used specifically for agricultural or silvicultural operations. Id.

[210]Id. §§ 8.2, 8.5(h).

[211]Id. §§ 8.2, 8.5(f),(g).

[212]Id. § 8.5(f),(g).

[213]Id. § 8.5(f)(3). Permit conditions may include provisions to protect certain trees, buffer waterways or certain lands, guarantee restoration of terrain, prevent pollution, insure reforestation, or preserve rare, valuable, or historic trees. Id.

[214]Id. § 8.5(g). Minimum criteria include provisions to prevent logging operations from 1) harming trees designated as rare, valuable, or historic, 2) occurring within 50 feet of residential lands, 3) occurring within 150 feet of any water body or public park, 4) contributing noticeably to pollution of water bodies, or 5) disrupting substantially the natural drainage of the land. Id.

[215]Id. at B-15. A 25 year, 24 hour design storm is a storm which occurs every 25 years and which lasts for 24 hours.

detention systems which have no positive outfall must retain runoff from a 100-year, 24-hour design storm.[216] The regulations provide different design storm requirements for certain systems[217] and provide a mechanism for increasing the design frequency if necessary to protect upstream or downstream properties.[218] Stormwater management facilities must also meet the following criteria:

1) The peak discharge resulting from the design storm after development must not exceed the peak discharge which existed prior to development;
2) Developments without a positive outfall must retain all runoff from the design storm;
3) The design of stormwater management systems must be based on soil characteristics.[219]

Seminole County also requires that developers use best management practices during and after construction to prevent pollution of surface waters through erosion.[220] The regulations set out five principles for reducing erosion and sedimentation from developing areas: (1) plan the development to fit the site; (2) expose the smallest practical area of land for the shortest possible time; (3) apply soil erosion practices to prevent on-site damage; (4) apply sediment control practices as a perimeter protection to prevent off-site damage; and (5) implement a thorough maintenance and follow-up operation.[221] Best management practices include: surface protection measures, such as use of vegetation as ground cover, mulching, fibrous matting, or netting; runoff control measures, such as reducing runoff velocities through the use of furrowing, berms, diversions, and ditches; and sediment trapping measures, such as silt fences, excavated pits, and sediment basins.[222]

Erosion and sediment control measures must be implemented at the "earliest practicable time consistent with good construction practices."[223] The control measures must be adequately maintained

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[216] Id.

[217] Id. The regulations have specific design storm requirements for retention and detention basins which are adjacent to a public right-of-way and have no positive outfall (25 year, 24 hour); closed drainage systems which are internal to development (10 year, 3 hour); roadside swales (10 year, 3 hour); arterial and collector streets (10 year, hydraulic gradient line, 1.0 feet below gutter line); local streets (10 year, hydraulic gradient line, 0.5 feet below gutter line); canals (25 year); bridges (100 year). Id.

[218] Id.

[219] Id. at B-14.

[220] Id. at B-37.

[221] Id. at B-37 - B-39.

[222] Id. at B-39 - B-40.

[223] Id. at B-41.

during construction of the project.[224] Material from sediment traps must not be stockpiled or disposed of in a manner which allows the material to be washed into a watercourse.[225]

Seminole County regulation of stormwater provides no additional protection over existing requirements of the St. Johns River Water Management District (the Water Management District stormwater regulations are discussed in this section).

5. Dredge and Fill

Seminole County requires a dredge and fill permit for some dredge or fill activities in waters below the ordinary or historical high water mark[226] or in wetlands which are not subject to wetlands permitting procedures.[227] Construction which is approved as part of a site plan or subdivision review process is exempt from obtaining a dredge and fill permit.[228] Normal maintenance and landscaping are also exempt if the work does not involve addition or relocation of structural or physical features.[229] The following activities are exempt from obtaining a dredge and fill permit but are reviewed for advisement and comment:

1) Improvements, construction, or maintenance dredging of drainage canals, retention or detention basin, borrow pits, and private ponds under single ownership on privately owned property.
2) Overhead power or communications lines, water, sewer and effluent mains, and petrochemical lines, where construction or replacement of supports is necessary in jurisdictional areas.
3) Installation of subaqueous power or communications lines, water, sewer and effluent mains, and petrochemical lines.
4) The non-mechanical removal of undesirable aquatic or shoreline vegetation providing such removal does not effect the physical stability of the shoreline or embankment.
5) Aquatic plant control operations involving chemical or biological methods.
6) Boat docks, boat houses and gazebos on single-family lots under four hundred (400) square feet, provided a building permit has been issued therefor.

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[224] Id.

[225] Id.

[226] Id. § 10.3.

[227] Id. § 10.5(a)(4).

[228] Id. § 10.5(a)(1),(2).

[229] Id. § 10.5(a)(3). This exemption does not include removal of desirable shoreline vegetation. Id.

7) Construction of seawalls on single-family lots less than two hundred (200) feet in length, provided a building permit has been issued therefor.[230]

Permit review criteria include consideration of: (1) potential effects on water quality and the propagation of wildlife, fish, aquatic plants and animals; (2) effects on other property owners and the public health, safety, and welfare; and (3) recommendations of any governmental or professional agencies.[231] The applicant may be required to undertake erosion and sediment control measures and replace trees or shrubs destroyed during the activity.[232]

B. Orange County

1. Conservation (Wetlands)

The Conservation Ordinance of Orange County[233] regulates activities within wetlands and immediately adjacent to wetlands which would have material adverse affects on wetlands.[234] The ordinance regulates wetlands of all sizes[235] and establishes a system to identify wetlands[236] and to evaluate the significance of particular wetlands.[237] The ordinance provides varying degrees of protection to wetlands depending upon the perceived overall significance and environmental productivity of the wetland.[238] Generally, the ordinance assigns greater significance to wetlands which have natural hydrological connections to natural surface waters and less significance to small isolated wetlands.

All activities which might adversely affect wetlands are subject to review under the ordinance. The conservation ordinance exempts no wetlands except those for which development permits or binding development orders were obtained prior to formal adoption of the ordinance on July 3, 1989.

In reviewing an application for development in a wetland area, Orange County staff determine: (1) whether a wetland actually exists, based on the Water Management District definition of wetlands, (2) the extent and location of the wetland, based on the Water Management District vegetative index, (3)

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[230]Id. § 10.5(b)(1)-(7).

[231]Id. § 10.7.

[232]Id. § 10.10.

[233]Orange County, Fla., Ordinance 89-8 (July 3, 1989).

[234]Id. § 2.01.

[235]Id.

[236]Id. §§ 3.02, 4.02.

[237]Id. §§ 1.04(b),(c),(d); 4.02; art. V.

[238]Id. §§ 1.02(d),(e); art. V; § 6.01.

the classification of the wetland as a Class I, II, or III wetland, and (4) the level of protection, compensation, or mitigation required.

Orange County classifies wetlands as either Class I, II, or III Conservation Areas. Class I conservation areas are wetland areas which are: (1) hydrologically connected to natural surface water bodies; (2) lake littoral zone; (3) large isolated uninterrupted wetlands 40 acres or larger; or (4) provide critical habitat for federal and/or state listed threatened or endangered species.[239] Class II Conservation areas are wetlands which "[c]onsist of isolated wetlands or formerly isolated wetlands ... and are greater than or equal to 5.0 acres; or [d]o not otherwise qualify as a Class I Conservation Area."[240] Class III conservation areas are wetlands which: (1) are isolated wetlands less than 5.0 acres; or (2) do not otherwise qualify as a Class I or Class II Conservation Area.[241]

Orange County staff consider the following factors to determine the level of protection and mitigation required for a particular wetland: functional significance, scarcity, vulnerability, and replaceability of habitat in its pre-developed and post-developed condition.[242] The significance and productivity of wetland habitat is measured by selecting evaluation species and determining the value the habitat provides to these evaluation species.[243] Significance and productivity of wetlands are expressed in habitat units.[244] Generally, one habitat unit represents one acre of optimum habitat for the particular evaluation species.[245] Each application is reviewed to determine the number of habitat units existing before the activity and to estimate the number of habitat units which will exist after the activity.[246]

Applicants must demonstrate the preservation, creation, or restoration of an equal number of habitat units after the activity, unless compensation or mitigation is allowed.[247] The relative values of evaluation species are determined based on the Habitat Evaluation Procedure (HEP) of the U.S. Fish and Wildlife Service.[248] Where evaluation species are determined to have high value because of scarcity

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[239]Id. § 1.04(b).

[240]Id. § 1.04(c).

[241]Id. § 1.04(d).

[242]Id. § 5.01.

[243]Id. § 5.03.

[244]Id. § 5.03.

[245]Id. § 1.04(f).

[246]Id. § 5.04.

[247]Id.

[248]Id. § 5.04(b). See Breedlove, B. W. and J. H. Exum, "Development of an Ordinance Based on Habitat Valuation Allowing Trade-offs of Wetlands to Maintain Value," in Urban Wetlands (Proceedings of the National Wetland Symposium) (June 26-29, 1988).

or vulnerability, the applicant must show no net loss of habitat units for the evaluation species or creation of an equal number of habitat units for species of equal value.[249] Where evaluation species are relatively abundant and have medium to high value, the applicant must show no more than 10% of the habitat units will be lost or the creation of an equal number of habitat units for other species of equal value.[250] Where evaluation species are relatively abundant and have a low value, the applicant must demonstrate minimal loss of habitat value.[251]

A development proposal which will result in an adverse impact to wetlands may proceed if the proposal complies with compensation or mitigation criteria contained in the ordinance.[252] The applicant may attempt to compensate for unavoidable loss of habitat by providing the county with money or with lands in areas designated by the county.[253] The ordinance provides two methods by which the amount of compensation is determined, and the applicant may choose either method.[254] Under the first method, the applicant may submit a property appraisal which provides an estimate of the average value per acre of the property.[255] This value is calculated by dividing the total estimated value of the property by the total acreage of the property.[256] The amount of compensation money required is calculated by multiplying the average value per acre of the property by the acres of wetlands lost.[257]

Under the second method, the applicant may purchase designated compensation lands or pay the required amount of compensation.[258] Orange County establishes off-site areas within the county and establishes the average cost per acre of these areas.[259] An applicant for habitat compensation may either purchase the amount of required land as determined by mitigation ratios, or pay compensation

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[249]Id. § 5.04(b)(i).

[250]Id. § 5.04(b)(ii).

[251]Id. § 5.04(b)(iii).

[252]Id. § 7.01.

[253]Id. § 6.01.

[254]Id.

[255]Id. § 6.01(a).

[256]Id.

[257]Id.

[258]Id. § 6.01(b).

[259]Id.

based on the average cost per acre of the designated compensation lands multiplied by mitigation ratios.[260]

The ordinance provides the basis for review of applications for habitat compensation for each class of wetland. In Class I wetlands, removal, alteration, or encroachment is prohibited unless "no other feasible or practical alternatives exist that will permit a reasonable use of the land or where there is an overriding public benefit."[261] "Protection, preservation and continuing viability" of Class I wetlands is the primary objective of review of development requests.[262] Habitat compensation or mitigation is required if encroachment, alteration, or removal of Class I wetlands is allowed.[263] In Class II wetlands, habitat compensation is "presumed to be allowed unless habitat compensation is contrary to the public interest."[264] In Class III wetlands, habitat compensation is allowed in all cases.[265]

Habitat compensation is placed in the Conservation Trust Fund, which may only be used for purchase, improvement, creation, restoration, or replacement of natural habitat within the county.[266] Funds do not have to be used to replace the same type of habitat which was lost due to development.[267]

Applicants may seek to mitigate adverse impacts on wetlands, rather than to provide land or monetary compensation.[268] Mitigation proposals may be evaluated to determine "the degree of impact to wetland functions, whether the impact to these functions can be mitigated ... [and] the anticipated post-development viability and performance ... [of the wetland]."[269]

Alternatively, mitigation proposals are acceptable if they meet the following minimum criteria. Mitigation ratios for Class I wetlands or for mitigation with unlike habitat are considered on a case by case basis.[270] Orange County staff indicate that mitigation ratios for Class I wetlands or unlike habitat are at least 4-5:1. Class II mitigation ratios require type for type mitigation at the following ratios:

1) Freshwater marshes and wet prairies - 1.5:1;

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[260]Id.

[261]Id. § 6.01.

[262]Id.

[263]Id.

[264]Id.

[265]Id.

[266]Id. § 6.02.

[267]Id.

[268]Id. § 7.01.

[269]Id.

[270]Id. § 7.04.

2) Cypress Wetlands - 2.0:1; and

3) Hydric hammocks, bayheads, and mixed hardwood swamps - 2.5:1.[271]

Mitigation ratios for Class III wetlands are 1:1.[272]

As with applications for review of habitat compensation, the basis for review for mitigation strongly discourages activities within Class I wetlands, presumes mitigation is allowed in Class II wetlands, and almost always allows mitigation in Class III wetlands.[273]

Applicants for mitigation must provide a monitoring and maintenance program which continues for a minimum of one year and results in at least 85% coverage of all planted areas.[274] In addition, applicants must provide reasonable assurance that the mitigation will be adequately completed, monitored, and maintained.[275]

Continued application of the Conservation Ordinance of Orange County could provide significant protection to many of the wetlands in the Econ Basin. All wetlands with a hydrological connection to the Econ River, and large isolated wetlands, would probably be Class I wetlands, and accordingly would receive the highest degree of protection afforded by the ordinance. However, the protection afforded by the ordinance may not be sufficient to preserve the Econ River ecosystem.

The Conservation Ordinance is limited in scope to review of activities which adversely affect wetlands. The ordinance does not apply to activities in uplands or non-wetland habitats unless those activities are immediately adjacent to a wetland and would adversely affect the wetland. Accordingly, the ordinance may not provide adequate protection for habitat of wetland-dependent species of wildlife. Furthermore, the ordinance clearly does not apply to purely upland areas to protect upland species.

Another limitation of the Conservation ordinance is that it does not provide for comprehensive management of the Econ River system as a whole entity. Applications for development in Class I wetlands, which would include most of the wetlands along the Econ River, are reviewed on a case by case basis. Although Orange County staff indicate that development is frequently not allowed in these areas, there is no explicit standard delineating the maximum amount of Class I wetlands which may be destroyed. Furthermore, the county presently does not have a county-wide system to monitor the total amount of Class I wetlands which are destroyed and what mitigation or compensation has been required when destruction is allowed.[276]

Several provisions of the Conservation Ordinance may prevent adequate protection of the Econ River system. First, the ordinance, in describing the functional characteristics of conservation areas

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[271]Id. § 7.04(b).

[272]Id. § 7.04.

[273]Id. § 7.04(a).

[274]Id. § 7.04(c).

[275]Id. § 7.04(d).

[276]Orange County staff indicate that a monitoring system is currently being developed to track wetlands permitting. See Breedlove and Exum, supra note 248.

(wetlands), states that conservation areas are wetlands which "after development of surrounding, contiguous areas will continue to provide significant and productive habitat."[277] This concept is employed in the measurement of habitat units. Measurement of habitat units before development and estimates of habitat units after development are "based on the assumption that adjoining lands not regulated by this ordinance have been or will be developed to the extent permitted by law."[278] The classification of a wetland may be lowered if the applicant demonstrates that "development of such unregulated lands would render the habitat on the [wetlands] no longer viable or significant or productive."[279] This assumption accents the need to preserve lands which are adjacent to wetlands. Furthermore, the assumption acts as an incentive for developers to pursue intense development of properties adjacent to wetlands, in the hope that they may cause the wetland to receive a lower classification. The assumption is inappropriate for maximum protection of irreplaceable wetlands and adjacent uplands along the Econ River.

Second, the ordinance may not protect adequate numbers of species which are currently abundant. Applicants proposing to develop in wetlands must demonstrate the preservation, creation, or restoration of an equal number of habitat units after development, except for losses which are mitigated or compensated.[280] Where evaluation species are relatively abundant and have a low value, the applicant must demonstrate minimization of loss of habitat value.[281] However, minimization is undefined in the ordinance. This lack of a measurable standard could lead to reductions of "abundant low value" wildlife throughout the county and reduce the bio-diversity of significant wetlands.

Provisions in the ordinance allowing land or monetary compensation for losses of wetlands have raised some concern that developers might find it profitable to develop highly sought river properties even though they are required to provide compensation. Activities in Class I wetlands are allowed only if "no other feasible or practical alternatives exist that will permit a reasonable use of the land or where there is an overriding public benefit."[282] The terms "feasible," "practical," "reasonable," "overriding," and "benefit" are undefined in the ordinance. Without more specific guidance as to when an activity may be allowed in Class I wetlands, there is the risk that activities may be allowed in Class I wetlands along the Econ River when application of the ordinance would not result in a taking.

Orange County staff indicate that development is rarely allowed in Class I wetlands and when it is allowed mitigation is often required at 4 or 5:1. However, Orange County presently does not monitor the amount of Class I wetlands which have been destroyed or the amount of mitigation or

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[277]Id. § 3.03(f).

[278]Id. § 5.03(c).

[279]Id.

[280]Id. § 5.04(a).

[281]Id. § 5.04(b)(iii).

[282]Id. §§ 6.01, 7.04.

compensation which was required.[283] Therefore, it is difficult to determine the amount of wetlands which are being lost in the Econ Basin.

In summary, the Conservation Ordinance alone cannot provide adequate protection for the Econ River ecosystem because it does not:

1) protect upland areas which provide critical habitat for wetland-dependent and upland species; and
2) prohibit development in sensitive floodplain areas unless the activity can be shown to have an adverse affect on wetlands.
3) provide adequate assurances that irreplaceable wetlands along the Econ River will not be developed.

2. Floodplains

The Orange County Floodplain Management Regulations[284] require a permit for construction or substantial alteration of any structure located in an area of special flood hazard.[285] Areas of special flood hazard are areas in the unincorporated portions of Orange County which are within the floodplain and are subject to a 1% or greater chance of flooding in any given year (base flood).[286] Standards for issuance of most permits require that the applicant show that (1) the structure will be elevated at least one foot above the base flood elevation,[287] (2) compensating storage will be provided for any development which will adversely affect the flood-carrying capacity of any watercourse,[288] and (3) development in floodways will not cause any increase in flood levels during the occurrence of the base flood discharge.[289]

Development in floodways is prohibited if the development would result in any increase in flood levels during the occurrence of the base flood discharge.[290] Development in areas without

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[283]See, supra note 276.

[284]Orange County, Fla., Ordinance 81-24, § 1 (Nov. 24, 1981). See generally, discussion of floodplain regulations on page 41 of this report.

[285]Orange County, Fla., Ordinance 81-24, § 36-111 (Nov. 24, 1981).

[286]Id. § 36-75, p. 5. Areas of special flood hazard are identified by the Federal Emergency Management Agency and are adopted by reference as part of the Orange County Floodplain Management Regulations. Id. § 36-77.

[287]Id. § 36-132.

[288]Id. § 36-113(a)(6).

[289]Id. §§ 36-133, 134.

[290]Id. § 36-133.

established floodways is prohibited within a certain distance from the stream, unless an engineer certifies the development will not result in increased flood levels.[291]

Orange County floodplain regulations discourage but do not prohibit development in floodplain areas. Many developments may be allowed if safety oriented criteria are met, although some development may be prohibited within floodways. The Orange County floodplain regulations allow development of floodplain areas which may result in adverse effects on watercourses, wildlife, and wildlife habitat.

3. Uplands/Sensitive Lands

Orange County does not have regulations which provide comprehensive protection of uplands or sensitive lands other than wetlands. However, the Orange County Tree Ordinance does regulate the removal of some trees in unincorporated portions of Orange County.[292] The ordinance acknowledges that trees perform valuable functions in producing oxygen, conserving soil, preventing erosion, enhancing property value, and providing wildlife habitat.[293] Trees which are less than about 3 inches in diameter and underbrush, including palmetto and shrubs, are usually exempt from the ordinance.[294] Trees on lots which already contain residential structures are also exempt from the regulations.[295]

A permit must be obtained for removal of trees which do not meet any of the exemptions.[296] Prior to removal, applicants must submit information concerning the type, size, and location of stands of trees and trees greater than or equal to 24 inches DBH (Diameter Breast Height).[297] It is not clear whether applicants must submit information about individual trees between 3" and 24" DBH, although the ordinance does require "an indication of the trees proposed for removal."[298]

County review of proposals to remove trees is often incorporated into other development review procedures.[299] Trees which are subject to the regulations may be removed if design alternatives are not feasible or reasonable, and (1) the trees restrict a street or right of way opening, (2) the trees restrict

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[291]Id. § 36-134(A). Development is prohibited "within a distance of the stream bank equal to five times the width of the stream at the top of bank or twenty feet each side from top of bank, whichever is greater," unless an engineer certifies the development will not cause an increase in flooding. Id.

[292]Orange County, Fla., Ordinance 85-33 (Dec. 9, 1985).

[293]Id. § 1.

[294]Id. § 4.

[295]Id.

[296]Id. § 6.

[297]Id. §§ 6-10.

[298]Id. § 6(b)2.

[299]Id.

construction of utility lines or drainage facilities, (3) the trees restrict property access or use, (4) the trees constitute a hazard, (5) the trees are diseased or dying, or (6) the trees are selectively thinned (25% of existing trees may be removed).[300] The ordinance also contains criteria to protect trees during development and construction.[301]

The Orange County tree removal regulations provide some protection for medium and large trees. Small trees, underbrush, and other types of vegetation are not protected by the ordinance. In addition, the ordinance does not require replacement of trees which are removed with a permit. Therefore, the regulations do not provide comprehensive protection for wildlife and wildlife habitat.

The Orange County Planned Development Ordinance may also provide protection for sensitive lands. All planned developments are required to provide some open space areas.[302] Developers can receive open space credits by permanently preserving undeveloped uplands.[303] However, developers may also satisfy the open space requirements by establishing recreational areas and landscaped areas.[304] Accordingly, while the ordinance may facilitate protection of some uplands, it does not routinely provide for preservation of undeveloped uplands.

4. Stormwater

Orange County stormwater regulations for planned unit developments,[305] subdivisions, commercial structures, and industrial structures are contained in Article 10 of the counties' subdivision regulations.[306] Stormwater systems must provide for pollution abatement, recharge (where possible), and protection from flooding.[307] Standards for pollution abatement require the "retention, or detention with filtration, of one-half inch of runoff from the developed site, or the runoff generated by the first one inch of rainfall on the developed site."[308] The system must be capable of discharging the stormwater within 72 hours.[309] In areas with soils which allow recharge, the total runoff generated by

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[300]Id. § 3.

[301]Id. § 11.

[302]Orange County, Fla., Resolution No. 88-Z-03 § 10(a)(9) (Sep. 26, 1988).

[303]Id. § 10(a)(9)(E).

[304]Id.

[305]Id. § 10 (Sept. 26, 1988).

[306]Orange County, Fla., Subdivision Regulations, Art. X (April 1, 1984).

[307]Id. § 10.1.

[308]Id. § 10.1.1.

[309]Id. § 10.4.4A.

a 25-year frequency storm event must be retained.[310] Stormwater systems must provide protection from flooding by ensuring that the post-development peak rate of discharge does not exceed the pre-development peak rate of discharge for a 25-year frequency storm event.[311]

Orange County stormwater regulations are similar to Water Management District stormwater regulations except Orange County regulations include specific criteria to enhance groundwater recharge in suitable areas. However, most areas within the Econ Basin have low recharge potential.

Orange County stormwater regulations provide for retention or detention with filtration systems. However, retention systems do not work well in the Econ Basin because of high water tables. Water Management District staff indicate that until recently, Orange County has been reluctant to allow wet detention systems because of concern over operation and maintenance of the systems. Therefore, many stormwater systems in the Econ Basin are detention with filtration systems, a treatment design which Water Management District staff indicate is less effective than wet detention systems.

5. Shoreline Protection

The Orange County Lakeshore Protection Regulations[312] provide protection for shoreline vegetation existing at or below the normal high water elevation in lakes.[313] The ordinance is unclear as to whether it applies to streams and rivers. The title of the ordinance suggests the ordinance applies only to lakes. In addition, the statement of legislative findings, purposes, and objectives refers to lakes and lake shores.[314] Lakes are also mentioned several times in the text of the ordinance.[315] However, the legislative findings, purposes, and objectives state that the board of county commissioners is authorized to "regulate all lakes, canals, streams, [and] waterways...."[316] Permits are required under the ordinance for "any shoreline alteration,"[317] and definitions of "shoreline alteration" and "shoreline vegetation" refer to neither lakes or rivers.[318]

Regardless of textual ambiguities concerning the scope of application of the ordinance, Orange County staff indicate that the ordinance is applied only to lakes. The ordinance protects vegetation at or

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[310]Id. § 10.1.2.

[311]Id. § 10.1.3.

[312]Orange County, Fla., Ordinance 83-25 (June 10, 1983).

[313]Id. §§ 3(5),(6).

[314]Id. §§ 2(1),(3),(4),(6),(7).

[315]Id. §§ (1)(d),(f).

[316]Id. § 2(6).

[317]Id. § 4(1).

[318]Id. §§ 3(5),(6).

below normal high water elevation, and does not protect contiguous or adjacent areas of wildlife habitat. In summary, the ordinance does not provide adequate protection for the Econ Basin because it is not applied to river shorelines and it does not protect habitat above the normal high water elevation.

6. Excavating and Filling

The Orange County Excavation and Fill Ordinance requires persons to obtain a permit before excavating or filling in unincorporated portions of Orange County.[319] Activities which are exempt from the ordinance include: (1) installation of utilities; (2) grading, filling, and moving of earth for approved commercial or subdivision construction; (3) excavating up to 200 cubic yards of material for approved commercial or subdivision construction; (4) construction of foundations and building pads for approved structures; (5) minor landscaping projects which do not encroach in flood prone areas; (6) approved swimming pool construction; and (7) certain agricultural use ponds.[320]

Permitted activities must satisfy a number of criteria, including provisions concerning reclamation, setbacks, and slopes.[321] Excavation and fill permits are prohibited for areas designated as conservation pursuant to Orange County comprehensive plans or regulations.[322] Conservation areas in Orange County are primarily wetlands.

The Orange County Excavation and Fill Ordinance prevents excavations and filling in conservation areas,[323] except to the extent that development may be allowed under the Conservation Ordinance of Orange County.[324] Criteria for permitted excavation and fill activities focus on regulating the manner of excavation and filling and do not consider the effect of these activities on wildlife and wildlife habitat.

C. Osceola County

1. Wetlands

Osceola County has no wetlands regulations although they are currently drafting a wetlands ordinance.

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[319]Orange County, Fla., Ordinance 85-32 (Nov. 25, 1985).

[320]Id. § 5.

[321]Id. § 7.

[322]Id. § 7(A)(4).

[323]Id. § 7(A)(4).

[324]See, Conservation Ordinance of Orange County, page 46 of this volume.

2. Floodplains

Osceola County Floodplain regulations[325] apply to all areas of special flood hazard within the county.[326] Residential structures must be elevated to or above the base flood elevation.[327] Non-residential structures must be elevated to the level of the base flood elevation or the portions of the structure below the base flood elevation must be flood proof.[328] Encroachments, including fill, are prohibited in floodways unless an engineer certifies that the encroachment will not result in an increase in flood levels during the base flood discharge.[329] In areas of shallow flooding[330] residential and non-residential structures must have the lowest floor elevated 18 inches above the crown of the nearest street or above the base flood elevation.[331] Alternatively, non-residential structures may flood-proof portions of structures which are below the base flood elevation.[332]

Osceola County Floodplain regulations discourage development within sensitive Econ headwater wetlands by requiring compensating storage and elevation of structures for some floodplain areas. However, the portion of the Econ Basin which lies in Osceola County is composed almost entirely of headwater swamp with no discernable river channel. Accordingly, prohibitions against encroachment in floodways might not apply to the headwaters of the Econ.[333] In conclusion, the floodplain regulations do not provide for comprehensive consideration and protection of watercourses, wildlife, and wildlife habitat.

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[325]Osceola County, Fla., Ordinance No. 82-3 (Feb. 1, 1982), Ordinance No. 87-3 (Mar. 16, 1987). See generally, discussion of floodplain regulations on page 41 of this report.

[326]Id. at art. 3A. "Area of special flood hazard" is defined as "land in the flood plain within a community subject to a one percent or greater chance of flooding in any given year." Id. at art. 2.

[327]Osceola County, Fla., Ordinance No. 82-2 art. 5B(1) (Feb. 1, 1982). "Base flood" is defined as "the flood having a one percent chance of being equalled or exceeded in any given year." Id. at art. 2.

[328]Id. at art. 5B(2).

[329]Id. at art. 5B(4).

[330]"Area of shallow flooding" means a designated zone with "baseflood depths from one to three feet where a clearly defined channel does not exist, where the path of flooding is unpredictable and indeterminate, and where velocity flow may be evident." Id. at art. 2.

[331]Id. at art. 5C(1),(2).

[332]Id. at art. 5C(2).

[333]"Floodway" is defined as the "channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than one foot." Id. at art. 2. It is unclear whether the Econ headwater wetlands would satisfy this definition.

3. Uplands/Sensitive Lands

Osceola County has no ordinance providing for preservation of uplands or other sensitive lands other than wetlands.

4. Stormwater

Osceola County has no stormwater regulations.

D. Oviedo

1. Wetlands

The city of Oviedo has no wetlands regulations.

2. Floodplains

The city of Oviedo requires development in floodplains to meet the minimum criteria necessary to satisfy federal floodplain regulatory criteria.[334] Structures must be elevated one foot above the base flood elevation.[335] Although the ordinance has no express provision stating that compensating storage must be provided, it does require that the proposed development be "consistent with the need to minimize flood damage."[336] The following uses may be allowed within floodplains:

1) General farming, pasture, outdoor plant nurseries, horticulture, forestry, wildlife sanctuary and other related uses
2) Ground-level loading areas, parking areas
3) Lawns, gardens, play areas
4) Golf courses, tennis courts, driving ranges, parks, trails, open space, and other similar private and public recreational uses
5) Single-family homes...[337]

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[334]See generally, discussion of floodplain regulations on page 41 of this report.

[335]City of Oviedo, Fla., Land Development Code § 155(c) (1989).

[336]Id. § 155(a)(1).

[337]Id. § 154.

The Ordinance prohibits construction or substantial improvements of buildings within any floodway.[338] Artificial obstructions are prohibited within floodways unless an engineer certifies the construction will result in no increase in flood elevations.[339]

Oviedo floodplain regulations prohibit some types of development within floodplain areas. However, the regulations allow other uses, such as farming, forestry, parking areas, and golf courses, which may be detrimental to water quality and wildlife habitat values of the Econ River.

3. Uplands/Sensitive Lands

The city of Oviedo has no ordinance providing for preservation of uplands or other sensitive lands. However, the Oviedo land development regulations do provide some protection for large trees. Article XX (Environmental Preservation) prohibits destruction of natural vegetation until a development plan has been approved, and requires implementation of protective measures for vegetation and soils prior to construction.[340] An applicant must obtain a permit prior to removing individual trees or clearing of land.[341] Permits will not be issued for removal of trees more than eight inches DBH (diameter at breast height) or other vegetation except for removal of underbrush or clearing by hand, unless a development permit has been approved.[342] The regulations provide for consideration of the affects of clearing on soil erosion and stormwater runoff.[343] However, the regulations do not provide for consideration of the effects of clearing on wildlife and wildlife habitat.

Exempt activities include: removal of trees less than 12 inches DBH on certain one and two family lots; emergency removal of trees; removal of dead or diseased trees; and removal of trees smaller than 24 DBH on agriculturally classified lands.[344] Applicants may be required to implement tree preservation measures addressing clearing procedures, protective barricades, construction of tree wells,

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[338]Id. § 155(b).

[339]Id. § 153. An artificial obstruction is defined as "any obstruction, other than a natural obstruction, that is capable of reducing the flood-carrying capacity of a stream or may accumulate debris and thereby reduce the flood-carrying capacity of a stream." Id.

[340]Id. § 219.

[341]Id. § 220. An environmental Level I permit must be obtained prior to removing trees, clearing, or grading of single family home sites, or clearing and grading of undeveloped or developed land with no approved development or building plan. An environmental Level II permit must be obtained prior to removal of trees and vegetation on sites for subdivision, multi-family, commercial, and industrial projects. Id. § 220(b).

[342]Id. § 220(c). DBH is defined as "the average diameter of the trunk measured at four and one-half ... feet above natural grade." Id. § 14(14).

[343]Id. § 220(d).

[344]Id. § 221.

use of alternative surfaces in traffic areas, and excavations.[345] Persons who violate the regulations may be required to restore trees or vegetation.[346]

Article XVII (Landscaping, Tree Planting & Buffer Requirements) provides for landscape preservation, planting, and design.[347] The regulations require planting or preservation of canopy trees and buffer yards.[348] The regulations encourage the use of existing vegetation to satisfy the landscaping standards.[349]

Oviedo landscape and environmental preservation regulations provide some protection for large trees and encourage preservation of existing vegetation. However, the regulations do not provide for comprehensive preservation of areas suitable for habitat for many species of wildlife.

4. Stormwater

The city of Oviedo stormwater regulations are similar to those of the Water Management District and Seminole County. The regulations require that runoff after development must be no greater than it was prior to development.[350] Oviedo requires stormwater permits for all primary stormwater management systems, regardless of the size of the project.[351] In addition, Oviedo requires developments to be constructed and operated in a manner that does not contribute to soil erosion or sedimentation.[352] Oviedo erosion and sediment control standards include basic principles, best management practices, and construction practices which are similar to those used by Seminole County.[353]

E. Orlando

The city of Orlando has had significant impacts on the Econ River, even though not much of the actual city limits fall within the Econ Basin. Stormwater and wastewater discharge from Orlando

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[345]Id. § 222.

[346]Id. § 226.

[347]Id. § 181.

[348]Id. §§ 183, 184.

[349]Id. § 181.

[350]Id. § 161.

[351]Id. § O-1.

[352]Id. § 165.

[353]Id. at Appendix P. See, supra notes 220-225 and accompanying text.

have contributed significantly to degradation of the water quality of the Little Econ and Econ Rivers.[354] In addition, channelization of tributaries of the Little Econ River has resulted in the reduction of base flows in downstream waters. Future impacts by Orlando cannot be discounted as the city continues to grow and annex portions of the Econ Basin.

1. Wetlands

The Northeast Growth Management Area Plan for Orlando (discussed in section II.C.5.) describes the basic point structure of Orlando's wetland regulations. Generally, the plan provides for a system to rank and value wetlands, and establishes thresholds for development in wetlands. The ordinance contained in the Orlando Land Development Code[355] imposes some additional criteria, several which appear to be inconsistent with provisions in the ordinance. Most comprehensive plans are policy documents and the resulting ordinance is the regulation. However, the Orlando plan appears to be part of the Orlando wetlands regulation, even though it is not formally adopted by the regulation.

The Orlando regulation[356] calls for 100-foot buffers adjacent to protected wetlands and 50-foot buffers around wetlands in which some development is allowed.[357] In addition, the regulation indicates that 0% of wetlands receiving the "protected" designation may be developed, while 40% of "transitional" and 100% of "altered" wetlands may be developed.[358] The Orlando wetland regulations protect wetlands but do not provide for comprehensive protection of wildlife habitat.

2. Floodplains

Orlando floodplain regulations[359] regulate development activities within the 100-year floodplain.[360] The regulations require (1) construction to be elevated above the base flood elevation,[361] (2) post-development runoff volume to not exceed pre-development volume,[362] and (3) compensating

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[354]Gerry, L., Econlockhatchee River System: Level I Report, St. Johns River Water Management District Technical Publication SJ 83-5 (June, 1983).

[355]Orlando, Fla., Orlando Illustrated Land Development Code (June 1988).

[356]Id. §§ 58.3511- 58.3520.

[357]Id. § 58.3515.

[358]Id. § 58.3514.

[359]Id. §§ 58.3431-58.3440.

[360]Id. § 58.3432.

[361]Id. § 58.3437.

[362]Id. § 58.3436.

storage must be provided for all displacement of flood water below the 100-year flood elevation.[363] Orlando floodplain regulations discourage but do not prohibit development in floodplain areas.

3. Uplands/Sensitive Lands

Orlando provides some regulation of uplands through its tree and woodlands protection regulation.[364] The regulation discourages removal of medium and large sized trees by requiring a permit for their removal.[365] In addition, the regulation establishes buffer areas around the bases of trees which must be fenced off so the area will not be disturbed during construction.[366]

The Orlando regulation is tailored to an urban habitat and is inadequate to preserve the integrity of upland ecosystems, which must include large areas of undisturbed ground cover, shrubs, and small trees. In addition, the regulation provides no criteria for identifying sensitive uplands.

4. Stormwater

Orlando has well-developed stormwater regulations[367] which essentially parallel the regulations of the Water Management District. The regulations are designed to reduce pollution from runoff and to control flooding.[368] The regulations require treatment of the first one-half inch of runoff or the runoff generated by the first inch of rainfall, whichever is greater.[369] Treatment is accomplished through retention with no discharge or detention with a filtered underdrain discharge.[370]

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[363]Id.

[364]Id. § 58.3341-58.3400.

[365]Id. § 58.3351.

[366]Id. § 58.3362.

[367]Id. §§ 58.3481-58.3490; Orlando, Fla., Orlando Urban Storm Water Management Manual (March, 1981).

[368]Orlando, Fla., Orlando Urban Storm Water Management Manual (March, 1981).

[369]Orlando, Fla., Orlando Illustrated Land Development Code § 58.3481 (June, 1988).

[370]Id.

ENVIRONMENTAL REGULATIONS

Activities in the Econ Basin are subject to the regulatory authority of federal, state, and regional agencies. This review is limited to those regulations having the greatest impact on the management and preservation of water, wetland, and wildlife resources of the Econ Basin. Table 5 illustrates environmental resources which are currently regulated in the Econ Basin by federal, state, and regional agencies.

TABLE 5

SUMMARY OF AGENCY ENVIRONMENTAL RESOURCE REGULATIONS IN ECON BASIN

	-------Water-------		----------Wildlife----------			----------Habitat----------		
Regulator	Quality	Quantity	Wetland	Endanger-ed	Other	Wetlands	Flood-plain	Uplands
EPA	R	R	R	R	N	R	N	N
COE	R	R	R	R	N	R	N	N
DER	R	R	R	R	N	R	N	N
SJRWMD	R	R	R	R	N	R	R	N

R = Regulation N = No Regulation

I. Point Source Discharges

The Environmental Protection Agency (EPA) is responsible for regulating point source discharges of pollutants into surface waters of the United States. Industrial and municipal point sources which discharge into the Econ River, such as wastewater treatment facilities, landfills, and factories are required to obtain National Pollutant Discharge Elimination System (NPDES) permits from EPA. NPDES permit requirements are designed to ensure enforcement of effluent limitations and new source performance standards. Prior to issuance of most NPDES permits, EPA must receive certification from

the state of Florida that the discharge will meet state water quality standards. In Florida, most point source dischargers must also obtain permits from the Department of Environmental Regulation (DER).

II. Surface Water and Stormwater Management

The St. Johns River Water Management District (Water Management District) regulates surface and storm water in the Econ Basin. Water Management District regulations are implemented through the management and storage of surface waters (MSSW)[371] and stormwater[372] permitting programs.

A. St. Johns River Water Management District MSSW Permitting Program

1. Description of Water Management District MSSW Permitting Program

Chapter 373, Florida Statutes,[373] provides regulatory authority and guidance for Water Management District MSSW regulations. Chapter 373 authorizes the Water Management District to require permits and impose reasonable standards to (1) "assure that the construction or alteration of any dam, impoundment, reservoir, appurtenant work, or works [MSSW system] will not be harmful to the water resources of the district,"[374] and (2) "assure that the operation or maintenance of any [MSSW system] will not be inconsistent with the overall objectives of the district and will not be harmful to the water resources of the district."[375] Permits issued for maintenance or operation are permanent,[376] unless the owner abandons the MSSW system[377] or the Water Management District revokes or modifies the permit.[378]

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371. Fla. Admin. Code § 40C-4 (August 1989).

372. Fla. Admin. Code § 40C-42 (August 1987).

373. Fla. Stat. § 373 (1989).

374. Id. § 373.413.

375. Id. § 373.416.

376. Id. § 373.416(2).

377. Id. § 373.426. MSSW systems which are not owned by the state, and which are not used or maintained for three years, are presumed abandoned and dedicated to the Water Management District. Id.

378. Id. § 373.429. The Water Management District may revoke or modify a permit if the district determines the MSSW system is a danger to the public health or safety or if operation of the system is inconsistent with the objectives of the district. Id.

Chapter 373 directs the Water Management District to conduct periodic inspections during the construction, alteration, and operation of MSSW systems[379] and to determine whether remedial measures are necessary.[380] The Water Management District may order that the owner of a MSSW system alter or repair the system within a reasonable time. If the owner fails to obey the order, the Water Management District may make the repairs and impose a lien against the owner's property for the cost of the repairs.[381] Furthermore, the Water Management District, state agencies, the state, and private persons may bring suit to enjoin MSSW systems which are violating the laws of the state or Water Management District standards.[382]

Chapter 373 expressly exempts certain activities from the MSSW permitting program. Agriculture, silviculture, floriculture, or horticulture activities which alter the land surface for "purposes consistent with the practice of such occupation," are exempt from the MSSW rule unless the sole or predominant purpose of the alteration is to impound or obstruct surface waters.[383] In addition, the MSSW rule does not apply to the construction, operation, or maintenance of closed agricultural systems.[384] However, the "taking and discharging of water for filling, replenishing, and maintaining the water level" of a closed agricultural system is subject to consumptive use regulations,[385] and dams, dikes, and levees must be constructed, operated, and maintained to conform with generally accepted engineering practices.[386]

Permit Thresholds

Water Management District MSSW regulations require a permit for "construction, alteration, operation, maintenance, removal or abandonment" of any system which meets or exceeds permitting thresholds.[387] The Water Management District may issue a conceptual approval permit, an individual

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379. Id. § 373.423.

380. Id. § 373.436.

381. Id. § 373.436.

382. Id. § 373.433.

383. Id. § 373.406(2).

384. Id. § 373.406(3); Corporation of President of Church of Jesus Christ of Latter-Day Saints v. St. Johns River Water Management District, 489 So. 2d 59 (Fla. 5th D.C.A. 1986), cert. denied, 496 So. 2d 142 (Fla. 1986).

385. Fla. Stat. § 373.406(3). The Water Management District regulates consumptive use of water through regulations contained in Fla. Admin. Code chapter 40C-2, which was adopted pursuant to Fla. Stat. § 373, Part II.

386. Fla. Stat. § 373.406(3).

387. Fla. Admin. Code § 40C-4.041(1) (Aug., 1989).

permit, or a general permit.[388] Conceptual approval permits do not authorize construction and may be issued for projects which are developed in phases.[389] Within the Econ Basin, an individual or general MSSW permit must be obtained for a system which:

1) is capable of impounding a volume of water of 40 or more acre feet; or
2) serves a project with a total land area equal to or exceeding 40 acres; or
3) provides for the placement of 12 or more acres of impervious surface which constitutes 40 or more percent of the total land area; or
4) contains a traversing work which traverses:
   a) a stream or other watercourse with a drainage area of five or more square miles upstream from the traversing work; or
   b) an impoundment with more than ten acres of surface area; or
5) contains a surface water management system which serves an area of five or more contiguous acres of a hydrologically sensitive area [wetland] with a direct hydrologic connection to:
   a) a stream or other watercourse with a drainage area of five or more square miles; or
   b) an impoundment with no outfall, which is not wholly owned by the applicant and which is ten acres or greater in size; or
   c) a hydrologically sensitive area not wholly owned by the applicant.[390]

Permit Criteria

Applicants for general or individual permits for the operation, maintenance, removal, or abandonment of a system, or for conceptual approval permits, must provide reasonable assurance that the activity will not:

1) adversely affect navigability of rivers and harbors;
2) adversely affect recreational development or public lands;
3) endanger life, health, or property;
4) be inconsistent with the maintenance of minimum flows and levels established pursuant to Section 373.042, Florida Statutes;
5) adversely affect the availability of water for reasonable beneficial purposes;
6) be incapable of being effectively operated;
7) adversely affect the operation of a work of the District ...
8) adversely affect existing agricultural, commercial, industrial, or residential developments;

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388. Id. § 40C-4.041(2).

389. Fla. Admin. Code § 40C-4.041(2)(a) (August 1989).

390. Id. § 40C-4.041(2)(b). Lower threshold criteria for MSSW systems within the Wekiva Basin are discussed in the section of this report entitled Special Protection of Florida Rivers.

9) cause adverse impacts to the quality of receiving waters;
10) adversely affect natural resources, fish, and wildlife;
11) induce saltwater or pollution intrusion;
12) increase the potential for damages to off-site property or the public caused by:
    a) floodplain development, encroachment or other alteration;
    b) retardance, acceleration, displacement or diversion of surface water;
    c) reduction of natural water storage areas;
    d) facility failure;
13) increase the potential for damages to residences, public buildings, or proposed and existing streets and roadways; and/or
14) otherwise be inconsistent with the overall objectives of the District.[391]

The Water Management District may balance the beneficial and harmful effects of the proposed system on the 14 individual objectives to determine whether the system is consistent with the overall objectives of the district.[392] The phrase "overall objectives of the District" appears to mean a compilation of objectives derived from the 14 individual objectives listed in the rule,[393] the statement of policy and purpose contained in the rule,[394] the declaration of policy contained in Chapter 373, Florida Statutes,[395] and the statement of water policy contained in Chapter 17-40, Florida Administrative Code.[396]

Applicants for permits for construction, alteration, operation, or maintenance of a system or to obtain a conceptual approval permit must give reasonable assurance that the activity will meet the following seven standards:

1) Adverse water quantity impacts will not be caused to receiving waters and adjacent lands
2) Surface and ground water levels and surface water flow will not be adversely affected
3) Existing surface water storage and conveyance capabilities will not be adversely affected
4) The system must be capable of being effectively operated
5) The activity must not result in adverse impacts to the operation of works of the district ...
6) Hydrologically-related environmental functions will not be adversely affected

391. Id. § 40C-4.301(1)(a).

392. Id. § 40C-4.301(1)(b).

393. Id. § 40C-4.301(1)(a).

394. Id. § 40C-4.011.

395. Fla. Stat. § 373.016 (1989).

396. Fla. Admin. Code chapter 17-40 (Dec. 1988).

7) Otherwise not be harmful to the water resources of the District[397]

If an applicant provides reasonable assurance that design criteria contained in the Water Management District Applicant's Handbook are met, then the seven harm to the water resources standards are presumed to be satisfied.[398] Table 6 lists MSSW activities that must satisfy the "objectives" test and the "harm to water resource" standards.

TABLE 6

REVIEW CRITERIA FOR MSSW ACTIVITIES

Activity	14 Objectives Balancing Test	Harm to Water Resources Standard
Construction	No	Yes
Operation	Yes	Yes
Maintenance	Yes	Yes
Removal	Yes	No
Abandonment	Yes	No
Conceptual Approval	Yes	Yes
Alteration	No	Yes

397. Fla. Admin. Code § 40C-4.301(2)(a) (August, 1989).

398. Id. § 40C-4.301(2)(b).

General Permits

General permits may be issued for MSSW systems which the Water Management District has determined do not harm the water resources of the district and are not inconsistent with the objectives of the district.[399] Applicants for MSSW general permits must provide reasonable assurances that the following general and threshold conditions are met:

1) General Conditions
   a) The surface water management system must meet the criteria specified in Rule 40C-4.301, F.A.C. [objectives and standards contained in Rule 40C-4.301 are discussed later in this subsection].
   b) The system must not be located in a stream, impoundment or other watercourse, or contain more than five contiguous acres of hydrologically sensitive area which has a direct hydrologic connection to:
      (1) a stream or other watercourse with a drainage area of five or more square miles;
      (2) an impoundment with no outfall, which is not wholly owned by the applicant, and which is ten acres or greater in size; or
      (3) a hydrologically sensitive area not wholly owned by the applicant.

2) Threshold Conditions
   a) The system must not be capable of impounding a volume of water more than 120 acre feet.
   b) The system must not serve a project of 120 acres or more total land area.
   c) The system must not serve a project which provides for the placement of more than 40% impervious surface in the total land area.[400]

The duration of general permits for the construction, alteration, or removal of an MSSW system is 5 years, or for the amount of time specified in the permit.[401] Permits for operation, maintenance or abandonment of MSSW systems are permanent.[402] Any general permit may be revoked or modified as provided for in Section 373.429, Florida Statutes.[403] In addition, the Water Management District may attach limiting conditions to the permit to assure the project is consistent with the overall objectives of the district and will not be harmful to the water resources of the district.[404]

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399. Id. § 40C-40.141 (Sept. 1989).

400. Id. § 40C-40.302.

401. Id. § 40C-40.321.

402. Id.

403. Id. § 40C-40.351.

404. Id. §§ 40C-40.381, 40C-4.381.

2. Wetlands Protection in Water Management District MSSW Permitting

The Water Management District regulates wetlands through a Management and Storage of Surface Waters (MSSW) permitting program under Chapter 373, Part IV.[405] Wetlands affected by MSSW systems meeting the thresholds contained in rule 40C-4.041 are evaluated as part of the review process. The Water Management District derives its authority to regulate wetlands from Chapter 373, Florida Statutes, which authorizes the district to ensure that surface water management systems are not harmful to the water resources of the district. Wetlands are considered part of the Water Management District's water resources.

Applicants must provide reasonable assurances that projects are both consistent with the overall objectives of the district and do not harm the water resources of the district.[406] Overall objectives of the district which relate to wetlands include consideration of: (1) minimum flows and levels; (2) availability of water for reasonable beneficial purposes; (3) quality of receiving waters; (4) natural resources, fish, and wildlife;
(5) saltwater or pollution intrusion; (6) damages to off-site property or the public caused by: floodplain development, encroachment, or other alteration; retardance, acceleration, displacement or diversion of surface water; reduction of natural water storage areas; or facility failure; (7) damages to residences, public buildings, or proposed and existing streets and roadways.[407] The Water Management District may balance these factors and other objectives of the district to determine whether the system is consistent with the overall objectives of the district.[408]

Wetlands values are also considered in determining whether a project may be harmful to the water resources of the Water Management District. The following standards relating to wetland values must be met and are not balanced against other considerations:

1) Adverse water quantity impacts will not be caused to receiving waters and adjacent lands
2) Surface and ground water levels and surface water flow will not be adversely affected
3) Existing surface water storage and conveyance capabilities will not be adversely affected
4) Hydrologically-related environmental functions will not be adversely affected
5) Otherwise not be harmful to the water resources of the District[409]

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405. The Water Management District MSSW permitting program is discussed beginning on page 65 of this volume.

406. See, supra text accompanying notes 391-398.

407. Fla. Admin. Code § 40C-4.301(1)(a) (August, 1989).

408. Id. § 40C-4.301(1)(b).

409. Fla. Admin. Code § 40C-4.301(2)(a) (August, 1989).

The term "hydrologically-related environmental functions" includes consideration of aquatic and wetlands dependent species of wildlife but does not extend to upland species.[410]

The standards are presumed met if the applicant satisfies criteria contained in the Water Management District's MSSW Applicant's Handbook.[411] These criteria focus on the value that wetlands provide to off-site aquatic and wetland dependent species of wildlife. With respect to wildlife, the scope of review is limited to consideration of the "impacts to off-site aquatic and wetland dependent species relative to the functions currently being provided by the wetland to these types of fish and wildlife."[412] Applicants must provide reasonable assurance that a proposed system will not cause adverse off-site changes in:

a) the habitat of an aquatic and wetland dependent species
b) the abundance and diversity of aquatic and wetland dependent species, and
c) the food sources of aquatic and wetland dependent species.[413]

Jurisdiction extends to all wetlands, including isolated wetlands. Chapter 373, Florida Statutes directs the Water Management District to adopt a rule which includes:

a) One or more size thresholds of isolated wetlands below which impacts on fish and wildlife and their habitats will not be considered. These thresholds shall be based on biological and hydrological evidence that shows the fish and wildlife values of such areas to be minimal;
b) Criteria for review of fish and wildlife and their habitats for isolated wetlands larger than the minimum size;
c) Criteria for the protection of threatened and endangered species in isolated wetlands regardless of size and land use; and
d) Provisions for consideration of the cumulative and offsite impacts of a project or projects.[414]

Water Management District rules presume that isolated wetlands of less than one half acre are of insignificant value to off-site aquatic or wetland dependent wildlife. Accordingly, the rules allow development in wetlands of less than one-half acre without the applicant having to satisfy the wetland

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410. Friends of Fort George, Inc. v. Fairfield Communities, Inc., DOAH Case No. 85-3596 (Dec. 15, 1986).

411. Id. § 40C-4.301(2)((b).

412. St. Johns River Water Management District, Applicants Handbook, Management and Storage of Surface Waters § 10.7.4 (August 1988). On-site impacts are assessed if the wetlands are used or reasonable scientific judgement would indicate use by threatened or endangered species which are aquatic or wetland dependent. Id.

413. Id.

414. Fla. Stat. § 373.414 (1989).

review criteria.[415] The Water Management District may rebut this presumption if it determines that wetlands of less than one half acre are of value to off-site aquatic or wetland dependent wildlife.[416]

The Water Management District considers several factors in determining a wetland's value to aquatic and wetland dependent species. Large wetlands are considered to support greater diversity of species and to have greater value than small wetlands.[417] Wetlands which have a regular hydrologic connection to off-site areas are considered to have greater value than intermittently connected wetlands.[418] Pristine or unique wetlands are considered to have greater value than disturbed or commonly occurring wetlands.[419] Wetlands surrounded by one or more natural community are considered to have greater value than wetlands surrounded by man-altered habitat or one natural community.[420]

Applicants may propose mitigation for projects which fail to satisfy wetland review criteria. Mitigation is "action or actions taken to offset the adverse effects of a system on off-site functions" and can consist of either wetland creation or wetland enhancement.[421] Mitigation proposals are considered on a case by case basis.[422] When reviewing mitigation proposals, the Water Management District examines the degree to which wetland functions are impacted, whether the impacts to these functions can be mitigated, and the feasibility of alternative project designs which would avoid impacts.[423]

Mitigation is usually required to take place on site or in close proximity to the wetland loss, although the Water Management District may allow off-site mitigation.[424] Mitigation proposals are typically required to replace the functions which were lost through wetland destruction, although the Water Management District may allow creation or enhancement of a different type of wetland if this would benefit the local or regional ecology.[425] The preservation of uplands adjacent to preserved or

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415. Id. Applicants do have to satisfy other MSSW permitting criteria. Note: The District is currently considering lowering the threshold.

416. Id.

417. Id. § 10.7.5(a).

418. Id. § 10.7.5(b). Wetlands with natural off-site hydrologic connections are considered to have greater value than wetlands with man-made off-site connections. Id.

419. Id. § 10.7.5(c),(d).

420. Id. § 10.7.5(e).

421. Id. § 16.1.3(a).

422. Id.

423. Id. § 10.7.4.

424. Id. § 16.1.3(b).

425. Id. § 16.1.3(c).

enhanced wetlands may be considered as mitigation for wetland loss.[426] Similarly, creation of additional wildlife habitat in lakes, such as expanded vegetated littoral zones, fluctuating water levels, and islands may be considered as mitigation.[427]

The Water Management District has guidelines to assist in determining how much wetland creation will be required to offset destruction of wetlands. Applicants who propose to destroy wetlands which have a direct hydrologic connection to a watercourse, impoundment, or wetland not wholly owned by the applicant may have to mitigate at the following ratios, depending upon site specific factors:

1) Hardwood swamps - The ratio of created wetland to lost wetland should be 2:1 to 5:1, or higher if the proposal depends extensively on natural recolonization.

2) Freshwater marshes - The ratio of created wetland to lost wetlands should be 1.5:1 to 2:1, or 3:1 to 4:1 if the proposal depends extensively on natural recolonization.[428]

The Water Management District requires less mitigation than that stated above for destruction of wetlands which have a man-made direct connection or which do not have a direct hydrologic connection to a watercourse, impoundment or wetland not wholly owned by the applicant.[429] The Water Management District may adjust mitigation ratios to reflect other beneficial mitigating factors such as creation of wetlands prior to wetland loss, creation of upland buffers adjacent to wetlands, dedication of conservation easements, enhancement of wetlands, or other alternative proposals.[430]

Applicants submitting mitigation proposals are required to include a plan for monitoring and maintaining the mitigation site. The Water Management District may include specific monitoring and maintenance requirements as specific conditions in the applicant's permit. Monitoring reports may be required to include information such as the survival of planted species, the extent of invasion by non-target species, and the overall vigor of the community.[431]

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426. Id. § 16.1.3(d).

427. Id. § 16.1.3(e).

428. Id. § 16.1.4.

429. Id.

430. Id. The Water Management District does not consider the donation of money to be acceptable mitigation for wetland loss. However, the Water Management District may allow donation or preservation of wetlands or uplands if they are "regionally significant or provide unique fish and wildlife habitat." Id. § 16.1.6.

431. Id. § 16.1.5.

3. Analysis of Water Management District MSSW Permitting Program

The Water Management District Management and Storage of Surface Waters permitting program regulates many activities which affect water quantity and quality and provides some protection for fish and aquatic and wetland dependent wildlife. However, the program does not provide sufficient protection for certain resource values within the Econ Basin, such as wildlife, wildlife habitat, and storage capacity.

The MSSW permitting program provides no definite assurances that critical wildlife habitat such as river buffers will be preserved and protected. The permitting criteria allow development in environmentally sensitive areas, such as near the river and within its floodplain. Although the rule provides for consideration of the impacts of MSSW systems on off-site aquatic and wetland dependent species of wildlife,[432] the MSSW rule does not require setbacks from the river's edge or from wetlands to preserve valuable habitat for wetland dependent and upland species of wildlife. Consideration of impacts to off-site aquatic and wetland dependent species is limited to functions which the wetland currently provides to these types of fish and wildlife.[433] Furthermore, the MSSW rule does not provide for consideration of the impacts of MSSW systems on upland species of wildlife or their habitat.

The MSSW rule does not provide for maintenance of the overall storage capacity of the Econ basin because the permitting criteria allow ground water tables to be lowered. Ground water levels may be lowered: (1) over the project area, up to an average of three feet lower than the average dry season low water table; or (2) at any location, up to five feet lower than the average dry season low water table; or (3) up to a level that would drain adjacent surface water bodies below minimum levels established by the Water Management District.[434]

Criteria for rates of discharge require that "post development peak rate of discharge must not exceed the pre-development peak rate of discharge."[435] By comparing only the peak rate of discharge, this standard does not address other important considerations for maintaining base flow, such as the timing and quantity of discharge. A standard which ensures that all characteristics of post-development

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432. St. Johns River Water Management District, Applicant's Handbook, Management and Storage of Surface Waters § 10.7.4 (Aug., 1988). Arguably, the Water Management District can consider the need to protect uplands which are adjacent to wetlands and provide habitat for wetland-dependent species of wildlife. However, the Water Management District was reluctant to adopt rules which provided for upland buffers in the Wekiva River Basin without an additional grant of legislative authority. See Whitney, N.S. & J.C. Elledge, Effective Environmental Action: The Case of the Wekiva River, Water: Laws and Management 9B-13 - 9B-22 (Symposium proceedings of the American Water Resources Association ((September, 1989)).

433. Id.

434. St. Johns River Water Management District, Applicant's Handbook, Management and Storage of Surface Waters § 10.6.3 (Jan., 1988).

435. Id. § 10.3.1.

runoff are equivalent to pre-development runoff characteristics could provide better long-term maintenance of the storage capacity of the Econ Basin.

Permitting criteria require compensating storage for MSSW systems which cause a net reduction in flood storage within the 10-year floodplain.[436] The compensating storage must be outside the 10-year floodplain. Accordingly, the floodplain criteria discourages but does not prohibit development within the 10-year floodplain, and allows development within the 100-year floodplain. The standard could be strengthened by prohibiting MSSW systems which would cause a net reduction in flood storage within the 100-year floodplain of the Econ River and its major tributaries, regardless of whether upland compensating storage could be provided. The more stringent standard would provide better protection against flooding and would discourage development within sensitive floodplain areas.

Some projects are exempt from the MSSW program because they fall below the thresholds.[437] Most of these projects are subject to stormwater permitting criteria, which only allow consideration of water quality impacts. Water Management District staff indicate there are large numbers of sub-threshold projects within the Econ Basin. The cumulative impacts of these projects could have adverse effects on the wildlife habitat and general integrity of the Econ River system. The MSSW program could provide more protection for the Econ Basin and river if thresholds were lowered.

Although the MSSW wetlands permitting criteria apply to all wetlands, development is routinely allowed in wetlands smaller than 0.5 acres because the criteria presume that these wetlands are of insignificant value to off-site aquatic or wetland dependent species. However, studies indicate that small ephemeral wetlands provide essential habitat to certain wildlife species.[438] While the Water Management District may rebut this presumption if they determine the wetland is of value to wetland dependent wildlife, rebuttal is unlikely unless endangered or threatened species are present. Furthermore, the criteria do not consider wetland values to on-site wildlife, regardless of the size of the

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436. Id. § 10.5.2(a).

437. The Water Management District is currently considering lowering the threshold for impacts to wetlands (Telephone interview with Glenn Lowe, Chief Environmental Specialist, Department of Resource Management, St. Johns River Water Management District (March, 1990)).

438. Brown, M.T., J.M. Schaefer, & K. Brandt, Buffer Zones for Water, Wetlands, and Wildlife in East Central Florida, Center for Wetlands, University of Florida, publication number 89-07 (1990) (report submitted to the East Central Florida Regional Planning Council), citing Ashton, R.E., & P.S. Aston, Handbook of Reptiles and Amphibians of Florida: Part Three - The Amphibians (1988); Caldwell, J.P., Demography and Life History of Two Species of Chorus Frogs (Anura: Hylidae) in South Carolina, Copeia 1987: 114-127 (1987); Heyer, W.R., R.W. McDiarmid, and D.L. Wiegmann, Tadpoles, Predation and Pond Habitats in the Tropics, Biotropics 7:100-111 (1975); Moler, P.E., and R. Franz, Wildlife Values of Small, Isolated Wetlands in the Southeastern coastal Plain, Proc. 3rd S.E. Nongame and Endangered Wildlife Sym. GA Dept. Nat. Res., Atlanta, GA (1987); Morin, T., Predation, Competition, and the Composition of Larval Anuran Guilds, Ecol. Monogr. 53: 119-138 (1983); Wilbur, H.M., Complex Life Cycles, Ann. Rev. Ecol. Syst. 1980: 67-93 (1980); Woodward, B.D., Predator Prey Interactions and Breeding Pond Use of Temporary-pond Species in a Desert Anuran Community, Ecology 64: 1549-1555. See also, Lowe, G. & C. Salafrio, The Evolution of Wetland Regulation Under Chapter 40C-4, F.A.C., Wetlands: Concerns and Successes 557 (1989) (published in the proceedings of a conference sponsored by the American Water Resources Association, Tampa, Fla., Sept. 17-22, 1989).

wetland. District staff indicate that occasionally they are unable to show that a wetland has value to off-site aquatic and wetland dependent wildlife. When this happens, destruction of the wetland may be allowed under existing criteria, notwithstanding the value of the wetland to on-site aquatic and wetland dependent wildlife species.

A number of questions surround the use of mitigation in MSSW and dredge and fill[439] permitting programs in Florida. The underlying premise supporting the use of mitigation is that wetland functions which are destroyed by a project can be replaced through creation, enhancement, or restoration of other wetlands, or by preserving other wetlands or valuable lands. Ideally, each acre of wetland which is destroyed will be replaced by a new or restored acre of wetland with equivalent functional value. However, recent critiques indicate that wetland mitigation programs are allowing a net loss of wetlands because often: (1) wetland creation is unsuccessful because of unsuitable hydrology, invasions of exotic plant species, and other site specific problems; (2) applicants do not commence or follow through with construction of the mitigation area; (3) mitigation areas are constructed improperly; (4) mitigation areas are not maintained properly; (5) mitigation areas are not monitored properly, by the applicant or regulatory agencies; and (6) regulatory agencies do not pursue enforcement actions against applicants who violate mitigation criteria or permit conditions.[440]

In addition, existing mitigation criteria are substantively inadequate to prevent a net loss of wetlands. While off-site, non-type for type, and monetary mitigation may be appropriate under certain circumstances, current regulatory criteria do not provide an adequate rationale or methodology for consistent consideration of often competing natural resource values. For example, Water Management District rules provide no mitigation ratios for isolated wetlands, wetland enhancement, upland preservation, or off-site mitigation.[441] The Water Management District and other government entities recognized the inherent limitations of the MSSW program for protecting sensitive riverine habitat when

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439. DER delegated dredge and fill authority to the Water Management District in 1988. The Water Management District applies DER mitigation criteria to dredge and fill projects and MSSW mitigation criteria to MSSW projects. If a project requires both a dredge and fill and MSSW permit then the applicant must satisfy Water Management District and DER mitigation criteria. (Interoffice memorandum from Glenn Lowe, Chief Environmental Specialist, Department of Resource Management, to Environmental Specialist Staff, Department of Resource Management, St. Johns River Water Management District (August 23, 1989)).

440. Interoffice memorandum from Lucianne Blair and Michael Dentzau to Janet Llewellyn, et al, Florida Department of Environmental Regulation (Sept. 1, 1989); Interoffice memorandum from James Beever III, Resource Management and Research Coordinator, Southwest Florida Aquatic Preserves, to Hank Smith, Environmental Specialist III, Bureau of State Lands Management, Division of State Lands, Department of Natural Resources (March 6, 1990); Crewz, David, Habitat-Mitigation Evaluations for Manatee-Sarasota Counties, Mid-project Summary: Projects 1-11, Report to Manasota 88 (Jan., 1990); Permit Audit, The Resource, (Resource Regulation Newsletter published by the Southwest Florida Water Management District) Vol III, Issue 2 (Mar.-Apr., 1990).

441. Memorandum from Jeff Elledge, Director, Department of Resource Management, St. Johns River Water Management District to the St. Johns River Water Management District Governing Board 5 (July 19, 1989).

they modified those requirements for the Wekiva River Basin. A discussion of these modifications is included in this volume in the section addressing Special Protection of Florida Rivers.

B. St. Johns River Water Management District Stormwater Permitting Program

1. Description of Water Management District Stormwater Permitting Program

Overview

The Water Management District regulates discharges of stormwater into waters of the state under authority delegated by the Florida Department of Environmental Regulation.[442] Permits are required for new stormwater discharge facilities and modifications of existing facilities.[443] Stormwater permitting requirements are incorporated into the review of MSSW projects.[444] Most projects which fall below MSSW thresholds must obtain stormwater discharge permits. However, stormwater facilities for single-family dwellings units, or for single-family residential projects of less than 10 acres total land area and which have less than 2 acres impervious surface, are exempt from stormwater permitting requirements unless the system is part of a larger common plan of development or sale.[445] Stormwater facilities for agricultural and silvicultural lands are not currently required to obtain a permit under chapter 40C-42 if certain conservation plans and best management practices are followed.[446]

The goal of the stormwater permitting program is to prevent pollution of waters of the state and to protect the most beneficial uses of waters.[447] An applicant must provide "reasonable assurance that the discharge will not cause or contribute to a violation of water quality standards in waters of the state."[448] Chapter 40C-42 contains design and performance standards which are "established for the purpose of determining compliance" with the rule.[449] However, the Water Management District may

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442. Fla. Admin. Code ch. 40C-42 (August, 1987). The Florida Department of Environmental Regulation had formerly regulated stormwater systems within the District under Rule 17-25, F.A.C. The delegation was intended to minimize duplication by consolidating stormwater permitting with MSSW permitting.

443. Fla. Admin. Code §§ 40C-42.011(2), 40C-42.021(8) (August, 1987).

444. Id. § 40C-42.061(1).

445. Id. § 40C-42.031(1)(a),(b) (Feb., 1987).

446. Id. § 40C-42.031(1)(d),(e).

447. Id. § 40C-42.011(1).

448. Id. § 40C-42.025.

449. Id. § 40C-42.025.

require more stringent design and performance standards to ensure the facility will not violate water quality standards.[450] Generally, stormwater treatment may be accomplished through the use of retention, detention with filtration, or wet detention systems. Treatment systems must be capable of accommodating a subsequent rainfall event within a specified period of time.[451] In addition, the rule provides standards for filtration systems, swales, side slopes, erosion and sedimentation, oil and grease removal, and criteria for Outstanding Florida Waters.[452]

General Permits

An applicant may obtain a general permit for new stormwater discharge facilities which:

a) ... discharge into a stormwater discharge facility which ... [is already permitted] or which was previously approved pursuant to a noticed exemption under Rule 17-25.030, where appropriate treatment criteria specified in this Chapter and applied to the permitted or exempt facility are not exceeded by the discharge ... [and written consent is obtained from the owner of the permitted or exempt facility]; or

b) ... provide retention, or detention with filtration, of the runoff from the first one inch or rainfall; or, as an option, for projects ... which consist of less than 80% impervious surface with drainage areas less than 100 acres, facilities which provide retention, or detention with filtration, of the first one-half inch of runoff. However, facilities which directly discharge to ... Outstanding Florida Waters shall provide additional treatment ...; or

c) [involve] [M]odification or reconstruction by a city, county, state agency or special district with drainage responsibility, of an existing stormwater management system which is not intended to serve new development, and which will not increase pollution loading, or change points of discharge in a manner that would adversely affect the designated uses of the waters of the state; or

d) [involve] [F]acilities of stormwater management systems that include a combination of management practices including but not limited to retention basins, swales, pervious pavement, landscape or natural retention storage that will provide for percolation of the runoff from a three-year, one-hour design storm.[453]

General stormwater permits are subject to the general permit procedures and limitations contained in Chapter 40C-40, Florida Administrative Code (See discussion of general MSSW permits

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450. Id.

451. Id.

452. Id. § 40C-42.025. Stormwater discharge facilities which discharge directly to Outstanding Florida Waters must provide "an additional level of treatment equal to fifty percent of the treatment criteria" required for class III waters. Id. § 40C-42.025(10).

453. Id. § 40C-42.035.

beginning on page 69 of this volume) and are permanent unless suspended or revoked pursuant to Section 373.429, Florida Statutes.[454]

Individual Permits

Persons planning to construct new stormwater discharge facilities must obtain an individual permit prior to construction of the facility unless the facility is exempted, permitted under a general stormwater permit, or permitted under a MSSW permit.[455] Generally, individual permits are required for stormwater systems which propose to satisfy water quality standards by treatment methodologies or devices other than those described in Chapter 40C-42.[456] Persons planning to modify existing stormwater discharge systems, except for emergency repairs, may also be required to obtain an individual permit.[457]

To obtain an individual permit, the applicant must provide reasonable assurance that the stormwater discharge facility will not "discharge, emit, or cause pollution in contravention of District standards, rules or regulations, including Chapter 17-3, F.A.C."[458] Facilities are presumed to have satisfied this standard if the facility will provide for

> treatment equivalent to either retention, or detention with filtration ... of the runoff from the first one inch of rainfall; or, as an option for projects ... which consist of less than 80% impervious surface with drainage areas less than 100 acres the first one-half inch of runoff ....[459]

Facilities which discharge directly into Outstanding Florida Waters must provide additional treatment.[460]

In addition, the applicant must provide for adequate operation and maintenance of the proposed facility.[461] The Water Management District may also consider: (1) whether best management practices are proposed, (2) the public interest served by the discharge, (3) the probable costs and

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454. Id. § 40C-42.035(1).

455. Id. § 40C-42.041(1).

456. Id. § 40C-42.025(12).

457. Id. § 40C-42.041(3).

458. Id. § 40C-42.041(4). Chapter 17-3, F.A.C., contains state water quality standards.

459. Fla. Admin. Code § 40C-42.041(5) (Feb., 1987).

460. Id. See, supra note 452.

461. Fla. Admin. Code § 40C-42.041(5).

efficacy of alternative controls, and (4) whether the proposed water quality benefits are reasonably related to the costs of the controls.[462]

2. Analysis of Water Management District Stormwater Permitting Program

Stormwater regulations attempt to prevent violations of state water quality standards and maintain existing water quality conditions by minimizing runoff pollution. However, there are some limitations in the scope and implementation of the rule. Design and performance standards are inadequate to maintain water quality and do not consider the effects of stormwater system construction on upland habitat or adjacent wetlands. In addition to limitations in the scope of the stormwater rule, Water Management District staff indicate there are enforcement and compliance problems in the implementation of the rule.

The stormwater rule provides design and performance criteria which are intended to result in the construction of stormwater treatment systems which do not violate state water quality standards. Stormwater system criteria are intended to meet a goal of 80% removal of the pollutant load from a given rainfall event, regardless of the actual amount of pollutant loading. Generally, the rule presumes this 80% removal efficiency is met if the treatment systems are designed in accordance with Water Management District design and performance criteria. However, if the pollutant loading is high, or the system is particularly vulnerable to pollution, a system designed to produce 80% removal efficiency may result in violations of water quality standards. Accordingly, in some instances, the design and performance standards may not result in compliance with water quality standards.[463] The rule addresses this problem by stating that discharges may not cause violations of specific values for a number of water quality parameters, regardless of whether the design or performance criteria are satisfied. The Water Management District may require monitoring of discharges and take action to ensure the water quality standards are not violated.

Despite these safeguards, Water Management District staff indicate that violations of water quality standards are a problem. Properly designed stormwater treatment systems are often poorly monitored and maintained and as a result may contribute to degradation of water quality. Monitoring and enforcement actions by the Water Management District are relatively rare compared to the number of stormwater systems which are likely to be violating water quality standards. In addition, stormwater treatment systems are occasionally permitted in locations with hydrological and geological traits which prevent the treatment system from working properly, such as in wetlands or other areas with high water tables. There are also concerns regarding the effectiveness of detention with filtration systems in the

462. Id. § 40C-42.041(6).

463. Id. § 40C-42.025.

Econ Basin.[464] Water Management District staff believe wet detention systems provide more effective treatment, with fewer maintenance problems, in areas with high water tables.

Another limitation involves the nutrient standard for Class III water bodies. The nutrient standard states "in no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora or fauna."[465] The standard is apparently based on the assumption that densities of aquatic flora and fauna are directly proportional to nutrient levels. However, other factors such as temperature, light, and the rate of water movement also affect densities of aquatic flora and fauna. Accordingly, it is difficult to predict whether nutrient discharges, individually or cumulatively, will cause algal blooms, accelerated growth of aquatic macrophytes, such as water hyacinths, or fish kills in slow moving downstream waters. The standard thus contains no maximum allowable concentration of nutrients. The only accurate basis for setting such limitations would be a comprehensive study of the Econ Basin which considers contributions of both point and nonpoint sources of nutrients and their effect on receiving waters.

The stormwater rule provides for consideration of the affects of water quality on wildlife but does not allow for consideration of the impacts of the creation of stormwater systems on wildlife. For example, the rule does not provide for evaluation of (1) the immediate affects of construction of detention and retention reservoirs on on-site and nearby wildlife species and (2) the cumulative long-term effects of loss of habitat caused by construction of stormwater reservoirs. In many cases, the construction of stormwater basins adjacent to wetlands has had the effect of draining water from the wetlands, thus degrading them. Current rules do not provide for consideration of this impact where the basin is constructed in uplands.

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464. Although the stormwater rule treats detention with filtration and wet detention as equivalent best management practices, the Water Management District discourages the use of detention with filtration and encourages wet detention. However, until recently, Orange County would not issue permits under their stormwater rule for wet detention systems. Accordingly, a large number of stormwater systems in the Econ Basin utilize detention with filtration, a treatment system which Water Management District staff believe is not as effective as other methods.

465. Fla. Admin. Code § 17-3.121(19) (May, 1987).

III. Wetlands

The development of wetlands is regulated by both the U.S. Army Corps of Engineers (Corps)[466] and the U.S. Environmental Protection Agency (EPA)[467] at the federal level. At the state level, the Florida Department of Environmental Regulation (DER) regulates dredge and fill activities in wetlands.[468] The Florida Department of Natural Resources (DNR) regulates the use of state-owned submerged lands,[469] which can include extensive areas of vegetated wetlands along the shores of navigable rivers and lakes. In addition, wetland impacts are a major consideration in the management and storage of surface waters permitting program of the St Johns River Water Management District, in the review of Developments of Regional Impact by the East Central Florida Regional Planning Council and the Department of Community Affairs, and in local government comprehensive plans and implementing regulations discussed elsewhere in this volume. There is considerable variation among the programs with respect to those activities subject to regulation, the geographic area regulated, and the criteria used for determining whether to permit an activity. Table 7 illustrates isolated wetlands permitting thresholds for federal, state, and regional agencies.

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466. 33 C.F.R. § 320.2 (July, 1988).

467. 40 C.F.R. part 230 (July, 1988).

468. Fla. Stat. § 403.91-403.938 (1989); Fla. Admin. Code ch. 17-312 (July, 1989).

469. Fla. Stat. § 253.03 (1989); Fla. Admin. Code ch. 18-21 (March, 1987).

TABLE 7

REGIONAL, STATE, AND FEDERAL ISOLATED WETLANDS PERMITTING THRESHOLDS IN THE ECON BASIN

Regulatory Entity	Acres
SJRWMD	0.5*
DER	NA**
EPA/COE	0.0***

* Wetlands are regulated through the Water Management District's MSSW permitting program. Accordingly, MSSW thresholds must be triggered before the Water Management District will evaluate the effects of a project on wetlands.

** DER regulates waters connected to the state but does not regulate isolated wetlands. DER has delegated this authority to the Water Management District.

*** EPA and COE have jurisdiction over all "adjacent" wetlands and isolated wetlands, the loss or destruction of which would adversely affect interstate commerce. 40 C.F.R. § 230.3(s) (July 1, 1988). Nationwide permits may authorize activities which do not cause the loss or substantial adverse modification of less than 10 acres of wetlands. 33 C.F.R. § 330.5(a)(26) (Nov. 13, 1986). Activities which cause the loss or substantial adverse modification of 1 to 10 acres of wetlands must notify the COE. Id.

A. Federal

The wetlands regulatory authority of the U.S. Army Corps of Engineers is derived from two federal statutes, the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act. Under Section 10 of the Rivers and Harbors Act, the Corps has broad authority to regulate activities affecting the course, location or capacity of navigable waters.[470] Jurisdiction is generally limited to activities below the ordinary high water mark of navigable waters. Under the Clean Water Act, on the other hand, jurisdiction extends to nonnavigable tributaries and adjacent wetlands. A hydrologic connection to navigable waters is not required. Only activities involving the discharge of dredged or fill material, however, are subject to permitting. Although land clearing and other activities involving a re-deposition of fill material are regulated, the excavation or drainage of wetlands may be unregulated.

The criteria for permitting involve the application of a public interest test adopted by the Corps[471] and a set of guidelines adopted by EPA[472] in consultation with the Corps. Only the public interest criteria are used in evaluating Rivers and Harbors Act permits. The public interest criteria involve a balancing of the various factors affecting the public interest, including the public interest in the preservation of wetlands and associated wildlife.

Guidelines adopted by EPA under section 404(b)(1) of the Clean Water Act are used to evaluate discharges of dredge or fill material. EPA can enforce these guidelines by "vetoing" Corps-issued permits under section 404(c), which is extremely rare. The guidelines prohibit the discharge of dredge or fill material unless the individual and cumulative effects on water quality, wildlife and other resource values associated with wetlands are not adverse. If there is a practicable alternative that would be less damaging, the discharge is prohibited and if the activity is not water dependent, practicable alternatives are presumed to be available.

B. State

State wetlands regulation was significantly reformed in 1984 with passage of the Warren S. Henderson Wetlands Protection Act.[473] Many developments, however, were vested under the existing statutes and regulations. The Wetlands Protection Act extended jurisdiction to encompass additional wetlands, expanded permitting criteria to allow consideration of a broad range of factors, required DER to consider mitigation, and exempted agricultural activities from permitting under the Act.

Jurisdiction applies to construction, dredge, or fill activities conducted in "waters of the state" whose landward extent is defined by the dominance of listed plant species. In all instances, water

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470. 33 C.F.R. § 320.2(b) (July, 1988).

471. Id. § 320.4.

472. 40 C.F.R. part 230 (1988).

473. Fla. Stat. § 403.91-403.938 (1989); Fla. Admin. Code ch. 17-312 (July, 1989).

quality standards must be maintained.[474] Beyond that, permitting depends on the application of public interest tests.[475] Generally, a permit must be issued if it is "not contrary to the public interest".[476] A project located within or which significantly degrades an Outstanding Florida Water must be "clearly in the public interest". In making the relevant public interest determination, DER is required to consider and balance a list of factors that include the project's effects on the general public health, safety and welfare, the property of others, fish and wildlife and their habitats, navigation, the flow of water, erosion, shoaling, fishing, recreation, marine productivity, and significant historical and archeological resources. DER is also required to consider the current condition and relative value of affected areas and whether the activity is of a temporary or permanent nature. Cumulative impacts must also be considered. If the applicant is unable to otherwise meet the public interest test, DER must consider proposals to mitigate the adverse effects of the project. Stricter permitting criteria may be adopted for Outstanding Florida Waters, aquatic preserves, areas of critical state concern, and areas subject to resource management plans adopted under chapter 380, Florida Statutes.

C. St. Johns River Water Management District

The St. Johns River Water Management District regulates many wetlands through its MSSW permitting program, which is discussed in this volume. In addition, the Florida Department of Environmental Regulation has delegated its dredge and fill permitting and enforcement authority to the Water Management District.[477] By operating agreement with DER, the Water Management District applies DER dredge and fill regulatory criteria for all projects which require a stormwater or MSSW permit, except for some exceptions including landfills, wastewater treatment plants, and wetland treatment facilities.[478] DER continues to regulate these exceptions, as well as dredge and fill activities which do not require a stormwater or MSSW permit from the Water Management District.[479] If a project requires a dredge and fill and MSSW or stormwater permit then the applicant must satisfy both

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474. Fla. Stat. § 403.918(1) (1989).

475. Id. § 403.918(2).

476. Fla. Admin. Code § 17-312.080(2) (July, 1989).

477. Fla. Admin. Code § 17-101.040(12)(a)3 (Sept., 1989). The Water Management District's dredge and fill authority became effective on October 1, 1988. Id.

478. Interoffice memorandum from Glenn Lowe, Chief Environmental Specialist, Department of Resource Management, to Environmental Specialist Staff, Department of Resource Management, St. Johns River Water Management District (August 23, 1989); Telephone interview with Glenn Lowe, Chief Environmental Specialist, Department of Resource Management, St. Johns River Water Management District (March, 1990).

479. Id.

Water Management District and DER regulatory criteria.[480] Initial assessments by DER indicate that the Water Management District's dredge and fill program has not yet attained the quality of regulation which existed prior to the delegation of authority.

480. Id.

SIGNIFICANT DEVELOPMENT, STRUCTURES, AND ACTIVITIES

The Econ Basin has been and continues to be impacted by a wide variety of development activities. This section will identify and briefly describe the most significant of recently constructed and proposed development activities. The purpose is to identify development trends and major activities affecting the basin. Activities are categorized by the following sub-basins: (1) the Little Econ basin, (2) the Big Econ Basin, and (3) the Lower Econ Basin. The locations of these basins are illustrated in Map 2. Map 3 illustrates the location of some of the major developments in the Econ Basin. Map 4 illustrates planned new road construction and road improvements.

I. Little Econ Basin

The Little Econ Basin has been subjected to intense development pressure for a number of years. Activities which would not be allowed today, such as channelization, occurred years ago on the Little Econ River. The Little Econ Basin is subject to continuing development pressures.

A. Major Developments, Planned Developments, and DRIs

1. Vista Lakes

Vista Lakes is located east of the south end of Goldenrod road and involves about 714 acres. The development will contain 915 single-family residences and 468 multifamily residences. Vista Lakes is located near a canal which connects with the Little Econ.

2. Scharlin Robaina/Crown Tree DRI

Crown Tree involves about 784 acres and is located east of Chickasaw Trail and north of the Bee Line. The development will involve about 1,840 residential units, 837,000 square feet of commercial space, 729,000 square feet of office space, 325 hotel rooms, and 379,000 square feet of light industrial space. The development located is near a tributary of the Little Econ River and a canal which drains into the Little Econ River.

3. Goldenrod

Goldenrod is located immediately north of Vista Lakes and adjacent to Goldenrod Road. The development involves 217 acres and will contain 622 single-family residences and 456 multifamily residences. Goldenrod is adjacent to a canal which connects with the Little Econ River.

4. Covered Bridge

Covered Bridge is located at the intersection of Curry Ford Road and the Little Econ River. The development involves 160 acres and will contain 160 single-family residences. Covered Bridge is immediately adjacent to the Little Econ River.

5. Cypress Springs

Cypress Springs is located slightly east of the intersection of Curry Ford Road and the Little Econ River. The development involves about 1,053 acres and will contain 1,506 single-family residences, 894 multifamily residences, and 90,000 square feet of commercial space. Cypress Springs is adjacent to the Little Econ River.

6. Young Pine DRI

Young Pine is located just west of the Easterly Regional Wastewater Treatment Plant and south of Cypress Springs and involves about 593 acres. The development will consist of about 802 residential units, 528,500 square feet of commercial space, and 1,660,000 square feet of business park. The property is located within 1 mile of the Little Econ River.

5. Martin Marietta

The Martin Marietta development is located just south of the East-West expressway and west of Alafaya Trail, near a tributary of the Little Econ and about one mile from the river. The development involves 1,250 acres and will consist of about 1.2 million square feet of office space.

6. Dean Road Condos

Dean Road Condos is located near the intersection of Lake Underhill Road and Dean Road and involves about 33 acres of land. The development will consist of about 135 single-family residences and is located on a tributary of the Little Econ River.

7. Chartered Corporate Center

Chartered Corporate Center is located immediately north of Dean Road Condos and involves about 192 acres of land. The development will consist of 502 multifamily residences, 210,000 square feet of office space, and 750,000 square feet of industrial space. The center is near the Little Econ and a tributary of the Little Econ.

8. Dean Woods

Dean Woods is located just north of the intersection of Lake Underhill Road and Dean Road and involves about 47 acres. The development will consist of 583 multifamily residences, 30,500 square feet of office space, and 61,000 square feet of industrial space. Dean Woods is adjacent to the east bank of the Little Econ.

9. Underhill Industrial Park

Underhill Industrial Park is located about one-half mile east of Dean Woods and involves about 107 acres. The development will consist of 157,480 square feet of office space and 777,000 square feet of industrial space. The site is less than a mile from the Little Econ River.

10. High Point

High Point is located to the east of Valencia Community College and Dean Road and involves about 482 acres. The development will consist of 2,205 single-family residences, 190,330 square feet of commercial space, and 496,800 square feet of office space. High point is located about a mile from the Little Econ River.

11. Eastmar Commons

Eastmar Commons is located just east of Valencia Community College and Dean Road and involves about 56 acres. The development will consist of 235 multifamily residences, 45,000 square feet of commercial space, and 250,000 square feet of office space. Eastmar Commons is adjacent to the Little Econ River.

12. Expressway Center

Expressway Center is located just north of the intersection of Chickasaw Trail and the East-West Expressway and involves about 590 acres. The development will consist of 1,325 single-family residences, 1,645 multifamily residences, 463,000 square feet of commercial space, and 593,072 square feet of office space. Expressway Center is located next to a canal which connects to the Little Econ River.

13. Sutton Ridge

Sutton Ridge is located south west of the intersection of Econlockhatchee Trail and State Road 50 and involves about 115 acres. The development will consist of 53 single-family residences and 507 multifamily residences and is located next to the Little Econ River.

14. Gainesway Plaza

Gainesway Plaza is located near the intersection of State Road 50 and the East-West Expressway and involves about 56 acres. The development will consist of 300 multifamily residences, 100,000 square feet of commercial space, and 295,000 square feet of office space. Gainesway Plaza is adjacent to a canal which is connected to the Little Econ River.

15. Scottish Glen

Scottish Glen is located north east of the intersection of Dean Road and State Road 50 and involves about 94 acres. The development will consist of 917 single-family residences and is adjacent to the Little Econ River.

16. Arbor Ridge

Arbor Ridge is located near the intersection of Dean Road and the Little Econ River and involves about 123 acres. The development will consist of 274 single-family residences and 317 multifamily residences and is adjacent to the Little Econ River.

17. Straw Ridge (Heather Glen)

Straw Ridge is located near the intersection of Dean Road and University Boulevard and involves about 130 acres. The development will consist of 942 multifamily residences and is adjacent to the Little Econ River.

18. Quadrangle

The Quadrangle is located near the intersection of University Boulevard and Alafaya Trail and involves about 474 acres. The development will consist of 246,631 square feet of commercial space, over 2 million square feet of office space, and 250 hotel rooms. The Quadrangle is located near the Little Econ River.

19. Carillon PUD

The Carillon PUD is located on a tributary of the Little Econ just south of the city of Oviedo. The development involves 468 acres and will consist of over 1,200 dwelling units by the year 2005.

20. Hunters Landing PUD

The Hunters Landing PUD is located along the Little Econ River south of Oviedo and along the Seminole/Orange County line. The development involves over 55 acres and will contain 322 dwelling units by the year 1995.

21. Twin Rivers DRI

The Twin Rivers DRI is located at the confluence of the Little and Big Econ rivers in the city of Oviedo. The development involves over 1,500 acres and will include more than 3,000 dwelling units by the year 2010.

B. Public Utilities and Institutions

1. Orange County Landfill

The Orange County Landfill is located near the headwaters of the Little Econ River. Leachate from the landfill is treated and then transported by canal directly into the Little Econ River.

2. Orange County Easterly Regional Wastewater Treatment Facility

The Orange County Easterly Regional Wastewater Treatment Center is located immediately north of the Orange County Landfill. The facility processes approximately 7.7 million gallons of wastewater per day. Secondarily treated effluent is sent through a series of created and natural wetlands and eventually discharges into the Little Econ River. A portion of the treated effluent is used for cooling at the Stanton Energy Center.

3. Stanton Energy Center

The Stanton Energy Center is a coal burning power plant located just east of the Orange County landfill and south east of the Orange County Easterly Regional Wastewater Treatment Center. The Stanton Energy Center uses approximately 3.7 million gallons per day of treated effluent from the Easterly Regional Wastewater Treatment Facility for cooling purposes.

4. Orlando Iron Bridge Wastewater Treatment Facility

The Iron Bridge Wastewater Treatment Facility is located in Seminole County immediately south of the City of Oviedo. The facility processes about 21 million gallons of effluent per day. Approximately 8 million gallons per day of treated effluent is discharged into the Little Econ River, while about 13 million gallons per day are transported to a "Wetland Park" located outside of the Econ basin near the St. Johns River.

5. Eastern Orlando Canals and Channelization of Portions of Little Econ River

Much of eastern Orlando is located below the 100 foot elevation and in poorly drained areas which are subject to flooding. There are over 30 lakes in the Orlando Urban Area which are part of the Little Econ Drainage Basin, many of which are landlocked. To prevent flooding, the water levels of many of these lakes are manipulated artificially though the use of drainage wells, open channels, and culverts. A number of drainage wells in the area discharge lake overflow and stormwater directly into the aquifer.

Canals have been constructed in the Little Econ Drainage Basin which drain stormwater and water from some of the landlocked lakes into the Little Econ River. Orlando is currently considering pumping excess water from Lake Underhill into canals leading into the Little Econ.

In addition, some portions of the Little Econ River have been channelized. Channelized portions of the Little Econ River consist of sloped concrete banks bordered by grass. Extensive development has occurred along both sides of much of the Little Econ River.

C. Roads

An examination of planned road improvements and new road construction is useful in predicting future development activities in the Econ Basin. Map 4 illustrates some of the proposed and existing road projects in the area. The expressway system, which will eventually encircle most of the significant development within the Orlando to Sanford corridor, is particularly significant with respect to the Econ basin. Portions of the eastern section of the expressway are already complete, while others are in the planning stages.

1. North Section of Eastern Beltway

The northern portion of the eastern beltway located in Orange county has been completed. The portion of the beltway located in Seminole County, which will pass just to the west of the city of Oviedo, is in the planning stages.

2. South Section of Eastern Beltway

The south section of the eastern beltway, which will extend south from the existing eastern beltway and intersect with the Bee Line, is currently under construction. The south section crosses a tributary of the Little Econ, the Little Econ itself, and the drainage canal from the Orange County Landfill.

3. Proposed Extension of Lockhart Road

Lockhart Road currently stops at County Road 419 in Oviedo. However, there are plans to extend the road north for a distance of 2.3 miles to intersect with Florida Avenue. This road would service proposed developments immediately adjacent to the proposed Conservation and Recreation Lands (CARL) acquisitions.

4. Proposed Widening of Highway 50

The Department of Transportation (DOT) is considering widening approximately 15 miles of State Road 50, beginning at State Road 436 and ending at State Road 520. The proposed widening involves a section of State Road 50 which crosses the Big and Little Econ rivers, and tributaries of both rivers.

5. Proposed Widening of Goldenrod Road

The DOT plans to widen about 9.4 miles of Goldenrod Road from two to four lanes. Goldenrod Road is located just east of State Road 436 and travels in a north-south direction. Goldenrod road crosses a number of canals which drain into the Little Econ River. DOT has conducted an environmental assessment of the project and has determined there will be no significant impact.

6. Proposed Widening of Curry Ford Road

The DOT plans to widen about 1.5 miles of Curry Ford Road from two to four lanes. Curry Ford Road will be widened between State Road 436 and Goldenrod Road. Curry Ford Road runs close to a canal draining into the Little Econ but does not cross any canals or the Little Econ. DOT has conducted an environmental assessment of the project and has determined there will be no significant impact.

7. Proposed Widening of Alafaya Trail

The DOT plans to widen Alafaya Trail from two to six lanes for 2.5 miles from State Road 50 north to a point just north of University Boulevard. The portion of Alafaya Trail which will be widened is located between the Big and Little Econ rivers and does not cross either river. However, the northern

end of the project is close to the Little Econ River. DOT has conducted an environmental assessment of the project and has determined there will be no significant impact.

II. Big Econ Basin

A. Major Developments, Planned Developments, and DRIs

1. Corporation of the President of the Church of Jesus Christ Of Latter Day Saints

A small portion of the Econ basin lies within the relatively undeveloped northeast section of Osceola County and is owned by one landowner, the Corporation of the President of the Church of Jesus Christ of Latter Day Saints (Corporation). The Corporation also owns considerable property in Orange County which is within the basin. To date much of this area has been left relatively undeveloped except for ongoing agriculture and silviculture activities.

However, there are indications that the Corporation may be planning to develop considerable portions of this land. For example, see the description of Magnolia Ranch in number three of this section. The Corporation has a contractual agreement with the state planning agency, DCA, which modifies commencement of the formal DRI review process.

2. Live Oak Estates

Live Oak Estates is located on Lake Mary Jane and is outside of the Econ Basin's natural boundaries. However, the development is located on the Disston Canal which is connected with the Big Econ River. The development involves about 646 acres and will include 271 single-family residences.

3. Proposed Magnolia Ranch DRI

The Corporation recently unveiled plans to develop a 7,000 acre parcel of land just south of the Bee Line Expressway and between ICP and the Martin Marietta Test Site. The proposed development will contain some 7,000 mixed use units and will be near several tributaries of the Big Econ River.

4. International Corporate Park DRI (ICP)

ICP is located just west of the intersection of the proposed Alafaya Trail extension and the Beeline Expressway. The development involves about 1,810 acres and will consist of about 1.9 million square feet of commercial space, 1 million square feet of office space, 200,000 square feet of industrial space, and 321 hotel rooms. ICP is located near tributaries of the Big Econ River.

5. Ranger Drainage District

The Ranger Drainage District is located just east of the Big Econ River between State Road 50 and the Bee Line. Ranger, a private drainage district, was created under Florida Statutes Chapter 298 and originally covered about 9,900 acres. The district consists of a system of drainage canals which lead into six outfall canals, five of which discharge directly in to the Big Econ River. The sixth outfall canal discharges into a tributary of the river. Roads are interspaced throughout the canals, although the area is largely uninhabited. There is a golf course located in the north east quadrant of the district.

Approximately 6,750 acres of the Ranger Drainage District are currently operating under a MSSW permit issued by the Water Management District in 1982. However, Water Management District personnel have indicated that the project is not currently meeting stormwater standards. Despite these apparent violations, the Water Management District has not pursued bringing the Ranger Drainage District into compliance with current stormwater regulations.

6. Spring Rise

Spring Rise is a proposed DRI which is located just east of the Easterly Regional Wastewater Treatment Facility along Alafaya Trail. The development involves 1,061 acres and will contain about 1,800 mixed use units. The development is in the pre-application phase and will be completed between 1990 and 2010.

7. Deer Run South

Deer Run South is located along Alafaya Trail just north of Spring Rise. The development involves about 643 acres and will contain about 1,298 single-family residences, 257 multifamily residences, and about 150,000 square feet of commercial space. The development is located between the Big and Little Econ rivers and is not near any tributaries.

8. Huckleberry DRI

Huckleberry is located near where the East-West Expressway intersects with Alafaya Trail and involves more than 1,800 acres. The DRI will consist of 2,242 single-family residences, 4,615 multifamily residences, 1.2 million square feet of commercial space, 687,800 square feet of office space and 450 hotel rooms. Huckleberry is located near tributaries of both the Big and Little Econ rivers.

9. Shadow Pines

Shadow Pines is located just north of where State Road 50 joins State Road 520. The development involves about 67 acres and will contain 450 single-family residences. The development is located near tributaries of the Big Econ River.

10. Cypress Lakes

Cypress Lakes is located just north of State Road 50 and East of Chuluota Road and involves about 775 acres. The development will contain 2,048 single-family residences and 685 multifamily residences. The development is not close to the Big Econ or its tributaries.

11. Lake Pickett Center

Lake Pickett Center is located just north of the intersection of State Road 50 and Lake Picket Road. The development involves about 46 acres and will contain about 1 million square feet of commercial space and 54,000 square feet of office space. The development is located near a tributary of the Big Econ River.

12. University Trust

University Trust is located north of State Road 50 and just east of Alafaya Trail. The development will consist of 28,000 square feet of commercial space, 217,000 square feet of office space, and 150 hotel rooms. The development is not located near the river or its tributaries.

13. University Village Park

University Village Park is located just north of Lake Pickett Center and involves about 41 acres. The development will contain 269 single-family residences and is located adjacent to a tributary of the Big Econ River.

14. Walker Cove

Walker Cove is located on Corner Lake just south of Lake Pickett Road. The development involves 213 acres and will contain about 18 single-family residences, 547 multifamily residences, 471,500 square feet of commercial space, and 1,245 hotel rooms. Corner Lake may be connected to a tributary of the Econ River.

15. Central Florida Research Park

Central Florida Research Park is located just south of the University of Central Florida and involves about 1,027 acres. The development will contain 267,800 square feet of commercial space, 209,500 square feet of office space, 700 hotel rooms, and over 6 million square feet of industrial use. The development is located between the Big and Little Econ rivers and is not near any tributaries.

16. Twin Rivers DRI

The Twin Rivers DRI is described in the Little Econ section of this volume.

17. Equinus Greens PUD

The Equinus Greens PUD, which fell just below DRI thresholds, is located south and east of the confluence of the Little and Big Econ rivers in Oviedo. The land was annexed into the city of Oviedo at about the same time that it was developed. The development covers 1,036 acres and is planned to contain 700 dwelling units by the year 2005.

B. Public Utilities and Institutions

1. Stanton Energy Center

The Stanton Energy Center is described in the Little Econ section of this volume.

C. Roads

1. Proposed Extension of Alafaya Trail

Alafaya Trail currently ends at the Stanton Energy Center. However, there are plans to continue the road south until it intersects with the Bee Line and the International Corporate Park, and then west to the Lake Nona development. This extension would cross several tributaries of the Big Econ River.

2. Proposed Eastern Extension of East West Expressway

The East-West Expressway may be extended from the point where it turns north to intersect with State Road 50 eastward for an undetermined distance. No definite plans currently exist, although preliminary sketches indicate the extension would cross tributaries and the main channel of the Big Econ.

3. Pineda Orlando Expressway

The DOT is considering a conceptual plan for a road running from Pineda, located on Florida's east coast south of Cocoa, east and north so as to intersect with the southern connector of the expressway around the Orlando to Sanford corridor. The current proposed alignments indicate the road would run just south of the Econ Basin. However, no definite alignment has been chosen. In any event, a road of this size would probably encourage development around the headwater swamp of the Big Econ River.

4. Proposed Widening of Highway 50

The Department of Transportation (DOT) is considering widening approximately 15 miles of State Road 50, beginning at State Road 436 and ending at State Road 520. The proposed widening involves a section of State Road 50 which crosses the Big and Little Econ rivers, and tributaries of both rivers.

III. Lower Econ Basin

A. Major Developments, Planned Developments, and DRIs

1. Pickett Downs

Pickett Downs is located between Mills Lake and Lake Pickett near several tributaries of the Big Econ River. The development is divided into four different units which together involve about 674 acres. The development will eventually contain 276 dwelling units.

2. Lake Linelle Woods

Lake Linelle Woods is located just east of Oviedo and involves about 47 acres and will contain 34 dwelling units. The development is within the Lower Econ Basin but is not close to the river or its tributaries.

3. River's Edge

The River's Edge development is located on the north shore of the Econ River just east of Snow Hill Road. The development covers involves about 80 acres and will contain 23 dwelling units.

B. Public Utilities and Institutions

There are no major public utilities or institutions in the Lower Econ Basin.

C. Roads

There are no announced plans for major road improvements in the Lower Econ Basin.

SPECIAL PROTECTION OF FLORIDA RIVERS

Existing state, regional, and local government regulations may not provide sufficient protection for sensitive river ecosystems such as the Econ. Typically, existing regulatory programs do not provide for comprehensive management of entire ecosystems, and do not provide for consideration of the affects of development activities on upland species of wildlife. State and regional agencies derive regulatory authority from delegations by the Florida Legislature and agencies may not expand their regulatory authority beyond the legislative authorization. Specific enabling statutes define the scope and extent of agency authority, and agency regulations and actions must be consistent with statutory directives and guidelines.[481] While some agencies could legitimately broaden their regulatory programs under existing delegations of authority, significant expansions of regulatory programs are unlikely without additional grants of legislative authority.

Local governments, while possessing considerably broader authority,[482] may have neither the inclination or the resources to effectively protect river ecosystems. In addition, the regulatory jurisdiction of local governments seldom encompasses the entire geographical area of the ecosystem. Regulation of a large contiguous resource, such as a river, by several local governments, may not provide as much protection as systemwide regulation.

The Florida Legislature recently recognized these regulatory problems and provided for additional protection for two Florida rivers. The Legislature, at the request of citizens and agencies, created legislation providing for additional protection for the Wekiva and Myakka rivers. A task force has also adopted management guidelines for the Suwannee River. An examination of these statutes, regulations, and guidelines helps identify some of the problems and potential solutions for managing the Econ River.

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481. Legislative delegations of regulatory authority must provide sufficient specificity and guidance so as not to be considered vague and over-broad. See Askew v. Cross Key Waterways, 372 So.2d 913 (Fla. 1978).

482. Local governments have broad home rule authority as well as comprehensive responsibilities under the Local Government Comprehensive Planning and Land Development Regulation Act, codified at Chapter 163, Florida Statutes (1989).

I. Wekiva River[483]

A. Wekiva River Task Force Findings

In February of 1988, amid intense public concern over increasing development near the Wekiva River, Governor Martinez issued an executive order creating the Wekiva River Task Force (Task Force).[484] The order directed the Task Force to create a report describing and evaluating existing planning, regulatory, and land acquisition programs of state, regional, and local government which pertain to the management and protection of the Wekiva River. In May of 1988, the Task Force submitted its report which recommended new legislation and changes in current planning, management, and regulatory processes.[485]

The Task Force found that the Wekiva River system was subject to intense development pressure which threatened to adversely affect many of the system's resource values. Appendix C contains a complete list of the Task Force's recommendations for the Wekiva River Basin. The following Task Force recommendations are of particular interest:[486]

1) The Task Force recommends the immediate purchase of existing proposed CARL properties within the Wekiva Basin ...

...

4) The Task Force recommends that the East Central Florida Regional Planning Council prepare a comprehensive management plan and principles for guiding development for the entire Wekiva basin for inclusion in its Comprehensive Regional Policy Plan.

5) The Task Force endorses the proposed SJRWMD [St. Johns River Water Management District] rule changes to Chapter 40C-41, F.A.C., which address the impact of permitted development activities on the water quality, water quantity and wildlife habitat values of wetlands within the Wekiva Basin.

....

11) The Task Force endorses two proposed amendments to the East Central Florida Comprehensive Regional Policy Plan ... that propose a new regional policy which recognizes the Wekiva River as a significant regional resource deserving special

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483. See Whitney, N.S. & J.C. Elledge, Effective Environmental Action: The Case of the Wekiva River, Water: Laws and Management 9B-13 (Sept., 1989) (published in the proceedings of a conference sponsered by the American Water Resources Association, Tampa, Florida, Sept. 17-22, 1989); Lowe, G. & C. Salafrio, The Evolution of Wetland Regulation Under Chapter 40C-4, F.A.C., Wetlands: Concerns and Successes 557 (1989) (published in the proceedings of a conference sponsered by the American Water Resources Association, Tampa, Fla., Sept. 17-22, 1989).

484. Fla. Exec. Order No. 88-26 (Feb. 4, 1988).

485. Wekiva River Task Force, Report to Governor Bob Martinez (May 20, 1988).

486. Id. at p. v-ix.

protection and that would revise an existing policy regarding buffers and regionally significant wetlands in order to clarify its intent and application.

....

16) The Task Force recommends that local governments adopt changes to their local comprehensive plans, zoning codes and land use designations and that they adopt ordinances that would require minimum setbacks of 550 feet from the edge of the Wekiva River, that would encourage and promote clustering of development to allow greater expanses of undeveloped areas preserved in perpetuity in conservation easements, and that would prohibit land uses and intensities of development that would adversely affect the natural resources of the Wekiva River Basin.

17) The Task Force recommends that each affected local government adopt a permanent restriction of development in designated buffer areas along tributaries and wetlands in the Wekiva Basin.

18) The Task Force recommends that the Legislature enact legislation that would reduce the thresholds for developments of regional impact in the Wekiva River Basin by at least one-half.

19) The Task Force recommends that where development is permitted to occur adjacent to public preserve areas and state parks, it be of sufficiently low intensity to prevent adverse impacts to the public lands.

20) The Task Force endorses an amendment to Chapter 373, F.S., to include a provision that the [Water Management District]...not issue any permit within the Wekiva River Protection Area until the appropriate local government has provided written notification to the district that the proposed activity is consistent with the local comprehensive plan and is in compliance with any land development regulation in effect in the area where the development will take place.

State, regional, and local government entities responded quickly to provide additional regulatory protection for the Wekiva River System.

B. Florida Legislature

1. Wekiva River Protection Act

The Florida Legislature enacted the Wekiva River Protection Act[487] (Act) which directs the counties having jurisdiction within the Wekiva River Protection Area (Wekiva Area) to revise their comprehensive plans and land development regulations to protect the Wekiva Area by April 1,

487. Fla. Stat. § 369.301 (1989).

1989.[488] The Act directs the counties to adopt goals, policies, and objectives for the Wekiva Area which will protect:[489]

1) Water quantity, water quality, and hydrology ....
2) Wetlands ....
3) Aquatic and wetland-dependent wildlife species ....
4) Habitat ... of species designated pursuant to Rules 39-27.003 [Designation of Endangered Species by Florida Game and Fresh Water Fish Commission (GFC)], 39-27.004 [Designation of Threatened Species by GFC], and 39-27.005 [Designation of Species of Special Concern], Florida Administrative Code ....
5) Native vegetation ...

The county plans must also provide for land uses, and densities and intensities of development which will protect the resources and rural character of the Wekiva Area.[490] County comprehensive plans must include:

1) Provisions to ensure the preservation of sufficient habitat for feeding, nesting, roosting, and resting so as to maintain viable populations of designated ... [endangered, threatened, or special concern species].
2) Restrictions on the clearing of native vegetation within the 100-year floodplain.
3) Prohibition of development that is not low-density residential in nature, unless that development has less impacts on natural resources than low-density development.
4) Provisions for setbacks along the Wekiva River for areas that do not fall within the protection zones established pursuant to s. 373.415 [Water Management District protection zones for MSSW permitting in Wekiva River Protection Area].
5) Restrictions on intensity of development adjacent to publicly owned lands to prevent adverse impacts to such lands.
6) Restrictions on filling and alteration of wetlands in the Wekiva River Protection Area.
7) Provisions encouraging clustering of residential development when it promotes protection of environmentally sensitive areas, and ensuring that residential development in the aggregate shall be of a rural density and character.

The county comprehensive plans must require that development which is permitted on property adjacent to the Wekiva River be concentrated on portions of the property furthest away from surface waters and wetlands of the river system.[491]

The Act directs the counties to develop land development regulations to implement the Wekiva River protection provisions of their comprehensive plans. The counties must also develop regulations

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488. Id. § 369.305(1).

489. Id. § 369.305(1)(a).

490. Id. § 369.305(b).

491. Id. § 369.305(1)(c).

restricting the location of septic tanks and drain fields within the 100-year floodplain and discharges of stormwater to the river system.[492]

The Act directs the counties to adopt comprehensive plan revisions and land development regulations for the Wekiva River Protection Area by April 1, 1989 and submit them for review by the Department of Commmunity Affairs (DCA) and the Governor and Cabinet. Orange,[493] Seminole,[494] and Lake[495] counties have adopted provisions for the Wekiva River Protection Area. Orange County regulations were reviewed by DCA and approved by the Governor and Cabinet.[496] Seminole County regulations have not been approved due to a 5 acre parcel within the Wekiva Area which is zoned commercial.[497] Lake County comprehensive plan and land development regulation amendments are currently being reviewed by DCA.[498]

In addition to requiring local governments to amend their comprehensive plans and land development regulations, the Act also mandates other regulatory actions. The Act directs that the numerical thresholds for DRIs located in the Wekiva River Protection Area be reduced by 50%.[499] The Act declares that the Wekiva River Protection Area is a "natural resource of state and regional importance," and directs the East Central Florida Regional Planning Council to adopt policies to protect "water quantity, water quality, hydrology, wetlands, aquatic and wetland-dependent wildlife species, habitat of species ... [designated by FGFWFC as endangered, threatened, and of special concern], and native vegetation in the Wekiva River Protection Area."[500] Finally, the Act directs the Department of Natural Resources to pursue acquisitions of conservation and recreation lands within the Wekiva River Protection Area.[501]

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492. Id. § 369.305(1)(e).

493. Orange County, Fla., Wekiva River Small Area Study, Ordinance 88-6 (April 18, 1988).

494. Seminole County, Fla., Amendments to the Elements of the Seminole County Comprehensive Plan (Feb. 28, 1989).

495. Lake County, Fla., Wekiva River Protection Area Amendment to Development Regulations (March 6, 1990).

496. Telephone interview with Jim Farr, Department of Community Affairs (Jan., 1990).

497. Id.

498. Telephone interview with Jim Farr, Department of Community Affairs (Feb., 1990).

499. Id. § 369.307(2). DRI applications filed prior to June 1, 1988 which were issued a development order on or before April 1, 1989 are exempt from the provisions of the Act. Id. § 369.307(4).

500. Id. § 369.307(3).

501. Id. § 369.307(5).

2. Amendment to Part IV, Chapter 373 - Management and Storage of Surface Waters (MSSW)

Section 373.415, Florida Statutes, amends the St. Johns River Water Management District MSSW permitting authority by directing the District to adopt rules establishing protection zones along the watercourses in the Wekiva River System.[502] The protection zones must be wide enough to "prevent harm to the Wekiva River System, including water quality, water quantity, hydrology, wetlands, and aquatic and wetland-dependent species" from activities regulated by the MSSW permitting program.[503] Section 373.415 directs the Water Management District to consider the following factors when determining the widths of the protection zones:[504]

(a) The biological significance of the wetlands and uplands adjacent to the designated watercourses ... including the nesting, feeding, breeding, and resting needs of aquatic species and wetland-dependent species.

(b) The sensitivity of these species to disturbance, including the short-term and long-term adaptability to disturbance of the more sensitive species, both migratory and resident.

(c) The susceptibility of these lands to erosion, including the slope, soils, runoff characteristics, and vegetative cover.

In addition, Section 373.415 authorizes the Water Management District to establish permitting thresholds, permitting exemptions, or general permits which do not allow significant adverse affects to the river system.[505]

Section 373.415 prohibits the Water Management District from issuing a MSSW permit without first obtaining the appropriate local government's certification that the proposed activity is consistent with the local comprehensive plan and is in compliance with land development regulations.[506] Section 373.415 does not affect the authority of local governments to establish setbacks from waters.[507]

Section 373.415 directs the Water Management District to develop a groundwater basin resource availability inventory for the Wekiva River Protection Area. The Water Management District must also establish minimum flows and minimum water levels for surface waters in the Wekiva River System and minimum groundwater levels within the Wekiva Basin.[508]

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502. Fla. Stat. § 373.415 (1989). The boundaries of the Wekiva River System are defined in Fla. Stat. § 369.303(10) (1989).

503. Fla. Stat. § 373.415(1) (1989).

504. Id. § 373.415(1)(a),(b),(c).

505. Id. § 373.415(1).

506. Id. § 373.415(2).

507. Id. § 373.415(6).

508. Id. § 373.415(3).

C. Regional Agencies

1. St. Johns River Water Management District - MSSW Wekiva Rule Criteria

The Water Management District promulgated rules to implement the statutory directives of Section 373.415, Florida Statutes, which lower permitting thresholds[509] and provide for additional standards and criteria[510] for MSSW applications in the Wekiva River Hydrologic Basin (Basin). The permitting program for areas outside the basin is discussed supra. Applicants for MSSW permits within the basin must satisfy the districtwide standards and criteria in Chapters 40C-4 and 40C-40, Florida Administrative Code, and the basin specific criteria contained in Chapters 40C-4 and 40C-41, Florida Administrative Code.

A MSSW permit is required prior to the "construction, alteration, operation, maintenance, abandonment or removal of a surface water management system" within the basin which (1) serves a project with a total land area greater than or equal to ten acres, (2) involves the placement of one-half acre or more of impervious surface, or (3) is located within the Wekiva River Riparian Habitat Protection Zone.[511] Table 8 illustrates the differences between MSSW permitting thresholds for systems inside and outside of the Wekiva Basin.

TABLE 8

DIFFERENCES BETWEEN MSSW AND WEKIVA BASIN MSSW PERMIT THRESHOLDS

Parameter	MSSW Permit	Wekiva MSSW Permit
Project Size	40 acres	10 acres
Impervious Surface	12 acres	0.5 acres
Riparian Zone	Not Applicable	Any MSSW System

509. Fla. Admin. Code § 40C-4.041(2)(b)3,5,8 (August, 1989).

510. Fla. Admin. Code § 40C-41 (Sept. 1988).

511. Id. § 40C-4.041(2)(b)3,5,8.

Projects which trigger the MSSW permitting thresholds within the Wekiva Basin must satisfy the criteria in rule 40C-4.301 as well as criteria specific to the basin. Rule 40C-41.063 establishes five criteria for projects within the Wekiva River Hydrologic Basin:

1) Recharge Standard: Projects located in Most Effective Recharge Areas must retain within the project three inches of runoff from all directly connected impervious areas, or show that post development recharge capacity is equivalent or greater than pre-development recharge capacity;

2) Storage Standard: MSSW systems are prohibited from causing a net reduction in flood storage within certain 100-year floodplains within the basin;

3) Erosion, Sediment Control, and Water Quality Standard: The rule creates a Water Quality Protection Zone which extends one half mile from the Wekiva River and many of its tributaries, and also extends one quarter mile from any wetland abutting an Outstanding Florida Water. MSSW systems which serve projects located partially or completely within the zone, or which serve projects with a total land area equal to or greater than 120 acres, must submit an erosion and sediment control plan as part of their MSSW permit application. Applicants must submit a plan which provides

> reasonable assurance ... that during construction or alteration of the system (including revegetation and stabilization), erosion will be minimized and sediment will be retained on-site.[512]

In addition, the plan must conform with erosion and sediment control principles and criteria contained in Sections 18.2 and 18.3 of the Water Management District Applicant's Handbook. Figure 1 illustrates the Water Quality Protection Zone.

Projects located within 100 feet of an Outstanding Florida Water (OFW) (the Wekiva River and most of its tributaries are designated OFWs) or within 100 feet of a wetland which is adjacent to an OFW must provide

> reasonable assurance that the construction or alteration of the system will not cause sedimentation within these wetlands and that filtration of runoff will occur prior to discharge into these wetlands and waters.[513]

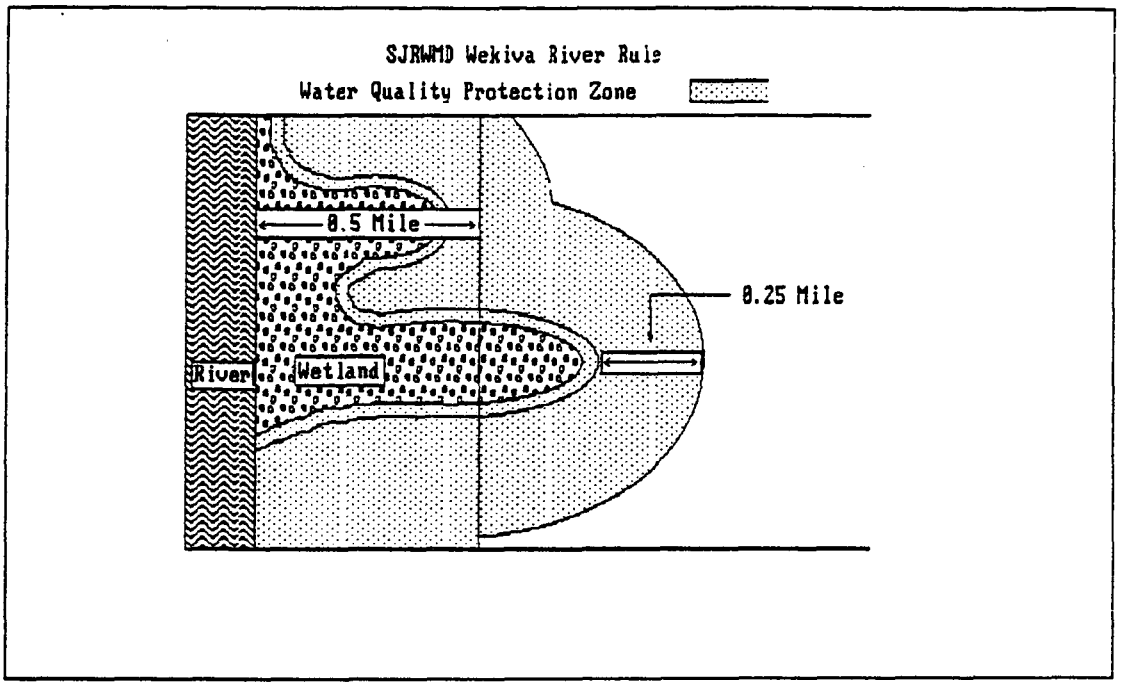
The standard is presumed met if any one of the following criteria is satisfied: (1) a 100-foot strip of undisturbed vegetation is retained landward of the OFW or abutting wetland, through which runoff from construction or alteration of the system is allowed to naturally sheetflow (limited construction of outfall structures may be permitted within this vegetative strip); (2) perimeter controls specified in the rule are constructed and maintained at all outfall points prior to construction or alteration of the system, and a 25-foot strip of undisturbed vegetation is retained landward of the OFW or abutting wetland (limited construction of outfall structures may be permitted within this vegetative strip); (3) during construction

512. Id. § 40C-41.063(C)1.

513. Fla. Admin. Code § 40C-41.063(3)2 (August, 1989).

Figure 1

Wekiva River Water Quality Protection Zone



or alteration of the system, no direct discharge occurs to the OFW or abutting wetland during the 10-year, 24-hour storm event or during de-watering activities. On-site storage must be available for use within 14 days of the rainfall event. A 25-foot strip of vegetation must be retained landward of the OFW or abutting wetland (limited construction of outfall structures may be permitted within this vegetative strip).

4) Drawdown Standard: The rule creates a Water Quantity Protection Zone which extends 300 feet landward from wetlands which abut the Wekiva River and many of its tributaries. When any part of a system is located within the zone, the applicant must provide

> reasonable assurance that ... the system will not cause ground water table drawdowns which would adversely affect the functions provided to aquatic and wetlands dependent species ... by the referenced wetlands.[514]

A system is presumed to satisfy the drawdown standard if it will not cause a ground water table drawdown within the Water Quantity Protection Zone.[515] Figure 2 illustrates the Water Quantity Protection Zone.

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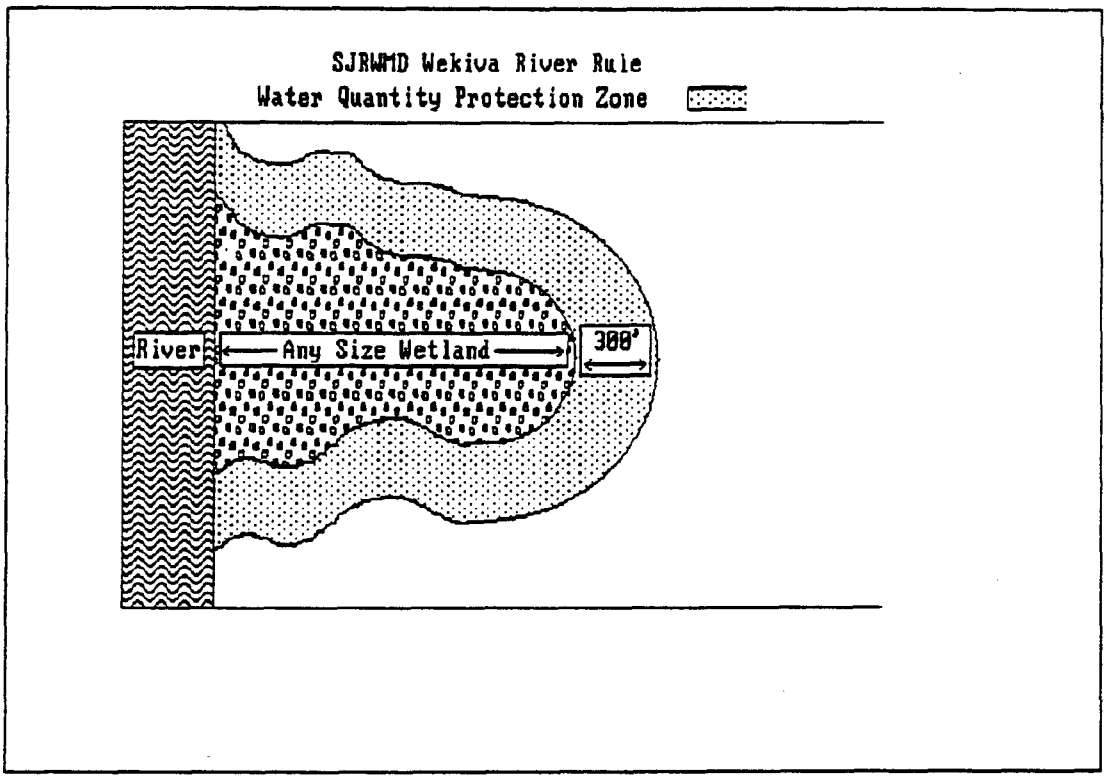
514. Id. § 40C-41.063(d).

515. Id.

Figure 2

Wekiva River Water Quantity Protection Zone



5) Riparian Wildlife Habitat Standard: The rule creates a Riparian Habitat Protection Zone which includes 1) wetlands abutting the river and its tributaries, 2) uplands within fifty feet of abutting wetlands, and 3) uplands which are within 550 feet of the river's edge.[516] Figure 3 illustrates the Riparian Habitat Protection Zone.

An applicant must provide

> reasonable assurance that the construction or alteration of a system will not adversely affect the abundance, food sources, or habitat (including its use to satisfy nesting, breeding and resting needs) of aquatic or wetland-dependent species provided by the [zone].[517]

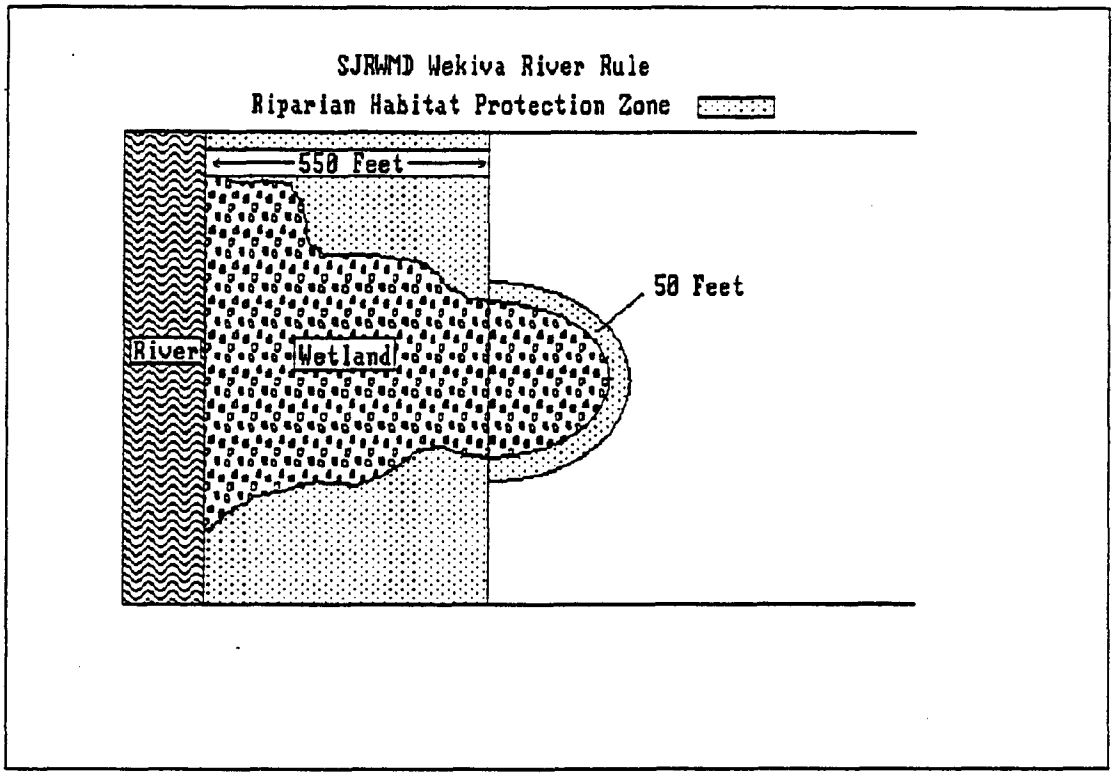
Within the Riparian Habitat Protection Zone, the construction of buildings, golf courses, impoundments, roads, canals, ditches, swales, and any land clearing resulting in the creation of any system is presumed

516. Id. § 40C-41.063(e)1.

517. Id. § 40C-41.063(e).

Figure 3

Wekiva River Riparian Habitat Protection Zone



to violate the Riparian Wildlife Habitat standard.

2. East Central Florida Regional Planning Council - Comprehensive Plan Policies

The Wekiva River Protection Act directs the East Central Florida Regional Planning Council (Planning Council) to adopt policies to protect the natural resources in the Wekiva River Protection Area.[518] The Planning Council adopted the following policies:

> Policy 43.11: Due to its unique regional significance as an Outstanding Florida Water, Aquatic Preserve and Wild and Scenic River, the East Central Florida Regional Planning Council shall consider the Wekiva River to be a Regionally Significant Resource deserving of special attention. All activities which have the potential to adversely affect the water quality, water quantity or wildlife habitat values of the Wekiva River shall be considered by the Council as impacts to a Regionally Significant Resource and shall be reviewed accordingly.
>
> Policy 43.8: In order to protect the quality and quantity of surface waters and provide habitat for semi-aquatic or water-dependent terrestrial species of wildlife, buffer zones should be established, by appropriate federal, state and local agencies, landward of regionally

518. See supra text accompanying note 500.

significant wetlands, except where such buffers would be ineffective, inappropriate or inconsistent with the public interest. The landward extent of wetland buffer zones shall be determined based on scientific evaluation of site specific conditions, including the nature of the existing soils, vegetation, topography, hydrology, water quality, wildlife diversity and the resource protection status of the receiving waters. No activity should be permitted within the buffer zone unless the proposed activity can be shown to not pose a significant adverse threat to water quality, water quantity or wildlife habitat for wetland-dependent species, or where it can be demonstrated that the project is clearly in the public interest consistent with Policy 56.1, 56.2, and 56.4. Buffer zones should consist of intact natural communities comprised of appropriate native species in the canopy, shrub and understory layers.

These policies provide some guidance for local governments attempting to address the requirements of the Wekiva River Protection Act. The policies are also used by the Planning Council to review Developments of Regional Impact in the Wekiva River Protection Area.

D. Local Governments

1. Seminole County

Seminole County responded to the Wekiva River Protection Act (Act) with a study which identifies existing comprehensive plan elements and regulations and recommends new provisions which address requirements of the Act.[519] Existing conservation oriented provisions of Seminole County are discussed supra. Accordingly, this discussion focuses on comprehensive plan provisions and regulations adopted in response to the Act. The study was adopted by Seminole County but has not been approved by the Department of Community Affairs.

Seminole County comprehensive plan and land development regulation amendments address the requirements of the Act by:[520]

1) using conservation easements or dedication of open space areas to preserve ecologically significant communities,
2) relying on the wetland ordinance and the Planning Guidelines For Natural Resources to protect habitat for aquatic, wetland-dependent, endangered, and threatened wildlife, and species of special concern,
3) coordinating with the Water Management District, the Department of Natural Resources, and the Florida Game and Fresh Water Fish Commission during development review to ensure that development orders and permits are consistent with the Act, Water Management District protection zone rules, and wildlife regulations,

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519. Seminole County, Fla., Amendments to the Elements of the Seminole County Comprehensive Plan (Feb. 28, 1989).

520. Id. at 38-49.

4) enforcing all clearing and building setbacks along the Wekiva River imposed by the Water Management District or other agencies, and establishing a minimum 200-foot clearing and building setback measured from the ordinary high water elevation or the landward limit of conservation areas,

5) requiring all development to conform with provisions of the Act, regardless of the land use designation or zoning classification of the property,

6) designating most lands within the Wekiva River Protection Zone as conservation, general rural (maximum of 1 dwelling unit per acre), suburban estates (maximum of 1 dwelling unit per acre), recreation, or public use,[521]

7) requiring planned developments which are adjacent to the Wekiva River or adjacent wetlands to maintain the rural density and character of the area, to concentrate development on the portions of the site furthest away from waters and wetlands, and to restrict required open space uses to passive recreational uses,

8) preventing the subdividing of land from disrupting implementation of protection zones, maintenance of the rural character of the area, and water quality and quantity, and

9) encouraging the use of central sewer and discouraging the use of individual septic systems (central sewer may be required for major developments).

2. Orange County

Orange County conducted the Wekiva River Small Area Study in response to the Wekiva River Protection Act (Act).[522] The study examined existing conditions in the Wekiva River Protection Area and created goals, objectives, and policies to address the requirements of the Act. The study has been adopted as part of the Orange County Comprehensive Plan and has been approved by the Department of Community affairs as satisfying the requirements of the Act.

The goal of the Wekiva River Small Area Study is to "preserve the water quality, hydrology, wetlands, flora and fauna, and recreational and scientific value of the Wekiva River."[523] In order to accomplish this goal, the Study directs that all new development will be low density residential, agricultural, or low intensity recreational in character.[524] The study designates state owned lands as conservation areas, and limits densities within the Rural Service Area to one dwelling per five

521. Id. at 42; Seminole County, Fla., Seminole County Comprehensive Plan VI-A37 (July 11, 1989).

522. Orange County, Fla., Wekiva River Small Area Study, Ordinance 88-6 (April, 18, 1988).

523. Id. § IV., Goal 1.

524. Id. § IV., Objective 1.

acres.[525] Gross residential densities within the Urban Service Area are limited to two units per acre.[526] The study prohibits other types of development.[527]

The Study directs that the natural resources of the Wekiva River be protected by:[528]

1) prohibiting all activities within a buffer zone 550 feet landward from the edge of waters or the landward edge of connected wetlands, whichever is greater, unless the activity can be shown to "pose no significant threat to water quality, water quantity, or wildlife habitat for wetland-dependent species,"
2) continuing to apply the Orange County Conservation Ordinance,
3) encouraging clustering of development or planned developments,
4) requiring developers to consult with the Florida Game and Fresh Water Fish Commission whenever endangered, threatened, or special concern plants or animals are present or likely to be present,
5) requiring developers of subdivisions and planned developments within the 100-year floodplain to minimize clearing of native vegetation (clearing only allowed when necessary for roads, utilities, or pedestrian access routes),
6) monitoring surface water quality in the study area,
7) requiring pre-development and post-development stormwater runoff rates to be equal,
8) prohibiting developments which may degrade groundwater quality,
9) discouraging the use of septic tanks in the 100-year floodplain and encouraging the use of public utilities (a septic tank permit may be issued if the applicant shows there will be no detriment to water quality),
10) requiring the density or intensity of development on parcels adjacent to the Wekiva River to be concentrated on portions of the parcel furthest from the river,
11) preventing subdividing of parcels which interferes with the 550-foot buffer zone, and
12) coordinating with the Water Management District to monitor groundwater quality, and to prevent saltwater contamination.

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525. Id. § IIIB.

526. Id.

527. Id.

528. Id. § IV, objective 2, policies 2.1-2.12.

3. Lake County

Lake County recently submitted proposed comprehensive plan amendments[529] and land development regulations[530] for review by the East Central Florida Regional Planning Council and the Department of Community Affairs. The Lake County response to the Wekiva River Protection Act includes several innovative mechanisms, such as Transferrable Development Rights (TDRs) and a Development Points Rating System, which encourage protection of sensitive lands while providing property owners with options for use of their land.

The Lake County amendments establish two overlay protection zones which limit density and intensity of land use within the Wekiva River Protection Area. District 1 corresponds with the farthest boundary established by the Water Management District's Wekiva River Hydrologic Basin Protection Zones and limits maximum density to one dwelling unit per 40 net acres.[531] Net acres is defined as the total acreage of the parcel minus (1) wetlands defined by the Water Management District or Lake County, (2) lands within the Water Management District's Wekiva River Riparian Habitat Protection Zone, (3) lands within the 100-year floodplain, and (4) road right of ways and easements for ingress and egress.[532] Alternatively, density may be increased to one dwelling unit per 10 net acres through successful application of the Development Point Rating System (infra).[533] District 2 includes most of the remaining lands within the Wekiva River Protection Area and limits maximum density to one dwelling unit per 20 net acres.[534] Density may be increased to one dwelling unit per five net acres through successful application of the Development Point Rating System.[535]

The amendments create a TDR system where Districts 1 and 2 are designated as sending areas.[536] Owners of land within the sending areas may sell their development rights to owners of land within designated receiving areas. Land owners within the receiving areas who purchase development rights may then increase the density of development on their lands. The amendments create two receiving areas into which Lake County wants to direct development activities. Receiving area number

529. Lake County, Fla., The Wekiva River Protection Area Comprehensive Plan Amendment (March 6, 1990).

530. Lake County, Fla., Wekiva River Protection Area Amendment to Development Regulations (March 6, 1990).

531. Lake County, Fla., The Wekiva River Protection Area Comprehensive Plan Amendment 12 (March 6, 1990).

532. Id. at 5.

533. Id. at 12.

534. Id. at 12-13.

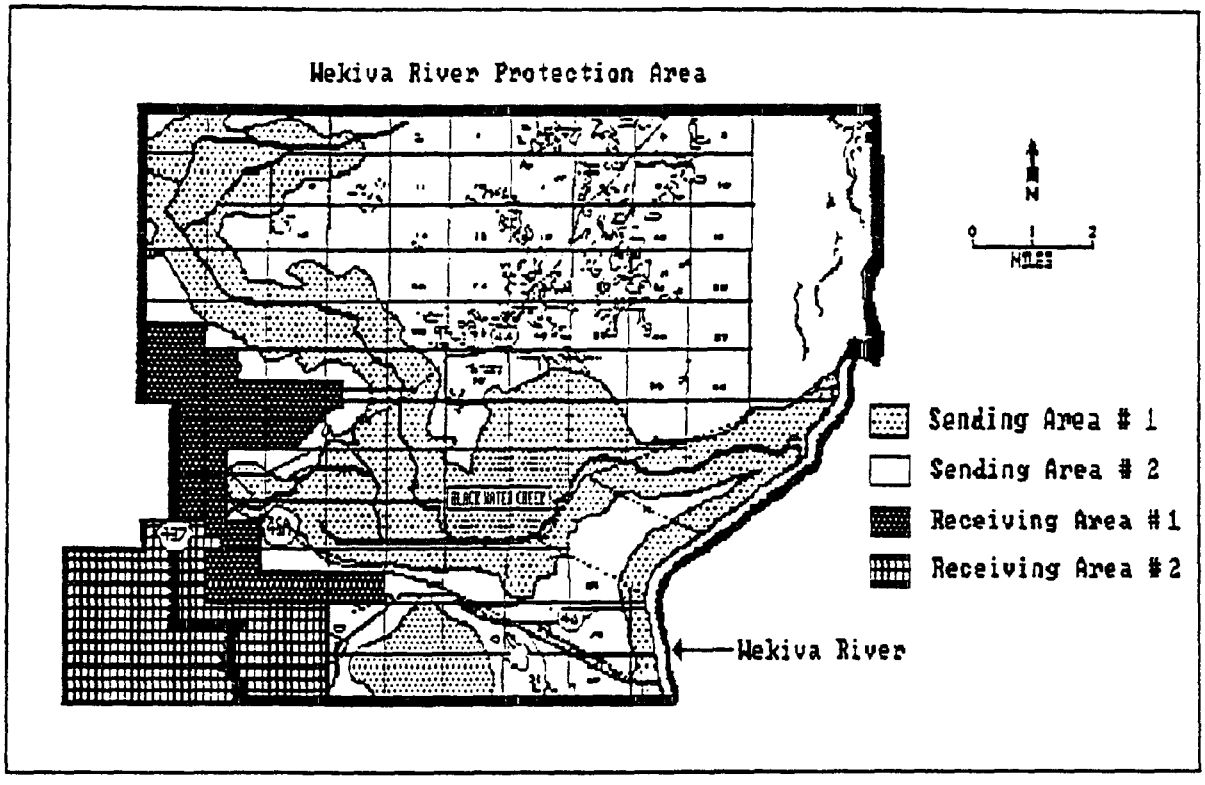
535. Id. at 13.

536. Id. at 11-13.

one allows a maximum density of one dwelling unit per twenty net acres.[1] However, density may be increased to a maximum of one dwelling unit per five net acres through the application of the Development Point Rating System,[2] and to a maximum of one dwelling unit per one net acre through application of the point system combined with the purchase of TDRs from Sending Areas 1 and 2.[3] An existing urban area is designated as Receiving Area number 2, within which land may be developed at a maximum density of five and one half dwelling units per one net acre through the purchase and use of TDRs from Sending Areas 1 and 2.[4] Figure 4 illustrates the Lake County TDR scheme for the Wekiva River Protection Area.

Figure 4

Lake County TDR Scheme for Wekiva River Protection



[1]Id. at 13.

[2]Id.

[3]Id. at 13-14.

[4]Id. at 16-17.

The Development Point Rating System assigns numerical values to various rating criteria. The objectives of these criteria are to

> ensure environmental protection; control urban sprawl; maximize land use efficiency; promote the efficient use of public facilities; ensure that services required by development are in place or are programmed concurrent with development impacts; and to direct appropriate growth patterns within the Wekiva River Protection Area.[541]

The Development Point Rating System awards points depending upon the degree to which the proposed development

1) is submitted as a Planned Unit Development,
2) is located within a designated TDR receiving area,
3) purchases TDRs,
4) utilizes innovative site design which protects more environmentally sensitive lands than would be protected under existing regulations (points are awarded for the use of buffers, preservation of native vegetation, dedication of preservation areas, preservation of existing hydrological patterns, and the use of clustering),
5) is subject to pre-existing environmental constraints,
6) contributes to the expansion of an existing or proposed wildlife corridor,
7) provides sufficient habitat for species designated as threatened, endangered, or of special concern,
8) provides for affordable housing,
9) utilizes existing infrastructure (including roads, potable water supply, sanitary sewer service, irrigation water supply, fire protection, schools, and neighborhood parks.[542]

Proposed developments are awarded points depending upon the degree to which they satisfy the rating criteria. The amendments establish ranges of scores which correspond to the amount of density increase which will be allowed. Proposed developments with high scores are allowed to develop at higher densities than developments with low scores.[543] Proposed developments which score below certain threshold are prohibited from increasing density.[544] Although the point system establishes guidelines for determining whether increases in density should be granted, the amendments state explicitly that the achievement of points will not bind the county to allow an increase in density.[545]

The amendments establish minimum building and clearing setbacks from the Wekiva River and associated wetlands. In areas which are regulated by the Water Management District, the county setbacks will conform to those established by the Water Management District. In areas which are not regulated by the Water Management District, the setback will be a minimum of 200 feet from the

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541. Id. at 17.

542. Id. at 17-23.

543. Id. at 23-24.

544. Id.

545. Id. at 17.

ordinary high water mark, 50 feet from associated wetlands, or as provided by the Lake County Code, whichever is farther.[546]

II. Myakka River

In 1985, the Florida Legislature designated a portion of the Myakka River located in Sarasota and Charlotte counties as a Florida Wild and Scenic River. The Myakka River Wild and Scenic Designation and Preservation Act (Act)[547] directs the Department of Natural Resources (DNR) and the Myakka River Management Coordinating Council (Council) to develop a plan for the management, administration, and protection of a portion of the Myakka River. The Council recently adopted the Myakka Wild and Scenic River Management Plan (Plan), which was prepared by a consultant, DNR, and the Council.[548]

The plan describes existing resources and regulations, identifies threats to the resources, and suggests management objectives and specific actions to remedy the problems. The Plan identifies development activities near the river as the primary threat to the river system. Such activities often result in the loss and degradation of wetlands, uplands, wildlife, wildlife habitat, water quality, water quantity, aesthetics, and recreation opportunities.

The plan creates three geographical areas, based on proximity to the river channel, and recommends a number of specific actions to help preserve each area. The three areas are the river and adjoining wetlands (River Area), a 220-foot wide contiguous Wild and Scenic Protection Zone (Protection Zone), and the remaining watershed (Watershed). The River Area receives the highest degree of protection, the Protection Zone receives intermediate protection, and the Watershed receives the least protection. Figure 5 illustrates the Myakka River Area and Wild and Scenic Protection Zone.

The Plan recommends that DNR adopt a rule and permitting system for the River Area which: (1) reviews activities which have an adverse impact on the river system; (2) identifies activities which are prohibited, such as point discharges of waste or effluent, major new activities which would adversely alter natural or historic hydrologic conditions, new marinas, and structures not related to water dependent activities; (3) identifies activities which may be conducted after obtaining a permit, such as creation or maintenance of shore protection structures, docks, decks, and roads; and (4) identifies activities which are allowed without obtaining a permit, such as commercial fishing, certain agricultural and forestry activities, and drainage and water management practices which do not have an adverse

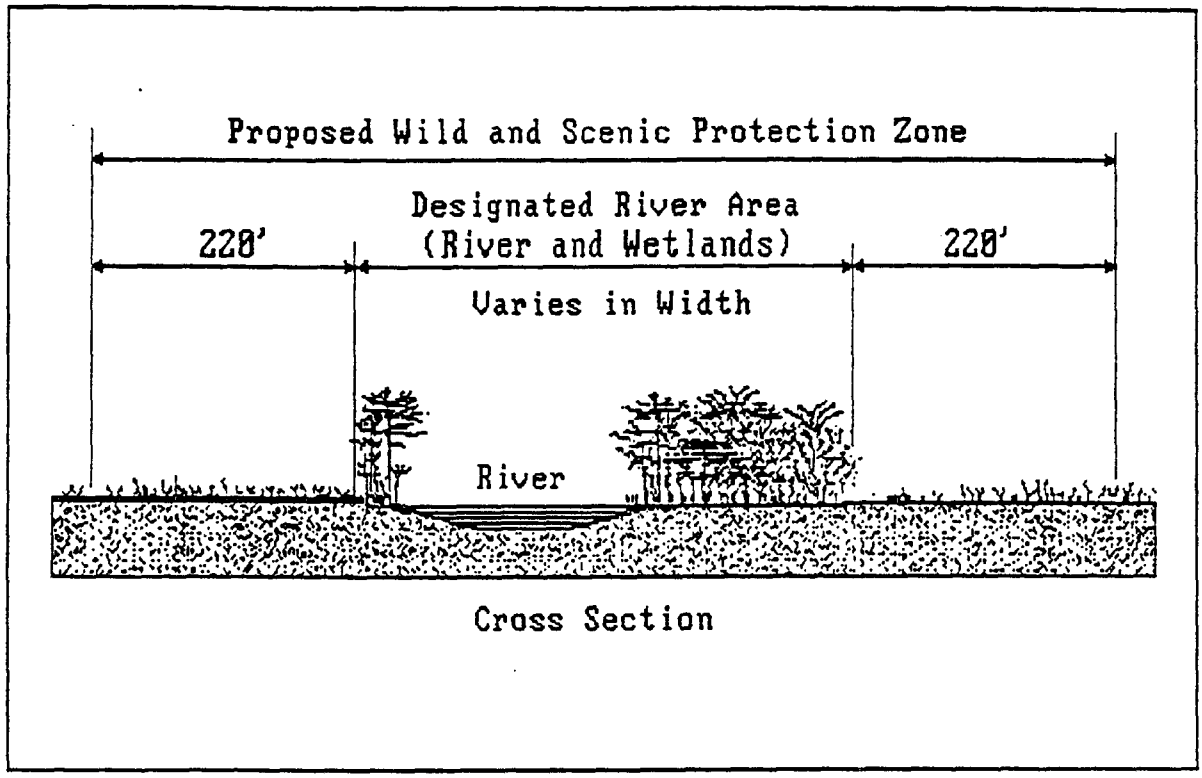
546. Id. at 31.

547. Fla. Stat. § 258.501 (1989).

548. Myakka Wild and Scenic River Management Plan, Prepared for the Florida Department of Natural Resources and Myakka River Management Coordinating Council by Hunter Services, Inc. (April 6, 1990).

Figure 5

Myakka River Area and Wild and Scenic Protection Zone



affect on water quality.

The Plan uses the average width of the river's visual corridor (the distance a person can see when standing along the river and looking landward) as its basis for determining the width of the Zone. The Plan recommends that the Legislature amend the Act to: (1) establish the Zone; (2) require local governments to amend their comprehensive plans and adopt regulations to implement the recommendations in the Plan; and (3) authorize DNR to carry out the management of the Zone if the local governments fail to adequately manage the zone. The Plan recommends that local governments provide regulatory protection for wetland-fringing hammocks and uplands within the Zone.

The Plan states that existing regulatory authorities are adequate to manage the Watershed area, although some of the regulations should be strengthened. The Plan recommends that local governments adopt strict performance standards for reviewing new development to ensure that water quality and quantity are adequately protected. The Plan recommends that the South West Florida Water Management District adopt special Myakka basin water management rules which strengthen review criteria for surface water management permit applications. In addition, the Plan recommends that the Act be amended to require all state and local agencies to provide DNR with notice of all requests for activities which might adversely affect the river.

In addition to the area specific recommendations, the Plan recommends the following actions for the entire basin: (1) agencies should acquire headwater lands, wetlands, tributaries, and lands bordering the Myakka River; (2) DNR should adopt a prescribed burning program; (3) the South West

Florida Water Management District and the Department of Environmental Regulation should establish resource based water quality and quantity standards for the river; and (4) agencies should conduct studies to evaluate wildlife habitat, wildlife populations, plant communities, water quality, hydrology, and a variety of other parameters.

III. Suwannee River

In November of 1988, Governor Martinez created the Suwannee River Task Force (Task Force)[549] to study the effects of increasing growth on the Suwannee River system. The Task force was charged with

> analyzing and evaluating the effectiveness of current planning, regulatory, and land acquisition programs related to the Suwannee River and to develop a plan for the future protection and management of the Suwannee River and related Resources. The plan is to include recommendations on the need for administrative and legislative action to implement measures to protect and manage the resources of the Suwannee River.[550]

The Task Force limited its area of study to the natural resources associated with the 100-year floodplain of the Suwannee River, as well as any activities outside the floodplain which could have an adverse impact on the floodplain itself.[551]

The Task Force found that the Suwannee River system was in good shape and that the existing local government comprehensive planning process and the Surface Water Improvement and Management (SWIM) program should be able to adequately protect the river system. The Task Force acknowledged that these two programs were as yet unproven, but stated that with sufficient guidance the programs should be able to effectively protect the river system.

The Task Force recommended a number of guidelines for implementing local government comprehensive planning and SWIM programs. A complete list of the Task Force recommendations is contained in Appendix H. The following recommendations of are particular interest:

1) Designate the floodplains of the Suwannee, Santa Fe, Alapaha and Withlacoochee Rivers as special planning areas.
2) Restrict development in the special planning areas to low-density residential, forestry, low-intensity agricultural, public recreational and limited commercial uses.

....

549. Fla. Exec. Order No. 88-246 (Nov. 23, 1988).

550. Suwannee River Task Force, Report to Governor Bob Martinez 3 (November 15, 1989).

551. Id.

7) Encourage incentives to prevent conversion of forestry lands to more intensive land uses.

8) Where possible, development should occur outside the 100-year floodplain and be concentrated as far from any water bodies as practicable.

9) DRI thresholds for projects wholly or partially within the 100-year floodplains should be lowered by 50%.

....

12) Local governments should amend their floodplain ordinances to be consistent with Suwannee River Water Management District buffer requirements. [75 feet]

13) Areas should be identified where additional setbacks are necessary to ensure adequate habitat for wildlife dependent on the river system.

14) There should be adequate setbacks to protect the aesthetic quality of the river.

15) All development in the floodplain should comply with existing buffer requirements and with minimum standards and requirements of the FEMA model ordinance.

....

25) Significant degradation should be defined as any unnatural variation from ambient water quality. There is to be no further degradation of water quality in the Suwannee River and its OFW tributaries.

....

28) The Department of Environmental Regulation should implement a permitting system for high-intensity agriculture, particularly for dairies, specific to the Suwannee River basin.

....

30) Stormwater management systems should be developed in areas of high residential density.

31) Endorse the changes to septic tank rules that would prohibit septic tanks in hydric soils or where high water table is at ground level, and prohibit mounding in floodways.

....

33) Assess whether septic tanks along the river system are operating as permitted or whether enforcement actions are necessary.

....

36) Prohibit all septic tanks, private wells and central wastewater facilities in the 10-year floodplain.

....

41) Prepare a regional recreational development and management plan for the publicly owned lands within the study area.

....

44) Assess wildlife needs in the Suwannee basin to determine which additional lands need to be protected for conservation purposes.[552]

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552. Id. at 1,2.

The Task Force also recommended a program to monitor implementation of the recommendations. The Task Force recommended formation of a Policy Advisory Committee, composed of one representative from all affected counties and regional and state agencies.[553] The Policy Advisory Committee would be responsible for (1) reviewing governmental actions with respect to development in the floodplain, (2) analyzing the governmental actions, identifying deficiencies, and making recommendations to correct deficiencies, and (3) preparing an annual comprehensive report to be sent to the Department of Community Affairs and all participating entities.[554] The Suwannee River Water Management District, the North Central Florida Regional Planning Council, and the Department of Community Affairs should agree to provide staff and support to the Policy Advisory Committee.[555] The Task Force recommended that the Department of Community Affairs be given responsibility for monitoring the overall success of the program and for taking actions to correct deficiencies in the program.[556]

IV. Summary and Conclusions

An examination of efforts to protect the Wekiva, Myakka, and Suwannee Rivers reveals some strengths and weaknesses of various approaches to river protection. Plans and recommendations for the Myakka and Suwannee Rivers are currently in the formative stage, while the plans and regulatory programs for the Wekiva are almost entirely in place. Similarities exist between the three river systems and the Econ Basin, although each of the rivers has distinct characteristics and each is subject to different degrees of development pressure.

The Wekiva River Protection Act assigned primary responsibility for protecting the Wekiva River to local governments and the St. Johns River Water Management District. In addition, the East Central Florida Regional Planning Council and the Department of Community Affairs play an important role in reviewing comprehensive plans, land development regulations, and proposals for Developments of Regional Impact. The approach taken in the Wekiva Basin has a number of strengths. Authorizing the St. Johns River Water Management District, a regional agency, to adopt special regulations for the Wekiva Basin ensures that enumerated values will receive consistent consideration throughout the entire Basin. The use of protection zones of constant width by the Water Management District ensures that District permitting criteria will be applied consistently throughout the Wekiva Basin, simplifies administration because it eliminates the need to map the entire basin, and provides applicants with easily

553. Id. at 32.

554. Id.

555. Id.

556. Id. at 32,33.

determined zones with consistent boundaries. Furthermore, the width of the protection zone is based on scientific findings.

The Act unambiguously directs the Water Management District to establish protection zones and regulations to protect wetland and wetland-dependent wildlife and other important habitat values, such as hydrology and water quantity. The Act removes any uncertainty as to the District's authority to regulate riparian habitat for the benefit of wetland and wetland-dependent wildlife. Although this authority can be implied from general language in Chapter 373, the District had previously been reluctant to regulate riparian habitat without additional legislative direction. The Act made it clear that the Water Management District was authorized, and in fact mandated, to regulate riparian habitat, including riparian uplands, for the benefit of wetland and wetland-dependent wildlife in the Wekiva Basin.

The Act authorized the Water Management District to adopt MSSW permitting thresholds which would prevent significant adverse effects to the river system. The District responded by lowering MSSW thresholds for systems within the Wekiva River Protection Area by over 75%. The effect of lowering thresholds is that now almost all development within the Wekiva River Protection Area has to obtain a MSSW permit from the Water Management District, thereby ensuring comprehensive application of the District's Wekiva Regulations.

The Act requires local governments within the Wekiva River Protection Area to undertake a number of planning and regulatory initiatives. Legislative enumeration of specific values and concerns which local governments must address ensures comprehensive and consistent regulation of the Wekiva River Protection Area. Local governments are well suited to participate in regulation of river systems because they typically regulate all forms of development and can often use existing development review mechanisms to implement new regulations.

Some potential problems and weaknesses with the approach taken in the Wekiva River Protection Act can also be identified. The legislation puts significant responsibility on local governments to do an effective job of protecting the river system when they may not have the money, resources, or inclination to do so. Local governments, charged with addressing the multiple and often conflicting needs of the electorate, may not be the best entities to make decisions regarding protection of limited and unique environmental systems such as rivers.

Individual local government plans and regulations may not result in a comprehensive and uniform protection of the resource. For example, legislative requirements that local governments in the Wekiva River Protection Area adopt setbacks from the river has resulted in Lake and Seminole counties adopting setbacks of 200 feet from the river, while Orange County has adopted a much wider setback of 500 feet from the landward edge of the river or connected wetlands. Similarly, Seminole County limits density on much of the land within the Wekiva River Protection Area to a maximum of 1 dwelling unit per acre, Orange County to 1 dwelling unit per 5 acres, and Lake County to 1 dwelling unit per 20 or 40 net acres.

Local governments need considerable time to develop and implement individual local government comprehensive plans and regulations. For example, Seminole and Orange Counties were able to develop plans and regulations relatively quickly, primarily because they already had some provisions in their comprehensive plans and some regulations which helped satisfy the requirements of

the Act. However, it took Seminole County about six months and Lake County about one and one-half years to adopt regulations for the Wekiva Basin. DCA has not approved the plans and regulations of either county at the time of this writing. The time delays were not that critical in Seminole County because the county had a moratorium in place since 1972.[557] Furthermore, Orange County had very little land which was within the Area, and development pressure was relatively low in Lake County. However, Lake County permitted significant amounts of development after the passage of the Wekiva River Protection Act.

The rapid enactment of protection mechanisms is critical to the preservation of the Econ Basin, where many new large scale developments have been proposed since the Water Management District announced plans to study the basin. Significant acerages of sensitive and irreplaceable habitat may be lost in the time it takes to develop new land development regulations and agency rules. Governmental entities could greatly reduce the amount of unsuitable development by adopting interim regulations until new land development regulations and rules are developed.

Local government staff indicate it has been difficult to administer the Wekiva regulations. Local governments find it difficult to interpret what types of projects may be allowed within the Water Management District protection zones. The Water Management District lists some activities as presumed adverse, but reviews each project on a case by case basis. Accordingly, local governments are often unable to give applicants for development permits meaningful feedback until the Water Management District has reviewed the application. Local government staff indicate that an applicant may have to make five or six submittals per development.

The Wekiva legislation requires the Water Management District and local governments to protect aquatic and wetland-dependent species, and habitat of endangered, threatened, or special concern species. However, the legislation fails to require protection of upland species of wildlife within the Wekiva Basin. While low density requirements may help preserve some upland habitat, there are no assurances that adequate upland habitat will be preserved in the future.

The Wekiva legislation fails to provide for setbacks from isolated wetlands within the Wekiva Basin. Studies indicate that isolated wetlands provide important habitat for certain species of wildlife and that upland buffers are needed to protect the water quality, water quantity, and habitat value of these wetlands.

The Myakka River plan contains similar recommendations to those of the Wekiva River Task Force and shares many of the same strengths and weaknesses. The plan recommends that the Legislature require local governments to amend their comprehensive plans and adopt regulations to protect the river resources and the watershed. As with the Wekiva, amendment of comprehensive plans and regulations will be time consuming. The Plan also recommends that the South West Florida Water Management District adopt special MSSW permitting criteria for the Myakka Basin.

There are several important differences between the Myakka recommendations and regulation of the Wekiva Basin. The Myakka plan provides for an additional set of regulations to protect the river and adjoining wetlands by recommending that the Department of Natural Resources adopt regulations in

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557. Seminole County, Fla., Amendments to the Elements of the Seminole County Comprehensive Plan, Attachment 5 (Feb. 28, 1989).

addition to local government and water management regulations. Such an approach could provide significant protection for the Myakka River and Basin depending upon the strength of each regulatory entities' regulations.

The width of the Contiguous Zone appears to be based on aesthetics or convenience rather than scientific findings. While the width (200 feet) may be appropriate for portions of the river, there are no assurances that the zone will provide adequate habitat for wildlife species.

The Suwannee River Task Force findings and recommendations differ significantly from findings for the Wekiva and Myakka Rivers. The Suwannee Task Force found that existing local government comprehensive planning processes and SWIM programs were adequate to protect the natural resources of the Suwannee River system. While the Task Force recommended a number of guidelines, they did not recommend any additional legislation to ensure that protective measures are created or implemented. Furthermore, the Task Force recommended that a number of additional studies be conducted which could take considerable time.

The approach taken for the Wekiva River Basin appears to be appropriate for the Econ River. A grant of additional legislative authority to the Water Management District would remove any uncertainty as to the District's authority to regulate uplands for the benefit of wildlife. Basin specific MSSW criteria could provide comprehensive and consistent protection for the Econ River and Basin. Legislative directives requiring local governments to modify comprehensive plans and land development regulations would ensure that these actions are completed. The approach taken for the Wekiva Basin could be improved by providing more specificity in the enabling legislation, such as establishing a minimum buffer width which all local governments must adopt, defining what constitutes "rural character," and providing the Water Management District with authority to consider all species of wildlife when reviewing MSSW applications. In addition, a legislative directive requiring regulatory entities to adopt interim regulations would prevent adverse development while the entities are developing permanent regulations.

HISTORICAL RESOURCES

(Archaeological, Architectural, Historic Properties)[558]

I. Federal

Federal legislation pertaining to cultural resources dates to the early 20th century. These laws, executive orders, directives, and regulations apply to actions within the Econlockhatchee Basin which involve federal activities, permitting, or funding (examples: highways, Corps of Engineers permits, federal acquisitions). The applicable laws, orders, directives, and regulations are:

1) Antiquities Act of 1906 (P.L. 59-209). This law provides for the protection of historic or prehistoric remains on federally owned or controlled lands. It also establishes criminal sanctions for destruction or appropriation of antiquities from federal lands, and authorizes a permit system for professional investigation of antiquities on federal lands.

2) Historic Sites Act of 1935 (P.L. 74-292). This law makes the Secretary of the Interior responsible for historic sites and buildings. The law also requires the preservation of properties "of national, historical or archaeological significance." It authorizes designation of historic and prehistoric sites and authorizes interagency efforts for preservation.

3) National Historic Preservation Act (NHPA) of 1966, as amended in 1980 (P.L. 89-665 and P.L. 96-515). This law is one of the most important pieces of legislation concerning cultural resources because it brings together all previous federal antiquities legislation into a concise form and establishes the direction for all future federal efforts to conserve and preserve the prehistoric and historic patrimony of the nation. Specifically, it states that:

> The heads of all federal agencies shall assume responsibility for the preservation of historic properties which are owned or controlled by such agency.... Each federal agency shall establish a program to locate, inventory, and nominate to the Secretary of the Interior all properties under the agency ownership or control by the agency that appear to qualify for inclusion on the National Register.... Each federal agency shall exercise caution to assure that any property that might

558. This section of the report was prepared by Lucy Wayne and Martin Dickinson, SouthArc Inc., Gainesville, Fla. (December, 1989).

qualify for inclusion is not inadvertently transferred, sold, demolished, substantially altered, or allowed to deteriorate significantly.

Section 106 of the law prescribes the procedures to be followed by an agency in the event of potential project effects on significant properties.

4) Procedures for the Protection of Historic and Cultural Properties (36 C.F.R. 620 and 36 C.F.R. 800). Regulation 36 C.F.R. 60 provides the legal mechanisms for nominating sites to the National Register of Historic Places. Regulation 36 C.F.R. 800 establishes the legal mechanisms for reviewing projects to determine the potential effects on properties eligible for the National Register. Both regulations provide the criteria for eligibility for the National Register.

5) National Environmental Policy Act (NEPA) of 1969 (P.L. 91-190). NEPA requires the evaluation of the effects of major federal actions on environmental resources, including cultural resources. This act also requires federal agencies to use all practical means to protect and preserve cultural resources. Requirements of this act do not abrogate responsibilities mandated within NHPA.

6) Executive Order 11593 (Protection and Enhancement of the Cultural Environment) (36 C.F.R. 8921). This order directs all federal agencies to make an inventory of the properties under their jurisdiction to determine the presence of cultural resources, nominate eligible properties to the National Register, develop policies which will contribute to preservation of non-federal historic properties, and exercise caution prior to completion of the inventories to ensure that eligible properties are not damaged or destroyed.

7) Archaeological and Historic Preservation Act (AHPA) of 1974 (P.L. 93-291). This act provides a mechanism for preservation of data "...which might otherwise be irreparably lost or destroyed as a result of...any alteration of the terrain caused as a result of any federal construction project or federally licensed activity or program." The act also outlines the required actions to be taken when a project is authorized and establishes funding guidelines for cultural resource management.

8) Archaeological Resources Protection Act (ARPA) of 1979 (P.L. 96-96). ARPA requires permits for the study of archaeological resources on federal lands and imposes both civil and criminal penalties for unauthorized use of such resources. ARPA calls for establishment of uniform regulations to implement the law, published as 29 C.F.R. 229. The law also prohibits release to the public of information concerning the nature or location of any archaeological resource.

9) Guidelines for Recovery of Scientific, Prehistoric, Historic, and Archeological Data: Methods, Standards, and Reporting Requirements (36 C.F.R. 66). This guideline establishes the basic professional standards for compliance with the AHPA of 1974. The standards apply to data recovery, curation, reports, and professional qualifications.

10) Archeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines (Federal Register Vol. 48, No. 190, Part IV). These standards and

guidelines were established to provide technical advice regarding archaeological and historic preservation activities and methods. The standards identify purposes and goals. The guidelines provide more specific guidance on the technical approaches to be utilized.

11) Working with Section 106 (ACHP 1986). This document summarizes the Section 106 process.

12) American Indian Religious Freedom Act (P.L. 95-341). This act provides for the protection of traditional American Indian religious practices. This applies to possession of sacred objects. The law is used in conjunction with Chapter 70 of ARPA to protect Indian sites or relics.

13) Tax Reform Act of 1976 as amended in 1981 and 1986. This act provides tax incentives for preservation or adaptive use of historic buildings, as well as financial disincentives for demolition of historic properties.

II. State

Individual state laws provide the framework within which the federal laws, specifically the National Historic Preservation Act, are implemented. The position of State Historic Preservation Officer (SHPO) is federally mandated and responsible for statewide implementation of the National Historic Preservation Act. In Florida, the SHPO is chief of the Division of Historical Resources (DHR) within the Department of State. Florida's historic preservation legislation consists of the following:

1) Florida Archives and History Act of 1967 (Chapter 267, Florida Statutes 1987), as amended in 1985 and 1986 (Florida Historical Resources Act). This law requires each state agency of the executive branch to be sensitive to the preservation of the state's historic properties. Implementation of this act requires consideration of the effect of any state or state assisted undertaking on such properties, mitigation of adverse effects, establishment of a program to locate, inventory and evaluate all historic properties under state ownership or control, and reuse of historic properties to the maximum extent feasible.

2) Historic Preservation Boards (Chapter 266, Florida Statutes 1989). This act establishes preservation boards for a limited number of Florida cities and counties. These boards exercise preservation authority at the local level with the intent of acquiring and preserving historic properties.

3) State Comprehensive Plan (Chapter 187, Florida Statutes 1989). The comprehensive plan specifically includes cultural resource preservation as one of the policies of the plan. The goal is to increase access to historical and cultural resources and encourage development of a cultural resource program. This Plan is basically used to establish overall state goals in planning.

4) Local Government Comprehensive Planning and Land Development Regulation Act (Chapter 163, Florida Statutes 1989). This law requires each county and municipality to prepare comprehensive plans which will be consistent with those of the State Comprehensive Plan. Historic preservation is addressed under the future land use element, the housing element, and where applicable, the coastal zone protection element. The Act also has provisions for an optional historical and scenic preservation element.

5) Section 193.505, Florida Statutes, 1984. This statute provides for transfer of development rights to the county in exchange for differential tax rates.

6) Community Contribution Tax Credit (Sections 220.183 and 624.5105, Florida Statutes 1989). This incentive provides tax credits for historic preservation through revitalization via contributions to a public organization.

7) Section 704.06, Florida Statutes 1989, as amended in 1986. This law provides for the use of conservation easements on properties for the purpose of preservation of historic elements. Such easements provide a charitable deduction on the federal income taxes.

8) Conservation and Recreation Lands Trust Fund (Chapter 259, Florida Statutes 1989) and Land Acquisition Trust Fund (Section 375.041, Florida Statutes 1989). These acts provide for preservation of historic or archaeological properties through state acquisition.

9) Florida Environmental Land and Water Management Act of 1972 and the Florida Coastal Management Act of 1978 (Chapter 380, Florida Statutes 1989). Section 380.05 of this act provides for designation of Areas of Critical State Concern, which can include areas containing significant cultural resources. Section 380.06 establishes the Development of Regional Impact (DRI) process for developments having a major impact on the region. Questions 19A and B of the Application for Development Approval address cultural resources. Section 380.061 establishes the Quality Developments program, which also includes provision for cultural resources as a criteria. The Coastal Zone Management Act requires that the state follow the federal lead in giving full consideration to historic values when undertaking comprehensive planning and management of coastal lands.

10) Florida Electrical Power Plant Siting Act, the Transmission Line Siting Act, and the Wetlands Protection Act of 1984, as amended in 1985. These acts provide for adoption of rules for protection of the environment during siting of power plants or transmission lines or dredging and filling wetlands.

11) Human Burial Act (Section Q872.02 and 872.05 Florida Statutes 1989). This law provides penalties for disturbing a grave, including archaeological sites. Knowingly disturbing a burial is a felony offense in the state.

At the local level, both counties and municipalities may enact preservation ordinances to protect historic properties and may designate historic sites or districts. Currently, none of the local governments in the Econ Basin have a historical and scenic preservation element in their comprehensive plans.

CONCLUSIONS

The Econ Basin is currently subject to intense development pressures. Development activities, once limited primarily to headwaters of the Little Econ River, are occurring rapidly throughout the basin. These development activities are subject to review under a number of policy and regulatory guidelines and criteria. However, certain resource values are not protected, despite the complex and overlapping planning and regulatory programs.

State and regional planning agencies and local governments identify the need to protect the integrity of the entire river system. Existing and draft local government comprehensive plans recommend that buffers, wildlife corridors, and uplands be preserved adjacent to rivers and wetlands. These recommendations could provide additional protection to the Econ Basin if implemented quickly and effectively. However, a common problem in the creation and implementation of comprehensive plans is that the process often takes several years or more.

The resources of the Econ Basin are subject to a variety of overlapping local, regional, state, and federal regulations. The regulations focus on the management and protection of water quality and quantity, floodplains, wetlands, and wetland-dependent wildlife, but do not provide for adequate protection of upland habitat and wildlife. Uplands adjacent to the Econ River may be developed with limited consideration of wildlife values. Furthermore, wetlands regulations may allow destruction of unique riverine habitat in exchange for wetland creation, monetary compensation, or off-site mitigation. This approach may allow development of considerable wetlands along the Econ River which cannot be replaced with comparable habitat.

The review of planned and ongoing development activities in the basin indicates that the basin will be subjected to increasing development pressures in the future. Development activity in the relatively undeveloped Big and Lower Econ Basins appears to be increasing, as well as in the already highly developed Little Econ Basin. Local government personnel indicate that development requests have increased dramatically in the last two months.

Section I of this study identifies areas within the basin which are threatened and which are critical to the preservation of the Econ River and Basin. This section analyzes the existing regulatory framework and concludes that critical areas are not adequately protected by existing regulations. Section III of this study contains specific management and regulatory initiatives to address the concerns identified in Sections I and II.

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Hunt, E. L. Roy. 1988. Florida's Historic Preservation Structure. In *Historic Preservation in Florida*, E. L. Roy Hunt, John K. McPherson, Caryl A. Brinson. D & S Publishers, Clearwater, Florida.

Wayne, Lucy B. and Martin F. Dickinson. 1987. *Historic Preservation Plan Camp Lejeune, North Carolina*. Water and Air Research, Inc., Gainesville, Florida.

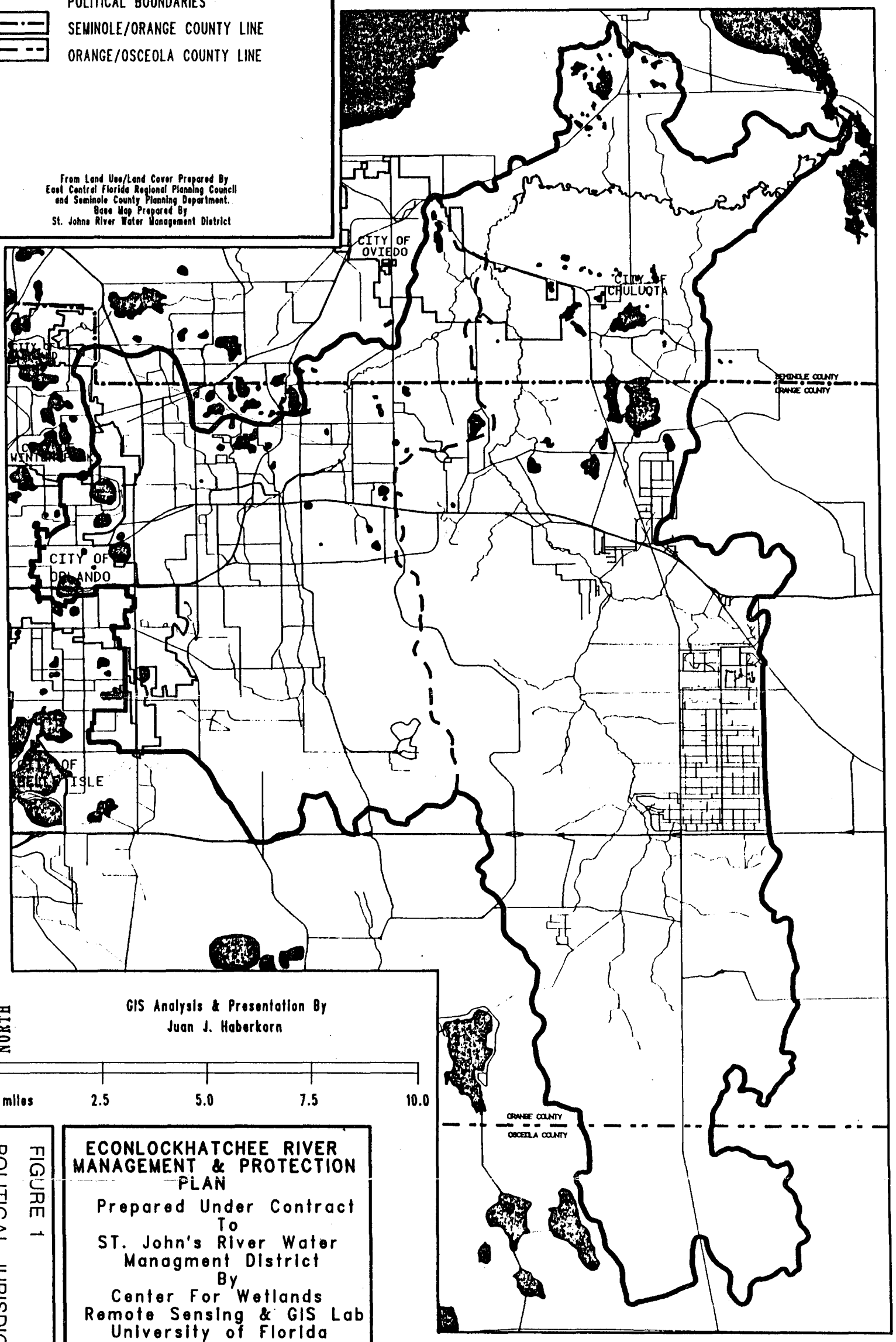
MAP LEGEND:

POLITICAL BOUNDARIES

SEMINOLE/ORANGE COUNTY LINE

ORANGE/OSCEOLA COUNTY LINE

From Land Use/Land Cover Prepared By
East Central Florida Regional Planning Council
and Seminole County Planning Department.
Base Map Prepared By
St. Johns River Water Management District



GIS Analysis & Presentation By
Juan J. Haberkorn

FIGURE 1
POLITICAL JURISDICTIONS

ECONLOCKHATCHEE RIVER MANAGEMENT & PROTECTION PLAN

Prepared Under Contract
To
ST. John's River Water
Managment District
By
Center For Wetlands
Remote Sensing & GIS Lab
University of Florida
January 1990

MARK T. BROWN
CENTER FOR WETLANDS
UNIVERSITY OF FLORIDA

RICHARD HAMANN/JOHN TUCKER
CENTER FOR GOVERNMENTAL
RESPONSIBILITY
UNIVERSITY OF FLORIDA

JOSEPH SCHAEFER
URBAN WILDLIFE PROGRAM
DEPT. OF WILDLIFE & RANGE SCIENCES
IFAS, UNIVERSITY OF FLORIDA

LUCY WAYNE & MARTIN DICKINSON
SOUTHARC, INC.
P.O. BOX 1702
GAINESVILLE, FL. 32602

MAP LEGEND:

DRAINAGE BASINS
LITTLE ECON BASIN
BIG ECON BASIN
LOWER ECON BASIN

From Land Use/Land Cover Prepared By
East Central Florida Regional Planning Council
and Seminole County Planning Department.
Base Map Prepared By
St. Johns River Water Management District

CITY OF OVIEDO
CITY OF CHULUOTA
SEMINOLE COUNTY
ORANGE COUNTY
CITY OF ORLANDO
CITY OF BELLE ISLE
ORANGE COUNTY
OSCEOLA COUNTY

NORTH

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Juan J. Haberkorn

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FIGURE 2
ECON DRAINAGE
SUB-BASINS

ECONLOCKHATCHEE RIVER MANAGEMENT & PROTECTION PLAN

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URBAN WILDLIFE PROGRAM
DEPT. OF WILDLIFE & RANGE SCIENCES
IFAS, UNIVERSITY OF FLORIDA

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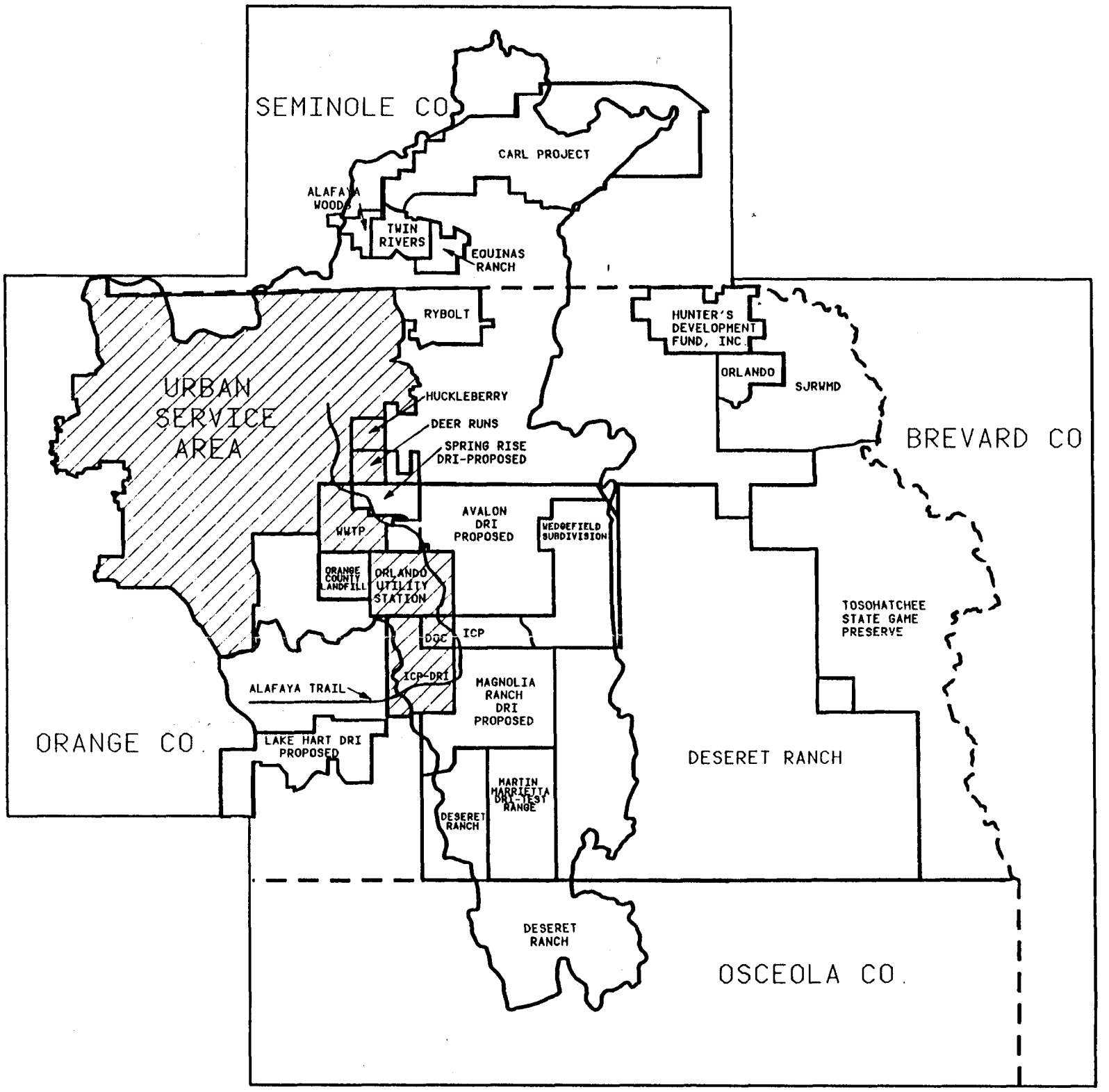

MAP 3
MAJOR DEVELOPMENTS
IN ECON BASIN

ECONLOCKHATCHEE RIVER MANAGEMENT & PROTECTION PLAN

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GIS Analysis & Presentation By
Juan J. Haberkorn

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MARK T. BROWN
CENTER FOR WETLANDS
UNIVERSITY OF FLORIDA

RICHARD HAMANN/JOHN TUCKER
CENTER FOR GOVERNMENTAL
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UNIVERSITY OF FLORIDA

JOSEPH SCHAEFER
URBAN WILDLIFE PROGRAM
DEPT. OF WILDLIFE & RANGE SCIENCES
IFAS, UNIVERSITY OF FLORIDA

LUCY WAYNE & MARTIN DICKINSON
SOUTHARC, INC.
P.O. BOX 1702
GAINESVILLE, FL. 32602

MAP LEGEND:

ROADS STATUS

NEW ROADS

ROAD IMPROVEMENTS

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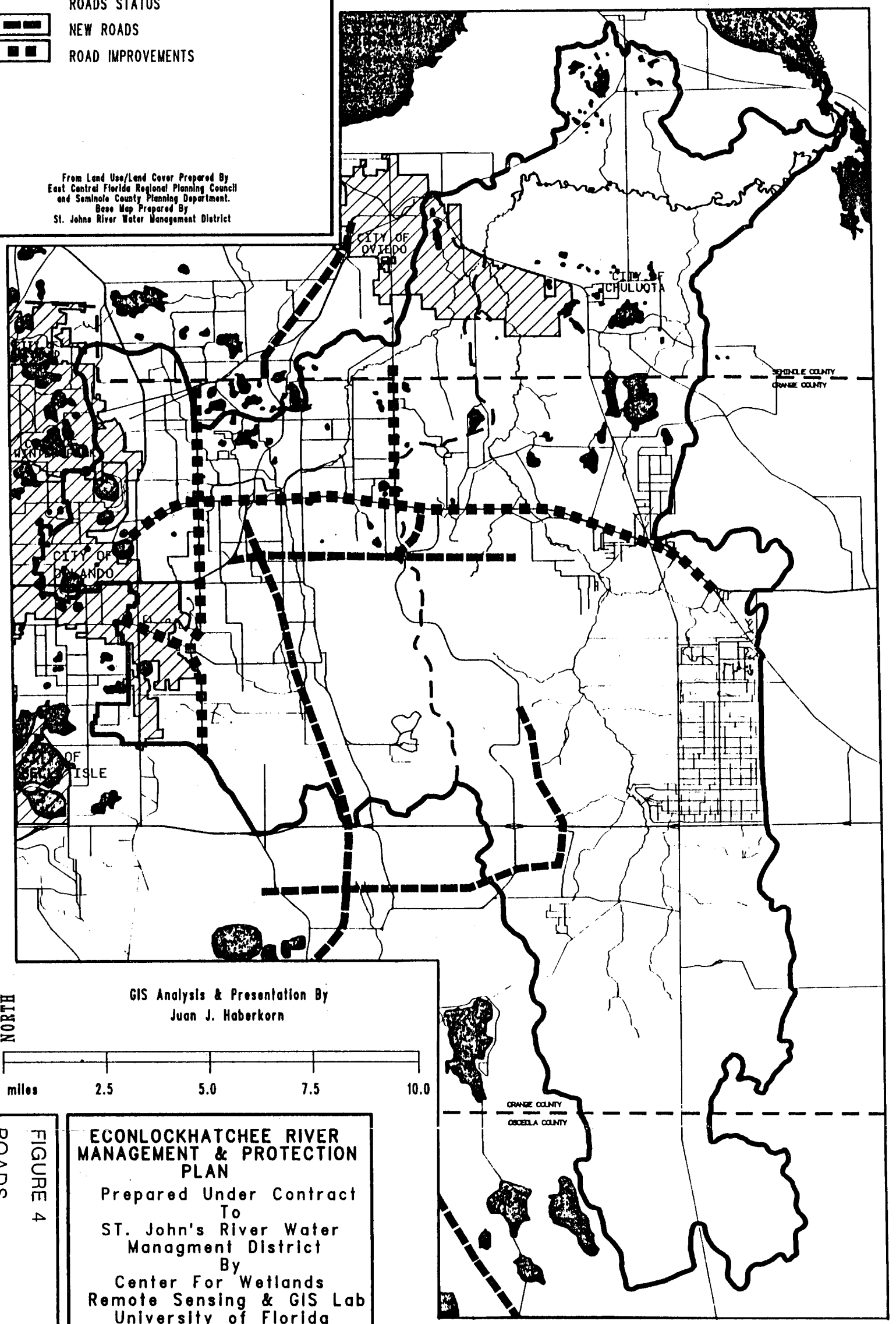
Base Map Prepared By
St. Johns River Water Management District



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GIS Analysis & Presentation By
Juan J. Haberkorn

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FIGURE 4
ROADS

ECONLOCKHATCHEE RIVER MANAGEMENT & PROTECTION PLAN

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UNIVERSITY OF FLORIDA

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UNIVERSITY OF FLORIDA

JOSEPH SCHAEFER
URBAN WILDLIFE PROGRAM
DEPT. OF WILDLIFE & RANGE SCIENCES
IFAS, UNIVERSITY OF FLORIDA

LUCY WAYNE & MARTIN DICKINSON
SOUTHARC, INC.
P.O. BOX 1702
GAINESVILLE, FL. 32602

VOLUME II

APPENDICES

APPENDIX A

FLORIDA GAME AND FRESH WATER COMMISSION POLICIES AND RECOMMENDATIONS FOR LOCAL GOVERNMENT COMPREHENSIVE PLAN CONSERVATION ELEMENT

A. Excerpts from the State Comprehensive Plan that Concern the Protection of Fish and Wildlife and Their Habitat

GOAL 10: NATURAL SYSTEMS AND RECREATIONAL LANDS

Florida shall protect and acquire unique natural habitats and ecological systems such as wetlands, tropical hardwood hammocks, palm hammocks, and virgin longleaf pine forests, and restore degraded natural systems to a functional condition.

Cluster 10-43: Protection of Natural Systems

1. Conserve forests, wetlands, fish, marine life and wildlife to maintain their environmental, economic, aesthetic, and recreational values.

7. Protect and restore the ecological functions of wetlands to ensure long-term environmental, economic, and recreational values.

8. Promote restoration of the Everglades system and the hydrological and ecological functions of degraded or substantially disrupted surface waters.

9. Develop and implement a comprehensive planning, management and acquisition program to ensure the integrity of Florida's river systems.

Cluster 10-44: Protection of Endangered Species

3. Prohibit the destruction of endangered species and protect their habitats.

4. Establish an integrated regulatory program to assure the survival of endangered and threatened species within the state.

Cluster 10-45: Land Management and Use

2. Acquire, retain, manage, and inventory public lands to provide recreation, conservation, and related public benefits.

5. Promote the use of agricultural practices which are compatible with the protection of wildlife and natural systems.

6. Encourage multiple use of forest resources, where appropriate, to provide for timber production, recreation, wildlife habitat, watershed protection, erosion control, and maintenance of water quality.

10. Emphasize the acquisition and maintenance of ecologically intact systems in all land and water planning, management and regulation.

B. **Excerpts from the State Land-Use Development Plan that Concern Fish and Wildlife and Their Habitats**

OBJECTIVE 44-A: By 1990, there will be no net loss of endangered species habitat as a result of land development decisions.

OPERATING POLICIES

1. Identify critical habitats of endangered species following a procedure similar to that used by the Federal Government.

2. Consult with the Florida Game and Fresh Water Fish Commission where state and federal management, development, or permitting activities will affect endangered or threatened species.

3. Ensure that local government comprehensive plans identify endangered species habitat and restrict activities known to affect the survival of endangered wildlife and plants.

4. Assure consistency with existing endangered species recovery plans and continue to develop additional endangered species recovery plans.

5. Develop positive financial incentives to encourage landowners and developers to protect or preserve endangered or threatened species.

6. Consider specific land acquisition and wildlife management area programs for endangered species.

7. Protect threatened species habitat.

8. Assist local governments and landowners in addressing endangered and threatened species issues.

C. **Florida Game and Fresh Water Fish Commission Recommendations for Satisfying Minimum Criteria Rule 9J-5.013 Minimum Criteria For Review of Local Government Comprehensive Plans and Determination of Compliance.**

(1) (a) 5: Element shall identify and analyze fisheries, wildlife, vegetative communities and species listed by the federal or state agencies as being endangered, threatened, or species of special concern.

RECOMMENDATIONS

A. Inventory and Analysis: Information on the location of protected wildlife and wildlife habitats can be obtained from the following sources:

1. Florida Natural Areas Inventory, Tallahassee, Florida;

2. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida (also see Section III); and

3. U.S. Fish and Wildlife Service, Jacksonville, Florida.

B. Mapping: A critical habitat map, using U.S.G.S. topographic maps (1:24000), should be developed to delineate specific locations of sensitive natural resources. This information can then be transferred to other land-use maps. Included in this map should be the following:

1. Habitats and locations of endangered, threatened or species of special concern;

2. Colonial nesting sites for wading birds and shorebirds;

3. High quality and/or unique natural plant communities (i.e., ravine forests, longleaf pine wiregrass, coastal hammock and xeric oak and sand pine scrubs); and

4. Corridor areas such as strips of undeveloped habitat separating existing conservation reserves, or transitional zones along major floodplains.

(1) (a) 5 (b): For fisheries, wildlife, and protected species, the element shall identify existing commercial, recreational or conservation uses, known degradation problems, and the potential for conservation, user, or protection.

RECOMMENDATIONS

1. Uses - Unfortunately, detailed county-by-county information is not available concerning the level of participation and economic value of fish and wildlife resources. Some effort has been made, however, to quantitatively obtain these values on a statewide basis. The following estimates may serve as an index to the relative benefits derived within a particular local government.

Nongame Wildlife Activities:

-Approximately 67 percent of Florida residents (more than 6 million adults) are participants in nongame wildlife-related recreation.

-Participants of nongame wildlife-related activities spend an average of $221 per person, per year, on food, lodging, transportation, equipment, and other related items.

-Total statewide value of nongame wildlife-related recreation was estimated at $1.3 billion for 1985 (average of $19.4 million per county).

Hunting:

-During 1985-86, The Florida Game and Fresh Water Fish Commission issued 250,000 licenses to residents and nonresidents.

-Florida hunters spent an estimated $1,166 per person during 1985.

-Total statewide value of hunting was estimated at $422 million for 1985 (average of $6.6 million per county).

Fishing:

-During 1985-86, the Commission issued 625,000 resident fishing licenses and 211,000 nonresident licenses.

-Florida fishermen spent and estimated $649 per person for 1985.

-Total statewide value of fishing was estimated at $1 billion for 1985 (average of $14.9 million per county).

2. Degradation Problems - In most cases, land-use changes brought about by increased urbanization are the primary factors responsible for the degradation of fish and wildlife populations. This situation is particularly acute when emerging growth corridors begin to encroach on forested and previously undeveloped areas. By overlaying the future land-use map over a map of critical fish and wildlife habitats, land planners should be able to identify potential sources of degradation and possible land-use conflicts. Instances where resource degradation may result include: the location of industrial or hazardous wastes within the watershed of an environmentally sensitive wetland; siting of high intensity developments within the habitats of threatened and endangered species; and construction of water control structures that alter natural hydrological characteristics.

3. Conservation/Protection - A variety of options are available to local governments for the purpose of effectuating natural resource protection. These may include zoning, special-use permits, incentives, transfer of development rights, impact and user fees, conservation easements, and direct acquisition. Zoning is the most common method of land-use regulation; however, use of this control for protecting fish and wildlife resources can be ineffective due to the common usage of variance procedures. Therefore, it is recommended that local governments place greater emphasis on adopting mechanisms that will result in the permanent protection of a site deemed to be of critical value to fish and wildlife resources. This may be undertaken through the use of conservation easements or local government acquisition programs that rely on natural resource impact fees as potential revenue sources.

(2) (a): The element shall contain one or more goal statements which establish the long-term end toward which conservation programs and activities (for wildlife and wildlife habitats) are ultimately directed.

RECOMMENDED GOALS (select all)

Goal: To protect endangered and threatened species habitats in order to enhance existing population numbers and distributions within the local jurisdiction.

Goal: To protect viable tracts of all natural plant communities occurring within the local jurisdiction.

Goal: To protect populations of species of special concern from further losses in populations within the local jurisdiction.

Goal: To maintain the current complement of fish and wildlife diversity and distribution within the local jurisdiction for the use and enjoyment of future generations.

Goal: To provide consumptive and non-consumptive fish and wildlife opportunities within jurisdiction.

(2) (b) 3 and 4: The element shall contain one or more specific objectives which conserve, appropriately use and protect native vegetative communities, fisheries, wildlife, and wildlife habitat.

RECOMMENDED OBJECTIVES

Objective: To establish a coordinated natural resources information exchange program with state and regional agencies.

Objective: To maintain the local government's current complement of wildlife species and natural plant communities.

Objective: To increase the abundance and distribution of endangered and threatened species within the local government jurisdiction.

Objective: To increase the amount of protected acreage of environmentally sensitive lands occurring within the local government jurisdiction.

(2) (c) (3): The element shall contain one or more policies for each objective which address implementation activities for the protection of native communities from destruction by development activities.

RECOMMENDED POLICIES

Policy: Discourage incompatible development and human encroachment in and around areas that have been identified as unique or important natural plant communities.

Policy: Prevent water management and development projects that may alter or disrupt the natural function of significant natural systems.

Policy: Encourage and promote the protection of viable tracts of sensitive or high quality natural plant communities within developments.

Policy: Maintain the local government's current complement of wildlife species through preservation of diverse and viable habitats.

Policy: Require detailed inventories and assessments of the impacts of development on environmentally significant systems.

(2) (c) (5): The element shall contain one or more policies for each objective which address implementation activities for restriction of activities known to adversely affect the survival of endangered and threatened wildlife.

RECOMMENDED POLICIES

Policy: Adopt intergovernmental agreements pertaining to the protection and enhancement of endangered, threatened or species of special concern.

Policy: Increase public knowledge of the existence, habitat, survival requirements of the local government's species considered to be endangered, threatened, or of special concern.

Policy: Restrict the use of critical habitats to that which is compatible with the requirements of endangered, threatened species or species of special concern.

Policy: New developments shall protect viable size habitats when listed vegetative and wildlife species inhabit a tract slated for development.

Policy: Provide for the protection of fish and wildlife and the habitats of protected vegetative and wildlife species.

Policy: Require disturbed land to be reclaimed and re-vegetated with native vegetation when no further conflicting use of the land is proposed.

Policy: Restrict unmitigated development and human encroachment in and around areas known to be potential habitat for endangered, threatened species or species of special concern.

Policy: Require detailed inventories and assessments of the impacts of development on endangered, threatened, and species of special concern.

(2) (c) (6): The element shall contain one or more policies for each objective which address implementation activities for protection and conservation of the natural functions of fisheries and wildlife habitats.

RECOMMENDED POLICIES

Policy: Maintain upland buffers along the local government's waterways to provide wildlife habitat and corridors, prevent erosion, retard runoff and preserve natural aesthetics.

Policy: Protect, restore, or create wetland areas to provide wildlife habitat, prevent water quality degradation, aid water storage and recharge the aquifer.

Policy: Conserve and protect the natural functions of soils, wetlands, and wildlife habitats.

Policy: Where development of high quality upland wildlife habitat occurs, preserve examples of the habitat to sustain those wildlife species that inhabit the site.

Policy: Incorporate upland preservation in and around preserved wetlands to provide habitat diversity, enhance edge effect, and promote wildlife conservation.

Policy: Promote the long-term maintenance of natural systems through such instruments as deed restrictions, covenants, easements, transfer of development rights, mitigation banks, zoning and acquisition.

Policy: Promote the establishment of wildlife corridors in order to help maintain regional species viability and diversity.

Policy: Inventory all ecologically important lands for the presence of significant resources.

Policy: Develop a computerized data base to facilitate the identification, location, and habitat needs of listed species within the region.

(2) (c) (7): The element shall contain one or more policies for each objective which address implementation activities for protection of existing natural reservations identified in the recreation and open space element.

RECOMMENDED POLICIES

Policy: Retain for public use environmentally sensitive lands, land adjacent to rivers, functioning wetlands and inholdings within or adjacent to state forests.

Policy: Use incentives at the local, regional, and state government levels to allow for the preservation of fish and wildlife habitats.

(2) (c) (9): The element shall contain one or more policies for each objective which address implementation strategies for the designation of environmentally sensitive lands for protection, based on locally defined criteria which further the goals and objectives of the conservation element.

RECOMMENDED POLICY

Policy: Based on state, regional and local fish and wildlife inventories, local governments will identify critical and high value habitats for designation as environmentally sensitive lands.

APPENDIX B

SELECTED PROVISIONS FROM EAST CENTRAL REGIONAL POLICY PLAN

REGIONAL ISSUE 38: Protection of Water Resources

POLICY 38.1: Comprehensive surface water and groundwater basin management plans should be developed for all major surface water and groundwater watersheds by the FDER, in cooperation with the FDNR, FGFWFC, RPC, WMDs, regional water authorities and local governments. These plans should assess the impacts of existing and anticipated future pollution sources on the water quality of surface waters and groundwaters, and should develop strategies to abate those impacts.

POLICY 38.2: All land use planning and development approval decisions which impact water resources should be made in conformance with comprehensive water basin management plans to the greatest extent practicable and appropriate. Areawide water quality management plans (208 studies), WMD groundwater basin resource inventories (made pursuant to s. 373.0935, F.S.), or other appropriate water management plans (including, but not limited to, those for the Green Swamp, Kissimmee River and Indian River Lagoons) should be used as guidelines until FDER comprehensive water basin management plans are available. Detailed studies of water resources which are either more site-specific or more resource oriented (such as wasteload allocation studies) may supersede comprehensive basin management plans where appropriate. Planning and development approval decisions which should conform may include, but are not limited to:

1. Development of new public wastewater or stormwater facilities; improvement of existing wastewater or stormwater facilities;

2. The siting of wellfields by public water supply utilities, and consumptive use permitting by the WMDs;

3. Assignment of wasteload allocations by FDER and permitting of septic tank systems by FDHRS;

4. Siting of industrial land uses which use or generate hazardous materials;

5. Siting of hazardous waste collection and transfer stations;

6. Development of hazardous waste spill emergency response programs.

7. Quality and quantity of recharge occurring to groundwater basins.

8. Potential for saltwater intrusion.

9. Potential for groundwater contamination from spills, leaking underground storage tanks, etc.

POLICY 38.3: Stormwater management systems should employ the most efficient and cost-effective pollutant control techniques available. Stormwater permitting agencies should encourage the use of new Best Management Practices whose potential for superior efficiency or cost-effectiveness has been demonstrated through research, and should incorporate such practices into their design standards once they have been proven efficient at pollutant removal, reliable and cost-effective in practical applications.

POLICY 38.4: Urban drainage systems which do not meet the performance standards of State stormwater regulations (Chapter 17-25, F.A.C.) and are contributing significantly to the degradation of surface waters shall be identified and scheduled for retrofitting with appropriate stormwater pollution controls. The priority for retrofitting of individual drainage basins should be based on the findings of comprehensive surface water basin

management plans. Where the improvement of such systems on a site-by-site basis is not practical, financially feasible or environmentally sound, a regional stormwater system design should be considered. Because of the cost and technical complexity of retrofitting projects, they should be cooperatively planned, financed, constructed and operated by the FDER, WMDs and local governments.

POLICY 38.5: New or re-designed stormwater management systems which use wet detention facilities, including isolated wetlands, whose combined area is five acres or greater, should provide diversion of the "first flush" of stormwater to separate retention facilities in order to protect the water quality in the detention system from the adverse effects of direct discharge of stormwater pollutants. The stormwater management design criteria of the FDER, WMD and/or local government shall apply, as appropriate, in the design of retention facilities.

POLICY 38.6: Best Management Practices for control of erosion and sedimentation shall be employed for all road construction, urban development and agricultural activities in order to protect natural water bodies, water courses, and wetlands from siltation. BMPs shall also be employed, as necessary, to protect the function of stormwater management systems (e.g., exfiltration systems) from excess sediment loads. Erosion and sediment control BMPs include, but are not limited to, those of the SCS, FDOT, FDER, FDACS, and IFAS.

POLICY 38.7: Long-term maintenance of stormwater management systems shall be the responsibility of financially responsible entities so as to ensure the proper functioning and expected pollutant removal efficiency of stormwater management systems in perpetuity. Local governments shall ensure that owner/operators of stormwater management systems maintain their systems properly so as to conform with the requirements of their construction permits and State water quality standards (Chapter 17-3, F.A.C.).

POLICY 38.8: Wastewater treatment plant effluent impacts on surface water quality shall be reduced to the maximum extent feasible. Mechanisms for reducing the impacts of wastewater treatment plants include, but are not limited to: consideration of the cumulative impacts of both point source and non-point source pollution in the establishment of wasteload allocations; increased monitoring of impacts of wastewater treatment plant effluent on surface waters; establishment of maintenance programs to ensure that wastewater treatment plants are in good repair; enaction of swift enforcement action against violations of State standards by wastewater treatment plants; and implementation of alternatives to surface water discharge of wastewater where such alternatives are economically feasible, environmentally sound and consistent with the protection of public health.

POLICY 38.9: On-site wastewater treatment in areas served by centralized wastewater treatment should be discouraged. Where septic tank use is appropriate, septic tank systems shall be installed in conformance with FDHRS septic tank siting and installation criteria (Chapter 10D-6, F.A.C.). Where lands are unsuitable for septic tank systems and centralized wastewater treatment is not available, development should be prohibited unless an alternative on-site disposal system (e.g., "package" wastewater treatment plant) is deemed sufficiently effective to prevent degradation of adjacent surface waters or groundwater by the FDER, the appropriate local government and FDHRS, and provisions are made for the plant's eventual retirement and connection of the development to a regional wastewater treatment facility.

POLICY 38.10: The disposal of non-hazardous wastes shall be managed and controlled to prevent surface water and groundwater contamination. Programs to control water quality degradation from waste disposal should include, but are not limited to: capping and lining of new landfills or landfill expansions; installation of leachate collection systems on existing unlined landfills; establishment of groundwater and surface water monitoring programs to detect contamination by leachate; implementation of septic sludge recycling programs and/or the creation of a publicly operated septic sludge disposal system; resource recovery or recycling of solid wastes.

REGIONAL ISSUE 39: Protection of Natural Systems

POLICY 39.2: No new structures (i.e., dams, weirs, locks, levees, canals, pumps, drainage wells or other artificial mechanisms) designed to control the stage and/or flow of waters of the State (s. 403.031(12), F.S.) shall be constructed, except where such structures are necessary to protect public safety, safeguard existing structures or restore the function of a natural water-dependent ecosystem, and no practical non-structural alternative exists. The use of temporary structural modifications to control the stage or flow of a waterbody as a part of any government sanctioned program of flood control, water quality restoration, habitat restoration or exotic plant control should be designed and operated so as to minimize harm to non-target organisms or natural ecosystems.

POLICY 39.3: New structures (i.e., dams, weirs, locks, levees, canals, pumps, drainage wells or other artificial mechanisms) designed to control the stage and/or flow of waters of the State (s. 403.031(12), F.S.) shall be designed and operated so as to minimize adverse changes in the physical, chemical and biological attributes of the affected waters and water dependent natural ecosystems to the greatest extent practicable. The following definitions shall apply in the interpretation of this policy:

1. "Physical" attributes include turbidity, light transparency, temperature, stage, hydroperiod, discharge and velocity.

2. "Chemical" attributes include those parameters listed in Ch. 17- 3, F.A.C., and any other substance which might be carried in water in solution, or as an emulsion, film or particulate suspension.

3. "Biological" attributes include those plants, animals and micro- organisms (except those species which are considered exotic or pest species by the FGFWFC, FDHRS, FDNR or FDACS) which either live in water, or are obligately dependent upon surface water at some point in their life cycle.

4. "Water dependent natural ecosystem" includes those natural communities identified by the Florida Natural Areas Inventory as Palustrine, Lacustrine, Riverine, Marine, or Estuarine.

POLICY 39.4: Existing structures (i.e., dams, weirs, locks, levees, canals, pumps, drainage wells or other artificial mechanisms) which control the stage and/or flow of waters of the State (s. 403.031(12), F.S.) and which cause significant harm to the physical, chemical or biological attributes of water resources or water dependent natural ecosystems shall be identified as part of the planning and project review functions of the FDER, WMDs, RPC and local governments. Where such a structure is identified, steps should be taken to correct the adverse impacts caused by it to the greatest practicable extent through removal or modification of the structure or mitigation for its effects. Incentives should be provided to the owners of privately owned structures to encourage their participation.

POLICY 39.5: The channelization or impoundment of waters of the State (s.403.031(12), F.S.) shall be prohibited, except where no practical alternative exists for those operations necessary to correct existing threats to public health or safety, allow maintenance of existing navigational waterways, or provide reasonable access to water dependent shore-based facilities. All practical steps shall be taken to minimize adverse impacts to biological attributes of the water resources and water-dependent natural ecosystems.

POLICY 39.6: Withdrawals from or discharges to waters of the State (s.403.031(12),F.S.) which alter hydroperiods, discharge volumes, in-stream velocities, surface water stages or groundwater levels so as to cause a significant, adverse effect on natural water-dependent ecosystems should be prohibited. Such projects should be permitted only in cases of over-riding public benefit, such as alterations in the stage or flow of surface waters as a part of any government sanctioned program of flood control, water quality restoration, habitat restoration or exotic plant control, and should be designed and operated so as to minimize harm to non-target organisms or natural ecosystems.

POLICY 39.7: Natural, isolated wetlands should be incorporated in surface water management systems as detention facilities, where such inclusion of wetlands is practical and appropriate, as an alternative to filling or excavating such wetlands. Whenever isolated wetlands are used for stormwater detention, hydroperiods and stage elevations should be designed to maintain the existing natural wetlands community, except where permitting agencies agree that the imposition of conditions which favor a different plant community is more desirable for the purpose of providing habitat, improving water quality or enhancing other wetland values. In order to maintain the long-term viability of isolated wetlands used for detention, stormwater should be treated to meet the general water quality criteria of s. 17-3.061, F.A.C., wherever feasible, prior to its discharge to isolated wetlands.

POLICY 39.8: Floodplains which are relatively undisturbed should be protected and preserved through regulation and/or public acquisition, as appropriate in order to preclude uses which would permanently degrade floodplain functional values.

POLICY 39.9: Floodplains whose functional values have been degraded or destroyed through human intervention should be restored through acquisition of historic floodplains via the "Save Our Rivers", "Save Our Coasts", CARL and other appropriate State, regional and local public land acquisition programs. Floodplains restoration efforts should strive to re-create the plant communities which existed prior to the alteration, where such restoration is practical and prudent. Floodplains restoration efforts shall maintain existing navigational waterways wherever the continued use of the waterway for boat traffic is not inconsistent with the objectives of the floodplain restoration effort, or where the waterway is a part of the federal Intracoastal Waterway System. Local governments should participate in floodplains restoration efforts to the maximum extent feasible, including the development of appropriate land use controls to buffer restored areas from the adverse impacts of adjacent land uses.

POLICY 39.10: Flood control for new development should be accomplished through the limitation of fill in the 100-year floodplain, as defined by FEMA FIRM maps, USGS floodprone maps, and other suitable means. Where no practical alternative to fill in the 100-year floodplain exists, compensatory storage for such fill should be provided through excavation of a volume of uplands equivalent to the loss of storage within the 100-year floodplain caused by the placement of fill, where the provision of compensatory storage can be accomplished in an environmentally sound and economically feasible manner.

POLICY 39.11: In order to control shoreline erosion, maintain water quality and protect fish and wildlife habit, the removal or control of native species of emergent, submersed or floating vegetation in natural waters of the State (s. 403.031(12), F.S.), shall be limited to that necessary to provide for reasonable and beneficial uses of surface waters consistent with FDNR rules for aquatic plant control permits (Chapter 16C- 20, F.A.C.). The FDER, WMDs, RPC and local governments should ensure, to the greatest degree practicable and where appropriate, that native aquatic vegetation is not managed inappropriately as a part of their planning, project review, project approval, project inspection and law enforcement operations.

REGIONAL ISSUE 43: Protection of Natural Systems

POLICY 43.1: Proposed activities which would destroy or degrade the function of wetlands or deepwater habitat shall not be permitted except where such activities are not contrary to the public interest and there is no practical alternative which reduces or avoids impacts to wetlands or deepwater habitat. Unavoidable losses of viable wetlands should be mitigated through the demonstrably successful restoration, creation or (where no other alternative is feasible) preservation of wetlands whose functional values are at least comparable to those of the wetlands lost. Wetlands mitigation should occur within the same watershed as the proposed impact to ensure that there is no net loss of wetland functional values within the drainage basin where the loss is to occur. Creation of new wetlands as mitigation should avoid impacts to ecologically valuable uplands including, but not limited to, bird nesting colonies, migratory wildlife corridors and rare or endangered ecosystems.

POLICY 43.3: Ecologically viable portions of natural upland plant communities, including but not limited to rare or endangered ecosystems, present on proposed urban development sites should be preserved and maintained in their original state, to the greatest extent practicable, within the open space requirements mandated by local governments. Both urban and agricultural landowners should be provided with economic incentives to conserve native uplands, including rare or endangered ecosystems, on their property, where appropriate.

POLICY 43.4: Public conservation land acquisition programs should give the greatest consideration permissible by law to the selection of lands which appear on lists or inventories of rare or endangered ecosystems, but for which public use and recreation may not be appropriate.

POLICY 43.5: The identification of habitat corridors which serve as biological connections between existing managed areas (i.e, parks, preserves, private conservation lands) should be given high priority by the FGFWFC, FDNR, FNAI and/or RPC. Once identified, public conservation land acquisition programs should give consideration to the acquisition of property where such connections are economically feasible and consistent with the ecological and/or species management objectives of the managed areas thereby connected. Property owners should be provided with economic incentives by State and local governments to participate voluntarily (e.g., in the form of conservation easements or transfers/purchases of development rights) in the formation of a habitat corridor system in order to minimize the amount of public acquisition necessary to safeguard habitat corridors.

POLICY 43.6: Habitat corridors identified as important to the movement of non-avian wildlife by the FGFWFC, FDNR, FNAI and/or RPC should be protected, to the greatest extent practicable, from disturbances which would render the corridors unusable or dangerous to the species which frequent them. All levels of government should give consideration to the protection of such corridors in their comprehensive planning and development approval processes. Transportation agencies at all levels of government should avoid construction or improvement of transportation facilities which would adversely impact habitat corridors, and should mitigate unavoidable crossings through provision of appropriate "wildlife underpasses."

POLICY 43.7: Lands which are designated "preservation" or "conservation" as a part of any development project should be identified as such in a legal agreement which ensures their protection from development or other uses inappropriate with conservation objectives, in perpetuity. Appropriate legal mechanisms may include, but are not limited to: deed restrictions; conservation easements; fee simple title acquisition; transfer of development rights; and purchase of development rights. Any legal instrument which conveys the development rights of a conservation parcel should also identify the party which is responsible for management of the parcel in a manner consistent with its intended purpose as conservation land.

POLICY 43.8: In order to protect the quality and quantity of surface waters and provide habitat for semi-aquatic or water-dependent terrestrial species of wildlife, buffer zones should be established, by appropriate federal, state and local agencies, landward of regionally significant wetlands, except where such buffers would be ineffective, inappropriate or inconsistent with the public interest. The landward extent of wetland buffer zones shall be determined based on scientific evaluation of site specific conditions, including the nature of the existing soils, vegetation, topography, hydrology, water quality, wildlife diversity and the resource protection status of the receiving waters. No activity should be permitted within the buffer zone unless the proposed activity can be shown to not pose a significant adverse threat to water quality, water quantity or wildlife habitat for wetland dependent species, or where it can be demonstrated that the project is clearly in the public interest consistent with Policy 56.1, 56.2 and 56.4. Buffer zones should consist of intact natural communities comprised of appropriate native species in the canopy, shrub and understory layers.

POLICY 43.9: In order to maintain good water quality in stormwater management detention ponds and maximize the provision of fish and wildlife habitat, stormwater management systems with permanently wet detention ponds should be designed, operated and maintained so as to resemble a natural pond to the greatest extent practicable. A natural pond design should include: a littoral zone comprised of native emergent and

submersed aquatic macrophytic vegetation; a deep, open-water limnetic zone free of rooted emergent and submersed vegetation; and, where feasible, an upland buffer of native trees, shrubs and understory vegetation.

POLICY 43.10: State, regional and local regulatory and land use management agencies should investigate the feasibility of allowing off-site "land banking" (i.e., contribution of funds towards the acquisition of environmentally sensitive lands by a conservation agency or organization) as an option for the mitigation of the unavoidable loss of protected rare or endangered lands, and should implement such programs when they are demonstrated to be appropriate, financially feasible, environmentally sound and consistent with protection of the public interest.

REGIONAL ISSUE 44: Protection of Endangered Species

POLICY 44.1: Planning and approval of development projects shall avoid adverse impacts to species listed as endangered, threatened or species of special concern to the greatest extent practicable. Where suitable habitat on a project site is utilized by a listed species, a management plan designed to minimize harm to the species and its habitat should be prepared by the developer and adherence to the plan made a condition of development approval. Management plans should be reviewed and approved by the appropriate State agency (FGFWFC for upland and freshwater species, FDNR for marine species) prior to their approval by local governments.

POLICY 44.2: All levels of government shall support the protection of critical habitat for endangered and threatened species to the maximum extent feasible. "Critical habitat" shall include those habitat types, or specific geographical locations, which are designated as such by the USFWS, NMFS, FGFWFC, FDNR, FDACS, or the RPC. The RPC shall serve as a data clearinghouse for information on critical habitat designations and shall provide this information to local governments and the general public.

REGIONAL ISSUE 45: Land Management and Use

POLICY 45.1: Agricultural and forestry operations should use Integrated Pest Management (IPM) programs, where appropriate, in order to reduce the use of chemical pesticides which may contaminate soils, groundwater and surface water. IPM programs should be modeled, after the guidelines given in: IFAS. 1978. An integrated pest management primer. Institute of Food and Agricultural Sciences, University of Florida. Gainesville, Florida.

POLICY 45.2: Agriculture and forestry operations shall adhere to accepted BMPs for surface water management and erosion control. Appropriate BMP's include, but are not limited to:

1. For forestry, those which appear in: FDACS. 1980. Best Management Practices. Division of Forestry, Florida Department of Agriculture and Consumer Services. Tallahassee, Florida; and

2. For agriculture, those which appear in: IFAS. 1982. Pollution solutions for Florida farmers. Institute of Food and Agricultural Sciences, University of Florida. Gainesville, Florida.

POLICY 45.3: Forest resources should be managed so as to preserve and enhance both game and non-game wildlife populations. Appropriate forestry practices include but are not limited to:

1. Harris, L. D., D. H. Hirth, and W. R. Marion. 1979. The development of silvicultural systems for wildlife. In: The 28th Annual Forestry Symposium. Louisiana State University. Baton Rouge, Louisiana.

2. Harris, L. D. and W. H. Smith. 1978. Relations of forestry practices to non-timber resources and adjacent ecosystems. In: T. Tippin (ed.), Proceed. Symp. Principles of maintaining productivity on prepared sites. New Orleans, Louisiana.

3. FDACS. 1980. Best Management Practices. Division of Forestry, Florida Department of Agriculture and Consumer Services. Tallahassee, Florida.

POLICY 45.4: Agricultural management should be conducted so as to conserve and encourage both game and non-game wildlife populations to the greatest extent practicable. Appropriate agricultural practices include but are not limited to those in: USDA. 1983. The Yearbook of Agriculture-Using Our Natural Resources. U.S. Department of Agriculture. Washington, D.C.

REGIONAL ISSUE 46: Parks and Recreation

POLICY 46.1: Purchase of land for parks, recreation, conservation, and open space should be based upon comprehensive plans which: set priorities for acquisition of recreation and conservation lands based on identification of those potential recreational areas most vulnerable to immediate development and those low-income and high-density areas with recreational deficiencies; identify the amount of current and future park acreage needed to satisfy demand, with reference to the State Outdoor Recreation Plan, as appropriate; identify future park sites and recreational areas for acquisition in advance of new development to ensure their preservation for public use at the least taxpayer cost; demonstrate method of funding to be used in achieving implementation of the plan; identify method for preserving existing parks and designated conservation areas; and identify appropriate roles of the private sector in providing recreational opportunities and services.

POLICY 46.4: Parks, open spaces, and recreational areas should be protected, to the greatest degree practicable, from the adverse affects of encroaching urbanization. Impacts which should be limited include those which would affect the hydrology, water quality, air quality, ambient noise level, wildlife populations, natural ecosystems and aesthetics of parks. Impacts should be avoided through comprehensive planning and development reviews, as appropriate.

REGIONAL ISSUE 58: Natural Resources Preservation

POLICY 58.1: Land use decisions shall be based on an assessment of the capabilities of natural resource systems, and on an assessment of the total short- and long-term environmental costs and benefits of supporting and maintaining development.

POLICY 58.2: All land use decisions undertaken in the region shall be consistent with and supportive of the natural resource protection policies contained within the Comprehensive Regional Policy Plan under various regional issue areas.

POLICY 58.3: Land use planning shall utilize the appropriate WMD's groundwater basin resource inventories or other appropriate data sources and reflect the limitations of groundwater and other water supplies on the future land use plans.

REGIONAL ISSUE 59: Maximizing the Use of Existing Public Facilities

POLICY 59.3: Graywater systems, wastewater reuse and waste recovery systems should be developed and implemented in new construction where such techniques prove to be technically and economically feasible and environmentally sound. The following minimum criteria and procedures should be adhered to in the implementation of this policy:

1. Guidelines and prototype systems for use in determining the technical and economic feasibility of implementing graywater, wastewater reuse and waste recovery systems in all forms of development should be developed and implemented, with consideration being given to:

a. Volume or throughput thresholds of applicability;

b. Locational and land area requirements;

c. Soils and hydrological requirements and constraints; and

d. Operation and maintenance requirements.

2. Opportunities for wastewater reuse be evaluated as a component of wastewater treatment systems master planning, with implementation being undertaken where feasible.

3. The feasibility of waste recovery systems be periodically evaluated in sanitary landfill and wastewater treatment system needs studies and management plans.

POLICY 59.6: Ensure the provision of long-term maintenance for public stormwater management systems which sustains or enhances the environmental protection and water storage functions that the system was originally designed to carry out. Adherence to this policy includes, at a minimum, that:

1. Methods be developed to establish long-term, reliable funding sources for the proper maintenance of stormwater management systems. Techniques should be developed to provide a annual inspection program and a maintenance schedule which will identify stormwater management facility maintenance needs and scheduled actions to provide proper maintenance throughout the year.

2. Proper long-term maintenance of stormwater management facilities should be considered as any actions necessary to ensure proper functioning and expected pollutant removal efficiency.

Number of local governments with established fiscal budgets for stormwater system maintenance programs.

POLICY 59.7: Stormwater management plans and programs shall be coordinated with other activities such as natural resource protection and recreation, while ensuring that opportunities are not overlooked for establishing stormwater management practices in conjunction with other capital improvements. The following minimum criteria and procedures shall be adhered to in the implementation of this policy:

1. All comprehensive basin management plans (see Policy 38.1) and especially the stormwater management portion of such plans shall be reviewed by local and state parks and recreation departments to identify the following:

a. Opportunities for the usage of existing public stormwater facilities as components of a park or recreational facility; and

b. Opportunities for creating new parks and recreational facilities in conjunction with a planned stormwater management system.

2. Planning departments and water management districts should review comprehensive basin management plans for opportunities to:

a. Combine the use of conservation areas and public lands with stormwater management objectives; and

b. Combine stormwater management objectives with other capital improvements plans.

REGIONAL ISSUE 60: Planning for Public Facilities

POLICY 60.6: New development which will depend upon the availability of central water and wastewater systems shall be approved by the local government only in areas where adequate public or private facilities are available, under construction, or where funds have been committed or scheduled for commitment for construction of the necessary facilities provided that the necessary facilities and services are available concurrent with the impacts of the new development. Adherence to this policy requires, at a minimum, that:

1. New development which is dependent upon central water and wastewater services shall be permitted only in areas where adequate existing potable water supply and wastewater treatment capacities are available or in areas where new facilities are scheduled to be provided.

2. Development orders and permits shall be conditioned on the availability of the facilities and services necessary to serve the proposed development.

POLICY 60.9: Efforts shall be undertaken to ensure that the effective and efficient use of the region's potable water resources are maximized, to include: the discouragement of new development in areas with existing or projected water supply problems; the implementation of water conservation practices in domestic, commercial, industrial and agricultural activities throughout the region; and the requirement of installation of devices and products which minimize the demand for water in all new development. Consideration shall be given to the following minimum criteria/procedures in the implementation of this policy:

1. The availability of sufficient volumes of adequate quality water should be proven prior to permits being issued to proposed developments in areas of questionable water supply conditions.

2. Other ordinances such as wastewater reuse, water source heat pump, water conservation as well as building codes should be established and used to accomplish water conservation objectives.

3. Model landscape or water conservation ordinances developed by the water management districts should be considered for adoption and implemented by local governments as they become available.

4. Public education and information materials shall identify proven and feasible water conservation practices and techniques, to include:

a. Devices for installation in residential and commercial plumbing to reduce water flow and volume requirements;

b. Landscape irrigation do's and don'ts;

c. Types of landscaping materials and vegetation suited for minimum water requirements;

d. Effective landscape irrigation techniques, procedures and practices; and

e. Water conservation and reuse methods for various types of agricultural operations, including citrus and other fruits, field row crop, sod, hay and silage, and vegetable production.

5. Evaluation of the use of nonpotable surface waters (lakes) and the provision of treated wastewater, including graywater, for nonpotable uses in the community, including landscape irrigation, industrial cooling water and as groundwater recharge, provided assurance of no adverse consequences or impacts on surface or groundwater levels or public health, safety and welfare.

POLICY 60.11: Stormwater management shall be conducted through comprehensive, consistent, and coordinated plans for each major watershed and such plans shall address not only flooding problems, but shall also assess the extent of nonpoint source pollution from agricultural and urban runoff and describe the actions necessary to minimize or eliminate the adverse effects of such pollution. The following minimum criteria/procedures shall be adhered to in the implementation of this policy:

1. Stormwater management plans shall be a component of comprehensive basin management plans (identified in Policy 38.1) to be developed for all major watersheds in the region;

2. The comprehensive basin management plans shall be developed for all major watersheds in the region. This applies to those watersheds which have not been the subject of a surface water quality management plan since 1983; and

3. All local comprehensive plans shall include a stormwater management element, which shall be consistent with applicable comprehensive basin management plans after their development.

POLICY 60.12: Financing techniques and programs shall be established to retrofit areas of existing development with nonpoint source pollution abatement systems. The following minimum criteria and procedures shall be adhered to in the implementation of this policy:

1. All local governments which have jurisdiction over areas found to be contributing urban runoff pollution to a waterbody which is the subject of a comprehensive basin management plan (see Policy 60.11) are requested to establish a program for retrofitting areas of existing development with the necessary stormwater treatment facilities on a priority basis according to their respective fiscal capabilities;

2. Local governments are requested to establish project priorities consistent with their capital improvement programs for retrofitting areas of existing development within two years after the development of a comprehensive basin management plan identifying the need for such retrofit;

3. The State Legislature is requested to consider the establishment of a financial assistance program to aid local governments in the implementation of needed stormwater system retrofit or treatment projects; and

4. The means for retrofitting areas of existing development with stormwater treatment facilities must be technically and economically feasible.

POLICY 60.15: Standards for stormwater management shall be developed, continually evaluated and maintained by water management districts to assure an adequate level of environmental protection, public safety, minimal public and private costs, maximum resource protection, and long-term efficiency. Adherence to this policy, at a minimum, shall include the following actions:

1. Each local government within the region is requested to develop and adopt ordinances by one year after adoption of its Local Government Comprehensive Plan which, at a minimum, apply state/local stormwater management standards to those developments currently under thresholds for state jurisdiction.

2. Standards for stormwater management should be evaluated at least every three years and updated as necessary.

POLICY 60.17: Nonstructural methods of stormwater management which reduce the generation and accumulation of potential stormwater runoff contaminants shall be utilized to the maximum extent feasible. Adherence to this policy requires, at a minimum, that: nonstructural means of stormwater management shall include activities such as pesticide and herbicide control, proper fertilizer management, erosion control, homeowner awareness of nonpoint source pollution, proper waste disposal, etc. In addition, the use of natural floodplain areas for filtration of naturally occurring runoff from adjacent lands shall be utilized where possible.

POLICY 60.18: The provision of public facilities and services is intended to serve as a growth management measure, as such provision shall be undertaken and expanded within existing or identified future designated facility service areas and discouraged elsewhere, except in cases of overriding public benefit or where needed to meet the needs of existing development; and

POLICY 60.21: The provision of public services and facilities shall be planned and coordinated so that the provision of public services and facilities occurs in a manner which encourages orderly growth and, to the extent feasible, is compatible with existing and desired land uses;

POLICY 60.24: Future growth and development shall be encouraged only within designated service areas where existing public facilities have sufficient capacity, or public/private financial commitments have been made, to support the projected service demands; and

POLICY 60.28: The planning and provision of public facilities and services in undeveloped areas should consider lands within the proposed service area in terms of their suitability for urbanization, with routing of lines and provision of services being used to guide growth into areas suitable for development while avoiding environmentally sensitive areas;

POLICY 60.29: In the extension of public facilities and services to undeveloped areas, priority shall be given to those areas deemed most suitable for development in terms of land use and environmental resources. Such services should be provided in coordination with the availability of other urban services; and

POLICY 60.30: The construction of new public facilities or the improvement of existing public facilities which will promote "leap-frog" development into undeveloped areas and negatively affect other public service programs, facilities and operations, should be discouraged, except in cases of overriding public benefit. Consideration shall be given to the following minimum criteria and procedures in the implementation of this policy cluster:

1. Carrying capacity studies be conducted in conjunction with any formal consideration of providing public facilities and services in undeveloped areas. Criteria for consideration in such studies should include, among others:

   a. Degree of soil limitation for buildings and septic tanks;

   b. Existing and planned availability of central water and sewer systems;

   c. Proximity to present urban service centers;

   d. Overall accessibility and traffic counts of nearby roads;

e. Existing zoning and land use;

f. Presence of floodplains, wetlands, prime recharge areas, or other environmentally sensitive lands; and

g. Presence of, or critical habitat conditions for rare, threatened or endangered species.

2. Priorities be established to evaluate the developmental capability of vacant land. Criteria for evaluating priorities shall include, among other factors:

a. Degree of natural limitation (slight, moderate, and severe) for various construction activities;

b. A numerical ranking of factors based on local evaluation (#3);

c. Use of state regulatory thresholds for determining severity of air and water variables; and

d. Presence of floodplains, wetlands, prime recharge areas, identified wildlife corridors, or other environmentally sensitive lands.

3. Development benefit assessments be conducted to include determinations of:

a. Provision of needed housing units, and commercial and industrial space at competitive prices;

b. Additional ad valorem tax base, utility fees, and impact fee revenues;

c. Additional new jobs and economic benefits to the local economy; and

d. Availability of a wider range of goods and services for the general public as a result of an expanded development base.

4. A land development guidance system or similar process be prepared to objectively evaluate land development and which shall encourage new building contiguous to existing development. Factors for evaluation shall include, among others:

a. Size of proposed site;

b. Extent of agricultural productivity, by soil type;

c. Amount of prime agricultural soils;

d. Percentage of surrounding area (five-mile radius) developed;

e. Distance to comparable development;

f. Percentage of adjacent land developed;

g. Distance to a fire department, public school, public water system line; and

h. Access road characteristics and limitations.

POLICY 60.31: Public facilities shall not be located within the 100-year floodplain or in floodprone areas, unless the facilities are water related, such as boat ramps, docks, or surface water management structures, or

are not adversely affected by periodic flooding or standing water, such as highway bridges and fills. Adherence to this policy, requires, at a minimum that:

1. Policies be promulgated, adopted and enforced, prohibiting the construction of public facilities within the 100-year floodplain or in wetland areas unless such facilities are directly water-related, flood proofed, above the 100-year flood elevation, or are not impacted by periodic flooding or standing water. If construction in the 100-year floodplain is necessary, such construction should be compatible with the conditions of Policy 39.10.

APPENDIX C

WEKIVA TASK FORCE RECOMMENDATIONS

1. The Task Force recommends the immediate purchase of existing proposed CARL properties within the Wekiva Basin (Seminole Woods and the B.M.K. Ranch) and of the Wekiva Park Estates tract (proposed for listing but not currently listed), Wekiva Falls, Wekiva Sulphur Springs Ranch, and other outparcels on the west bank of the Wekiva River.

2. The Task Force recommends the establishment of joint participation in land acquisition programs by state, regional and local government agencies and encourages the development of alternative funding sources for land acquisition and management in the Wekiva Basin.

3. The Task Force recommends that necessary funding be provided for staff and operating expenses for the appropriate management of public lands and for the enforcement of all regulatory programs that serve to protect the natural resources of Wekiva Basin.

4. The Task Force recommends that the East Central Florida Regional Planning Council prepare a comprehensive management plan and principles for guiding development for the entire Wekiva basin for inclusion in its Comprehensive Regional Policy Plan.

5. The Task Force endorses the proposed SJRWMD rule changes to Chapter 40C-41, F.A.C., which address the impact of permitted development activities on the water quality, water quantity and wildlife habitat values of wetlands within the Wekiva Basin.

6. The Task Force recommends the establishment of a date certain by which minimum flows and levels shall be established by the St. Johns River Water Management District for the Wekiva River and its tributaries, consistent with the requirements of s. 373.042, F.S., and of a date certain by which the St. Johns River Water Management District shall complete a groundwater basin resource availability inventory (s. 373.0395, F.S.) for the Wekiva River Basin.

7. The Task Force endorses the current initiative by the Florida Department of Environmental Regulation to designate Black Water Creek, Lake Norris, Seminole Creek, Sweetwater Creek and Sulphur Run as Outstanding Florida Waters (OFWs).

8. The Task Force recommends that the proposed Western Beltway (Part B) be planned in a manner that would minimize to the greatest possible extent impacts to the Wekiva Basin's water and wildlife resources. This would include spanning all wetlands and the floodplain immediately adjacent to the Wekiva River, maintaining limited access to the Beltway, and the inclusion of sufficient wildlife crossings for protection of the Florida black bear and other wildlife.

9. The Task Force recommends that all existing and future roadways in the Wekiva Basin have adequate wildlife crossings.

10. The Task Force recommends that the Department of Natural Resources establish as a priority that its Bureau of Surveys and Mapping complete the delineation of the Ordinary High Water line of the Wekiva River Aquatic Preserve and those reaches of the Little Wekiva River contained within the study boundary.

11. The Task Force endorses two proposed amendments to the East Central Florida Comprehensive Regional Policy Plan as submitted by the Policy Plan Committee, subject to the inclusion of the wording "consistent with Policies 56.1, 56.2 and 56.4", that propose a new regional policy which recognizes the Wekiva River as a significant regional resource deserving special protection and that would revise an existing policy regarding buffers and regionally significant wetlands in order to clarify its intent and application.

12. The Task Force endorses the creation and funding of the Wekiva River Basin Resources Council.

13. The Task Force recommends that motorized traffic on the Wekiva River be restricted consistent with resource protection needs.

14. The Task Force recommends the adoption of smoke management ordinances to allow the continued management of public properties by controlled burning.

15. The Task Force recommends the implementation of education programs to reduce man's impact on the Wekiva River Basin. These programs should consider energy conservation, water conservation, recycling of solid wastes, wildlife conservation, etc.

16. The Task Force recommends that local governments adopt changes to their local comprehensive plans, zoning codes and land use designations and that they adopt ordinances that would require minimum setbacks of 550 feet from the edge of the Wekiva River, that would encourage and promote clustering of development to allow greater expanses of undeveloped areas preserved in perpetuity in conservation easements, and that would prohibit land uses and intensities of development that would adversely affect the natural resources of the Wekiva River Basin.

17. The Task Force recommends that each affected local government adopt a permanent restriction of development in designated buffer areas along tributaries and wetlands in the Wekiva Basin.

18. The Task Force recommends that the Legislative enact legislation that would reduce the thresholds for developments of regional impact in the Wekiva River Basin by at least one-half.

19. The Task Force recommends that where development is permitted to occur adjacent to public preserve areas and state parks, it be of sufficiently low intensity to prevent adverse impacts to the public lands.

20. The Task Force endorses an amendment to Chapter 373, F.S., to include a provision that the St. Johns River Water Management District not issue any permit within the Wekiva River Protection Area until the appropriate local government has provided written notification to the district that the proposed activity is consistent with the local comprehensive plan and is in compliance with any land development regulation in effect in the area where the development will take place.

APPENDIX D

WEKIVA RIVER PROTECTION ACT

CHAPTER 369, FLORIDA STATUTES (1989)

WEKIVA RIVER PROTECTION

369.301 Short title.—This part may be cited as the "Wekiva River Protection Act."
History.—s. 1, ch. 88-121; s. 26, ch. 88-393.

369.303 Definitions.—As used in this part:

(1) "Council" means the East Central Florida Regional Planning Council.

(2) "Counties" means Orange, Seminole, and Lake Counties.

(3) "Department" means the Department of Community Affairs.

(4) "Development of regional impact" means a development which is subject to the review procedures established by s. 380.06 or s. 380.065, and s. 380.07.

(5) "Land development regulation" means a regulation covered by the definition in s. 163.3164(22) and any of the types of regulations described in s. 163.3202.

(6) "Local comprehensive plan" means a comprehensive plan adopted pursuant to ss. 163.3164-163.3215.

(7) "Revised comprehensive plan" means a comprehensive plan prepared pursuant to ss. 163.3164-163.3215 which has been revised pursuant to chapters 85-55, 86-191, and 87-338, Laws of Florida, and subsequent laws amending said sections.

(8) "Wekiva River development permit" means any zoning permit, subdivision approval, rezoning, special exception, variance, site plan approval, or other official action of local government having the effect of permitting the development of land in the Wekiva River Protection Area. "Wekiva River development permit" shall not include a building permit, certificate of occupancy, or other permit relating to the compliance of a development with applicable electrical, plumbing, or other building codes.

(9) "Wekiva River Protection Area" means the lands within: Township 18 south range 28 east; Township 18 south range 29 east; Township 19 south range 28 east, less those lands lying west of a line formed by County Road 437, State Road 46, and County Road 435; Township 19 south range 29 east; Township 20 south range 28 east, less all lands lying west of County Road 435; and Township 20 south range 29 east, less all those lands east of Longwood Markham Road.

(10) "Wekiva River System" means the Wekiva River, the Little Wekiva River, Black Water Creek, Rock Springs Run, Sulphur Run, and Seminole Creek.
History.—s. 1, ch. 88-121; s. 26, ch. 88-393.

369.305 Review of local comprehensive plans, land development regulations, Wekiva River development permits, and amendments.—

(1) It is the intent of the Legislature that comprehensive plans and land development regulations of Orange, Lake, and Seminole Counties be revised to protect the Wekiva River Protection Area prior to the due dates established in ss. 163.3167(2) and 163.3202 and Chapter 9J-12, Florida Administrative Code. It is also the intent of the Legislature that the counties emphasize this important state resource in their planning and regulation efforts. Therefore, each county shall, by April 1, 1989, review and amend those portions of its local comprehensive plan and its land development regulations applicable to the Wekiva River Protection Area, and, if necessary, adopt additional land development regulations which are applicable to the Wekiva River Protection Area to meet the following criteria:

(a) Each county's local comprehensive plan shall contain goals, policies, and objectives which result in the protection of the:

1. Water quantity, water quality, and hydrology of the Wekiva River System;

2. Wetlands associated with the Wekiva River System;

3. Aquatic and wetland-dependent wildlife species associated with the Wekiva River System;

4. Habitat within the Wekiva River Protection Area of species designated pursuant to Rules 39-27.003, 39-27.004, and 39-27.005, Florida Administrative Code; and

5. Native vegetation within the Wekiva River Protection Area.

(b) The various land uses and densities and intensities of development permitted by the local comprehensive plan shall protect the resources enumerated in paragraph (a) and the rural character of the Wekiva River Protection Area. The plan shall also include:

1. Provisions to ensure the preservation of sufficient habitat for feeding, nesting, roosting, and resting so as to maintain viable populations of species designated pursuant to Rules 39-27.003, 39-27.004, and 39-27.005, Florida Administrative Code, within the Wekiva River Protection Area.

2. Restrictions on the clearing of native vegetation within the 100-year flood plain.

3. Prohibition of development that is not low-density residential in nature, unless that development has less impacts on natural resources than low-density residential development.

4. Provisions for setbacks along the Wekiva River for areas that do not fall within the protection zones established pursuant to s. 373.415.

5. Restrictions on intensity of development adjacent to publicly owned lands to prevent adverse impacts to such lands.

6. Restrictions on filling and alteration of wetlands in the Wekiva River Protection Area.

7. Provisions encouraging clustering of residential development when it promotes protection of environmentally sensitive areas, and ensuring that residential development in the aggregate shall be of a rural density and character.

(c) The local comprehensive plan shall require that the density or intensity of development permitted on parcels of property adjacent to the Wekiva River System be concentrated on those portions of the parcels which are the farthest from the surface waters and wetlands of the Wekiva River System.

(d) The local comprehensive plan shall require that parcels of land adjacent to the surface waters and watercourses of the Wekiva River System not be subdivided so as to interfere with the implementation of protection zones as established pursuant to s. 373.415, any applicable setbacks from the surface waters in the Wekiva

River System which are established by local governments, or the policy established in paragraph (c) of concentrating development in the Wekiva River Protection Area as far from the surface waters and wetlands of the Wekiva River System as practicable.

(e) The local land development regulations shall implement the provisions of paragraphs (a), (b), (c), and (d) and shall also include restrictions on the location of septic tanks and drainfields in the 100-year flood plain and discharges of stormwater to the Wekiva River System.

(2) Each county shall, within 10 days of adopting any necessary amendments to its local comprehensive plan and land development regulations or new land development regulations pursuant to subsection (1), submit them to the department, which shall, within 90 days, review the amendments and any new land development regulations and make a determination.

(3) If the department determines that the local comprehensive plan and land development regulations as amended or supplemented comply with the provisions of subsection (1), the department shall petition the Governor and Cabinet to confirm its determination. If the department determines that the amendments and any new land development regulations that a county has adopted do not meet the criteria established in subsection (1), or the department receives no amendments or new land development regulations and determines that the county's existing local comprehensive plan and land development regulations do not comply with the provisions of subsection (1), the department shall petition the Governor and Cabinet to order the county to adopt such amendments to its local comprehensive plan or land development regulations or such new land development regulations as it deems necessary to meet the criteria in subsection (1). A determination or petition made by the department pursuant to this subsection shall not be final agency action.

(4) The Governor and Cabinet, sitting as the Land and Water Adjudicatory Commission, shall render an order on the petition. Any local government comprehensive plan amendments directly related to the requirements of this subsection and subsections (1), (2), and (3) may be initiated by a local planning agency and considered by the local governing body without regard to statutory or local ordinance limitations on the frequency of consideration of amendments to local comprehensive plans.

(5) During the period of time between the effective date of this act and the due date of a county's revised local government comprehensive plan as established by s. 163.3167(2) and Chapter 9J-12, Florida Administrative Code, any local comprehensive plan amendment or amendment to a land development regulation, adopted or issued by a county, which applies to the Wekiva River Protection Area, or any Wekiva River development permit adopted by a county, solely within protection zones established pursuant to s. 373.415, shall be sent to the department within 10 days after its adoption or issuance by the local governing body but shall not become effective until certified by the department as being in compliance with purposes described in subsection (1). The department shall make its decision on certification within 60 days after receipt of the amendment or development permit solely within protection zones established pursuant to s. 373.415. The department's decision on certification shall be final agency action. This subsection shall not apply to any amendments or new land development regulations adopted pursuant to subsections (1) through (4) or to any development order approving, approving with conditions, or denying a development of regional impact.

(6) Prior to March 1, 1990, the department shall prepare and deliver to the Governor, the Speaker of the House of Representatives, the Minority Leader of the House of Representatives, the President of the Senate, and the Minority Leader of the Senate a report recommending whether the reviews and certifications of amendments to land development regulations and development permits required under subsection (5) should be continued after the due dates described therein.

(7) In its review of revised comprehensive plans after the due dates described in subsection (5), and in its review of comprehensive plan amendments after those due dates, the department shall review the local comprehensive plans, and any amendments, which are applicable to portions of the Wekiva River Protection Area for compliance with the provisions of subsection (1) in addition to its review of local comprehensive plans and amendments for compliance as defined in s. 163.3184; and all the procedures and penalties described in s. 163.3184 shall be applicable to this review.

(8) The department may adopt reasonable rules and orders to implement the provisions of this section.

History.—s. 1, ch. 88-121; s. 26, ch. 88-393.

369.307 Developments of regional impact in the Wekiva River Protection Area; land acquisition.—

(1) Notwithstanding the provisions of s. 380.06(15), the counties shall consider and issue the development permits applicable to a proposed development of regional impact which is located partially or wholly within the Wekiva River Protection Area at the same time as the development order approving, approving with conditions, or denying a development of regional impact.

(2) Notwithstanding the provisions of s. 380.0651 or any other provisions of chapter 380, the numerical standards and guidelines provided in Chapter 28-24, Florida Administrative Code, shall be reduced by 50 percent as applied to proposed developments entirely or partially located within the Wekiva River Protection Area.

(3) The Wekiva River Protection Area is hereby declared to be a natural resource of state and regional importance. The East Central Florida Regional Planning Council shall adopt policies as part of its comprehensive regional policy plan and regional issues list which will protect the water quantity, water quality, hydrology, wetlands, aquatic and wetland-dependent wildlife species, habitat of species designated pursuant to Rules 39-27.003, 39-27.004, and 39-27.005, Florida Administrative Code, and native vegetation in the Wekiva River Protection Area. The council shall also cooperate with the department in the department's implementation of the provisions of s. 369.305.

(4) The provisions of s. 369.305 of this act shall be inapplicable to developments of regional impact in the Wekiva River Protection Area if an application for development approval was filed prior to June 1, 1988, and in the event that a development order is issued pursuant to such application on or before April 1, 1989.

(5) The Department of Natural Resources is directed to proceed to negotiate for acquisition of conservation and recreation lands projects within the Wekiva River Protection Area provided that such projects have been deemed qualified under statutory and rule criteria for purchase and have been placed on the priority list for acquisition by the advisory council created in s. 259.035.

History.—s. 1, ch. 88-121; s. 26, ch. 88-393; s. 14, ch. 89-116.

373.415 Protection zones; duties of the St. Johns River Water Management District.—

(1) Not later than November 1, 1988, the St. Johns River Water Management District shall adopt rules establishing protection zones adjacent to the watercourses in the Wekiva River System, as designated in s. 369.303(10). Such protection zones shall be sufficiently wide to prevent harm to the Wekiva River System, including water quality, water quantity, hydrology, wetlands, and aquatic and wetland-dependent wildlife species, caused by any of the activities regulated under this part. Factors on which the widths of the protection zones shall be based shall include, but not be limited to:

(a) The biological significance of the wetlands and uplands adjacent to the designated watercourses in the Wekiva River System, including the nesting, feeding, breeding, and resting needs of aquatic species and wetland-dependent wildlife species.

(b) The sensitivity of these species to disturbance, including the short-term and long-term adaptability to disturbance of the more sensitive species, both migratory and resident.

(c) The susceptibility of these lands to erosion, including the slope, soils, runoff characteristics, and vegetative cover.

In addition, the rules may establish permitting thresholds, permitting exemptions, or general permits, if such thresholds, exemptions, or general permits do not allow significant adverse impacts to the Wekiva River System to occur individually or cumulatively.

(2) Notwithstanding the provisions of s. 120.60, the St. Johns River Water Management District shall not issue any permit under this part within the Wekiva River Protection Area, as defined in s. 369.303(9), until the appropriate local government has provided written notification to the district that the proposed activity is consistent with the local comprehensive plan and is in compliance with any land development regulation in effect in the area where the development will take place. The district may, however, inform any property owner who makes a request for such information as to the location of the protection zone or zones on his property. However, if a development proposal is amended as the result of the review by the district, a permit may be issued prior to the development proposal being returned, if necessary, to the local government for additional review.

(3) Not later than March 1, 1991, the St. Johns River Water Management District shall develop a groundwater basin resource availability inventory as provided in s. 373.0395 for the Wekiva River Protection Area and shall establish minimum flows and minimum water levels for surface watercourses in the Wekiva River System and minimum water levels for the groundwater in the aquifer underlying the Wekiva Basin as depicted on the map entitled "Wekiva Basin, 40C-41" which is on file at the offices of the St. Johns River Water Management District.

(4) Nothing in this section shall affect the authority of the water management districts created by this chapter to adopt similar protection zones for other watercourses.

(5) Nothing in this section shall affect the authority of the water management districts created by this chapter to decline to issue permits for development which have not been determined to be consistent with local comprehensive plans or in compliance with land development regulations in areas outside the Wekiva River Protection Area.

(6) Nothing in this section shall affect the authority of counties or municipalities to establish setbacks from any surface waters or watercourses.

(7) The provisions of s. 373.617 are applicable to final actions of the St. Johns River Water Management District with respect to a permit or permits issued pursuant to this section.

History.—s. 2, ch. 88-121; s. 27, ch. 88-393.

APPENDIX E

ST. JOHNS RIVER WATER MANAGEMENT
WEKIVA RIVER BASIN RULES

FLORIDA ADMINISTRATIVE CODE

40C-4.041 Permit Required.

(1) Unless expressly exempt by statute or rule, a surface water management permit must be obtained from the District prior to the construction, alteration, operation, maintenance, removal or abandonment of any dam, impoundment, reservoir, appurtenant work or works.

(2) The District issues three types of surface water management permits: conceptual approval permits, individual permits and general permits.

(a) A conceptual approval permit may be issued for projects that are to be developed in phases. A letter of conceptual approval does not authorize any construction.

(b) An individual or general permit is required prior to the construction, alteration, operation, maintenance, abandonment or removal of a surface water management system which:

1. Is capable of impounding a volume of water of forty or more acre feet; or

2. Serves a project with a total land area equal to or exceeding forty acres; or

3. Serves a project with a total land area equal to or exceeding ten acres, when any part of the project is located within the Wekiva River Hydrologic Basin north of State Road 436; or

4. Provides for the placement of twelve or more acres of impervious surface which constitutes 40 or more percent of the total land area; or

5. Provides for the placement of one half acre or more of impervious surface, when any of the impervious surface is located within the Wekiva River Hydrologic Basin north of State Road 436; or

6. Contains a traversing work which traverses:

a. A stream or other watercourse with a drainage area of five or more square miles upstream from the traversing work; or

b. An impoundment with more than ten acres of surface area; or

7. Contains a surface water management system which serves an area of five or more contiguous acres of a hydrologically sensitive area with a direct hydrologic connection to:

a. A stream or other watercourse with a drainage area of five or more square miles; or

b. An impoundment with no outfall, which is not wholly owned by the applicant and which is ten acres or greater in size; or

c. A hydrologically sensitive area not wholly owned by the applicant.

8. Is wholly or partially located within the Wekiva River Hydrologic Basin's Riparian Habitat Protection Zone as described in Paragraph 40C-41.063(3)(e).

(c) A general permit will be issued for specific classes of surface water management systems which satisfy the thresholds and conditions of Chapter 40C-40, F. A. C. A general permit may authorize the construction, alteration, operation, maintenance, abandonment, or removal of a system.

(d) An individual permit may be issued for projects which do not qualify for general permits under the provisions of Chapter 40C-40, F. A. C. An individual permit may authorize the construction, alteration, operation, maintenance, abandonment or removal of a system.

(3)(a) The Governing Board may designate specific geographic areas within which individual or general permits shall be required for the construction, alteration, operation, maintenance, removal, or abandonment of any systems with threshold volumes and areas different from those specified in subsection (2)(b) above.

(b) Such designation shall be adopted by rule pursuant to Chapters 120 and 373, Florida Statutes, and Chapter 40C-1, F. A. C.

(c) Prior to the adoption of such rule, the Governing Board shall hold at least one public meeting in the vicinity of the area for which such designation is proposed. The purpose of the meeting shall be to hear testimony regarding the justification and anticipated impacts of the designation.

Specific Authority 373.044, 373.113, 373.171, 373.415 FS. Law Implemented 373.409, 373.413, 373.415, 373.416, 373.426, 373.429 FS. History—New 1-31-77, Formerly 16I-4.04, 40C-4.04, Amended 2-3-81, 12-7-83, Formerly 40C-4.041, 40C-4.0041, Amended 8-28-88, 8-1-89.

CHAPTER 40C-41
SURFACE WATER MANAGEMENT BASIN CRITERIA

40C-41.011 Policy and Purpose. The rules in this Chapter establish additional surface water management standards and criteria for the Upper St. Johns River Hydrologic Basin, the Oklawaha River Hydrologic Basin, and the Wekiva River Hydrologic Basin which insure that development within the basins incorporates the appropriate water quantity and water quality control and other environmental measures necessary to protect the integrity of the public investments in the basins and which minimizes adverse impacts to the water resources of the District. Standards and criteria delineated in this Chapter are in addition to those criteria specified in Chapters 40C-4 and 40C-40, F. A. C. The standards, criteria, exemptions, and additional requirements specified in this Chapter are not intended to supersede or rescind the terms and conditions of any valid surface water management permit issued by the District prior to the effective date of this Chapter.

Specific Authority 373.044, 373.113, 373.171, 373.415 FS. Law Implemented 373.413, 373.415, 373.416, 373.426 FS. History—New 12-7-83, Amended 5-17-87, 8-30-88.

40C-41.023 Basin Boundaries.

(1) The Upper St. Johns River Hydrologic Basin is that area generally depicted in Figure 41-1 and defined in Applicant's Handbook, Appendix K as incorporated by reference in Rule 40C-4.091, F. A. C.

(2) The Oklawaha River Hydrologic Basin is that area generally depicted in Figure 41-1 and defined in Applicant's Handbook, Appendix K as incorporated by reference in Rule 40C-4.091, F. A. C.

(3) The Wekiva River Hydrologic Basin is that area generally depicted in Figure 41-1 and defined in Applicant's Handbook, Appendix K as incorporated by reference in Section 40C-4.091, Florida Administrative Code.

Specific Authority 373.044, 373.113, 373.171 FS. Law Implemented 373.413, 373.416, 373.426 FS. History—New 12-7-83, Amended 5-17-87.

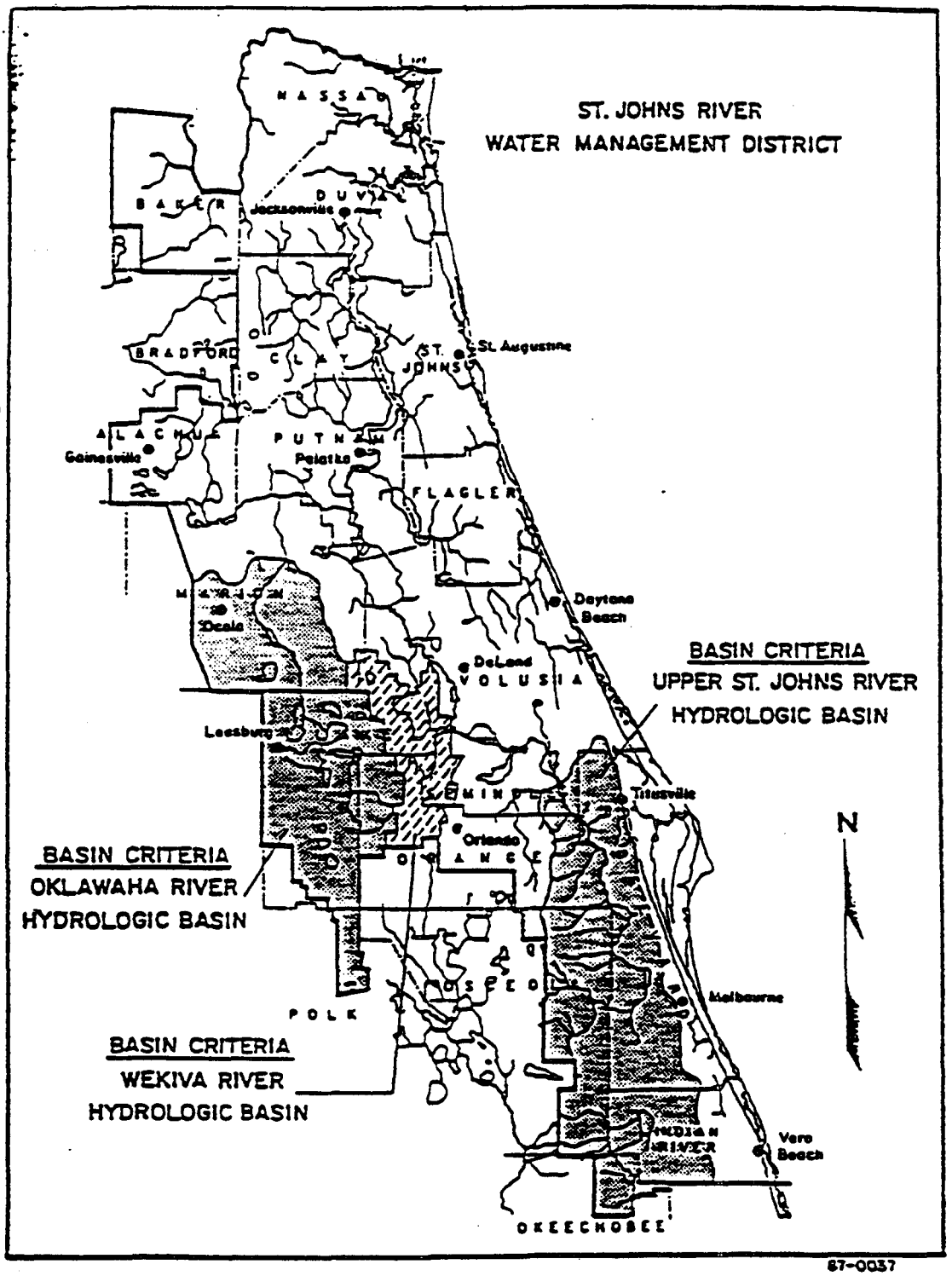
ST. JOHNS RIVER
WATER MANAGEMENT DISTRICT
NASSAU
BAKER
DUVAL
Jacksonville
BRADFORD
CLAY
ST. JOHNS
St. Augustine
ALACHUA
Gainesville
PUTNAM
Palatka
FLAGLER
Daytona Beach
DeLand
VOLUSIA
Deale
Leesburg
SEMINOLE
Titusville
Orlando
ORANGE
OSCEOLA
Melbourne
POLK
INDIAN RIVER
Vero Beach
OKEECHOBEE
BASIN CRITERIA
UPPER ST. JOHNS RIVER
HYDROLOGIC BASIN
BASIN CRITERIA
OKLAWAHA RIVER
HYDROLOGIC BASIN
BASIN CRITERIA
WEKIVA RIVER
HYDROLOGIC BASIN
N
87-0037

Figure 41-1

40C-41.033 Implementation.

(1) The effective date of this Chapter is December 7, 1983 for the criteria of Subsections 40C-41.063(1) and (2), and May 17, 1987 for the standards of Paragraphs 40C-41.063(3)(a) and (b), and August 30, 1988 for the standards and criteria of Paragraphs 40C-41.063(3)(c), (d) and (e).

(2) If the validity of any provision of Chapter 40C-41, F. A. C., as amended on December 7, 1983, May 17, 1987, and August 30, 1988, or the application thereof to any person or circumstance is challenged pursuant to Chapter 120, Florida Statutes, or pursuant to any other basis in law, it is the intent of the Governing Board of the St. Johns River Water Management District that neither a challenge to the validity of a provision or application thereof nor the invalidation of a provision or application thereof shall affect the validity or application of other provisions of the rule which can be given effect without the challenged or invalidated provision or application and to this end the provisions of Chapter 40C-41, F. A. C., as amended on December 7, 1983, May 17, 1987, and August 30, 1988, are declared severable.

Specific Authority 373.044, 373.113, 373.171, 373.415 FS. Law Implemented 373.413, 373.415, 373.416, 373.426 FS. History—New 12-7-83, Amended 5-17-87, 8-30-88.

40C-41.043 Application of Chapter. All projects located within the Upper St. Johns River Hydrologic Basin, the Oklawaha River Hydrologic Basin, or the Wekiva River Hydrologic Basin requiring permits pursuant to Rule 40C-4.041, F. A. C., shall be constructed, operated, maintained, altered, abandoned and removed in accordance with the standards and criteria specified in Rules 40C-4.301 or 40C-40.302, and 40C-41.063, F. A. C., unless specifically exempted. The most restrictive criteria will be applicable unless the applicant provides reasonable assurance that the purposes and intent of this Chapter and Chapter 40C-4, F. A. C., will be fulfilled using alternate criteria.

Specific Authority 373.044, 373.113, 373.171, 373.415, FS. Law Implemented 373.413, 373.415, 373.416, 373.426 FS. History—New 12-7-83, Amended 5-17-87, 5-30-88.

40C-41.063 Conditions for Issuance of Permits.

(1) Within the Upper St. Johns River Hydrologic Basin the following criteria are established:

(a) Storm Frequency — For purposes of design and evaluation of system performance, both the 10 year and the 25 year design storm frequencies must be met.

(b) Runoff Volume — For design purposes, those systems utilizing pumped discharge, the total post-development discharge runoff volumes shall not exceed pre-development discharge runoff volumes for the four-day period beginning the third day of the four-day design storm event.

(c) Interbasin Diversion —

1. A system may not result in an increase in the amount of water being diverted from the Upper St. Johns River Hydrologic Basin into coastal receiving waters.

2. It is an objective of the District to, where practical, curtail diversions of water from the Upper St. Johns River Hydrologic Basin into coastal receiving waters.

(2) Within the Oklawaha River Hydrologic Basin the following criteria are established:

(a) Storm Frequency — For purposes of design and evaluation of system performance, both the 10 year and the 25 year design storm frequencies must be met.

(b) Runoff Volume — For design purposes, those systems utilizing pumped discharges, the total post-development discharge runoff volumes shall not exceed pre-development discharge runoff volumes for the four-day period beginning the third day of the four-day design storm event.

(3) Within the Wekiva River Hydrologic Basin, the following standards and criteria are established:

(a) Recharge Standard — Three inches of runoff from all directly connected impervious areas must be retained within the project area for projects or portions of projects in Most Effective Recharge Areas. As an alternative, applicants may demonstrate that the post development recharge capacity is equal to or greater than the predevelopment recharge capacity.

(b) Storage Standard — A system may not cause a net reduction in flood storage within the 100 year floodplain of a stream or other water course which has a drainage area of more than one square mile and which has a direct hydrologic connection to Little Wekiva River, Wekiva River, or Black Water Creek.

(c) Standards for Erosion and Sediment Control and Water Quality — A Water Quality Protection Zone shall extend one half mile from the Wekiva River, Little Wekiva River north of State Road 436, Black Water Creek, Rock Springs Run, Seminole Creek, and Sulphur Run, and shall also extend one quarter mile from any wetland abutting an Outstanding Florida Water.

1. An erosion and sediment control plan must be submitted as part of the surface water management permit application for a surface water management system which:

a. Serves a project which is located wholly or partially within this zone; or

b. Serves a project with a total land area equal to or exceeding 120 acres.

The applicant proposing such a system must give reasonable assurance in the erosion and sediment control plan that during construction or alteration of the system (including revegetation and stabilization), erosion will be minimized and sediment will be retained on-site. The plan must be in conformance with the erosion and sediment control principles set forth in Section 18.2, Applicant's Handbook: Management and Storage of Surface Waters, and must contain the information set forth in Section 18.3, Applicant's

Handbook: Management and Storage of Surface Waters.

2. For a project which will be located wholly or partially within 100 feet of an Outstanding Florida Water or within 100 feet of any wetland abutting such a water, an applicant must provide reasonable assurance that the construction or alteration of the system will not cause sedimentation within these wetlands or waters and that filtration of runoff will occur prior to discharge into these wetlands and waters.

It is presumed that this standard will be met if, in addition to implementation of the plan required in subparagraph 1., any one of the following criteria is met:

a. A minimum 100 foot width of undisturbed vegetation must be retained landward of the Outstanding Florida Water or the abutting wetland, whichever is more landward. During construction or alteration, runoff (including turbid discharges from dewatering activities) must be allowed to sheetflow across this undisturbed vegetation as the natural topography allows. Concentrated or channelized runoff from construction or alteration areas must be dispersed before flowing across this undisturbed vegetation. Construction or alteration of limited scope necessary for outfall structures may occur within this area of undisturbed vegetation.

b. Construction of the following perimeter controls at all outfall points to the Outstanding Florida Water or its abutting wetlands must be completed prior to the start of any construction or alteration of the remainder of the system:

I. Stormwater discharge facility meeting the requirements of Chapter 40C-42;

II. Sedimentation trap or basic located immediately upstream of the stormwater discharge facility referred to above; and

III. Spreader swale to reduce the velocity of discharge from the stormwater facility to non-erosive rates before discharge to wetlands abutting the Outstanding Florida Water.

These perimeter controls must be maintained routinely and operated throughout construction or alteration of the entire system. A minimum 25 foot width of undisturbed vegetation must be retained landward of the Outstanding Florida Water or the abutting wetland, whichever is more landward. Construction or alteration of limited scope necessary for outfall structures may occur within this area of undisturbed vegetation.

c. During construction or alteration, no direct discharge to the Outstanding Florida Water or its abutting wetland may occur during the 10 year 24 hour storm event or due to discharge from dewatering activities. Any on-site storage required to satisfy this criteria must be available (recovered) within 14 days following the rainfall event. A minimum 25 foot width of undisturbed vegetation must be retained landward of the Outstanding Florida Water or the abutting wetland, whichever is more landward. Construction or alteration of limited scope necessary for outfall structures may occur within this area of undisturbed vegetation.

In determining whether construction or alteration is of "limited scope necessary", pursuant to any of the three presumptive criteria above, the District shall require that the area of disturbance be minimized and that the length of time between initial disturbance and stabilization of the area also be minimized.

(d) Standard for Limiting Drawdown — A Water Quantity Protection Zone shall extend 300 feet landward of the landward extent of Black Water Swamp and the wetlands abutting the Wekiva River, Little Wekiva River, Rock Springs Run, Black Water Creek, Sulphur Run, Seminole Creek, Lake Norris, and Lake Dorr. As part of providing reasonable assurance that the standard set forth in Subparagraph 40C-4.301(2)(a)6. is met, where any part of a system located within this zone will cause a drawdown, the applicant must provide reasonable assurance that construction, alteration, operation, or maintenance of the system will not cause ground water table drawdowns which would adversely affect the functions provided to aquatic and wetland dependent species (see Subsections 10.7.4 and 10.7.5, Applicant's Handbook: Management and Storage of Surface Waters) by the referenced wetlands.

The applicant shall provide an analysis which includes a determination of the magnitude and areal extent of any drawdowns, based on site specific hydrogeologic data collected by the applicant, as well as a description of the referenced wetlands, the functions provided by these wetlands, and the predicted impacts to these functions.

It is presumed that the part of this standard regarding drawdown effects will be met if the following criteria is met:

A ground water table drawdown must not occur within the Water Quantity Protection Zone.

(e) Standard for Riparian Wildlife Habitat

1. The applicant must provide reasonable assurance that the construction or alteration of a system will not adversely affect the abundance, food sources, or habitat (including its use to satisfy nesting, breeding and resting needs) of aquatic or wetland dependent species provided by the following designated Riparian Habitat Protection Zone:

a. The wetlands abutting the Wekiva River, Little Wekiva River, Rock Springs Run, Black Water Creek, Sulphur Run, or Seminole Creek;

b. The uplands which are within 50 feet landward of the landward extent of the wetlands above.

c. The uplands which are within 550 feet landward of the stream's edge as defined, for the purpose of this subsection, as the waterward extent of the forested wetlands abutting the Wekiva River, Little Wekiva River, Rock Springs Run, Black Water Creek, Sulphur Run or Seminole Creek. In the absence of forested wetlands abutting these streams, the stream's edge shall be defined, for the purpose of this subsection, as the mean annual surface water elevation of the stream; however, if

hydrologic records are unavailable, the landward extent of the herbaceous emergent wetland vegetation growing in these streams shall be considered to be the stream's edge.

2. Any of the following activities within the Riparian Habitat Protection Zone is presumed to adversely affect the abundance, food sources, or habitat of aquatic or wetland dependent species provided by the zone: construction of buildings, golf courses, impoundments, roads, canals, ditches, swales, and any land clearing which results in the creation of any system. (Activities not listed above do not receive a presumption of no adverse effect.)

3. The presumption in subparagraph 2. shall not apply to any activity which promotes a more endemic state, where the land in the zone has been changed by man. An example of such an activity would be construction undertaken to return lands managed for agriculture or silviculture to a vegetative community that is more compatible with the endemic land cover.

(4) Local Government Notification for Wekiva River Protection Area — The District shall not issue a conceptual approval, individual, or general permit for a proposed surface water management system located wholly or partially within the Wekiva River Protection Area, as defined in Section 369.303(9), F. S., until the appropriate local government has provided written notification that the proposed activity is consistent with the local comprehensive plan and is in compliance with any land development regulation in effect in the area where the development will take place. The applicant proposing such a system must submit to the District form no. 40C-41.063(4), entitled "Local Government Notification", after it has been completed and executed by the local government. This form is hereby incorporated by reference and is available upon request from the St. Johns River Water Management District, Post Office Box 1429, Palatka, Florida 32078-1429. Permit applications for systems within the Wekiva River Protection Area shall be processed by the District staff pursuant to the time frames established in Section 120.60, F.S., and any District rule regarding permit processing, except that any agency action to approve or approve with conditions shall not occur until the Local Government Notification has been received by the District.

Specific Authority 373.044, 373.133, 373.171, 373.415 FS. Law Implemented 373.413, 373.415, 373.416, 373.426 FS. History—New 12-7-83, Amended 5-17-87, 8-30-88, Amended 8-1-89.

APPENDIX F

MYAKKA RIVER WILD AND SCENIC DESIGNATION AND PRESERVATION ACT

CHAPTER 258, FLORIDA STATUTES (1989)

WILD AND SCENIC RIVERS

258.501 Myakka River; wild and scenic segment.—(1) SHORT TITLE.—This act may be cited as the "Myakka River Wild and Scenic Designation and Preservation Act."

(2) LEGISLATIVE DECLARATION.—The Legislature finds and declares that a certain segment of the Myakka River in Manatee, Sarasota, and Charlotte Counties possesses outstandingly remarkable ecological, fish and wildlife, and recreational values which are unique in the State of Florida. These values give significance to the river as one which should be permanently preserved and enhanced for the citizens of the State of Florida, both present and future. The permanent management and administration of the river involves a complex interaction of state, regional, and local interests which require balancing and coordination of purpose. It is the intention of the Legislature to provide for the permanent preservation of the designated segment of the Myakka River by way of development of a plan for permanent administration by agencies of state and local government which will ensure the protection necessary but retain that degree of flexibility, responsiveness, and expertise which will accommodate all of the diverse interests involved in a manner best calculated to be in the public interest.

(3) DEFINITIONS.—As used in this act:

(a) "Activity" means the doing of any act or the failing to do any act, whether by a natural person or a corporation.

(b) "Coordinating council" means the council created by subsection (6).

(c) "Department" means the Department of Natural Resources.

(d) "Division" means the Division of Recreation and Parks of the Department of Natural Resources.

(e) "Executive board" means the Governor and Cabinet sitting as the head of the Department of Natural Resources.

(f) "Resource value" means any one or more of the specific economic, scenic, recreational, geologic, fish and wildlife, historic, cultural, or ecological features associated with the river area as determined by the coordinating council.

(g) "River area" means that corridor of land beneath and surrounding the Myakka River from river mile 7.5 to river mile 41.5, together with a corridor extending from the center of the river to the maximum upland extent of wetlands vegetation.

(4) DESIGNATION OF WILD AND SCENIC RIVER.—The corridor of land surrounding and beneath the Myakka River between river mile 7.5 and river mile 41.5 is hereby designated as a Florida wild and scenic river for the purposes of this act and is subject to all of the provisions of this act. Such designated portion is more particularly described as that portion of the Myakka River located between State Road 780 in Sarasota County and the Sarasota–Charlotte County line.

(5) DEVELOPMENT OF MANAGEMENT PLAN.—

(a) The department and the coordinating council shall jointly develop a proposed management plan for the designated segment of the Myakka River, subject to and consistent with the provisions of this act.

(b) The development of the proposed management plan shall be by public hearing and shall include participation by all appropriate state agencies and by all appropriate or interested local governments and private organizations.

(c) The proposed management plan shall include provision for:

1. Permanent protection and enhancement of the ecological, fish and wildlife, and recreational values within the river area, primary emphasis being given to protecting agricultural, aesthetic, scenic, historic, archaeologic, and scientific features.
2. Continuation of land uses and developments on private lands within the river area which are in existence on January 1, 1986.
3. Periodic studies to determine the quantity and mixture of recreation and other public uses which can be permitted without adverse impact on the resource values of the river area.
4. Regulation, control, and distribution of public access where necessary to protect and enhance the resource values of the river area.
5. Consideration of need for basic facilities to absorb user impact on the river area, including necessary toilet or refuse containers, but, if found to be necessary, located in order to minimize their intrusive impact.
6. Restriction of motorized travel by land vehicle or boat where necessary to protect the resource values in the river area.
7. Agricultural and forestry practices similar in nature to those presently in the river area on January 1, 1986.
8. Resource management practices for the protection, conservation, rehabilitation, or enhancement of river area resource values.
9. Monitoring of existing water quality.
10. Continuance of existing drainage and water management practices, unless such existing practices will adversely affect, degrade or diminish existing water quality or existing resource values in the river area, and allowance of new water resource management practices which will not have an adverse impact on resource values in the river area.
11. Review and regulation of all activities conducted or proposed to be conducted within the river area which will or may have an adverse impact on any of the resource values in the river area as provided in this act.

(d) To the extent not inconsistent with this act, the proposed management plan may also include any other provisions deemed by the department to be necessary or advisable for the permanent protection of the river as a component of the Florida Wild and Scenic Rivers System.

(6) MANAGEMENT COORDINATING COUNCIL.—

(a) Upon designation, the department shall create a permanent council to provide interagency and intergovernmental coordination in the management of the river. The coordinating council shall be composed of one representative appointed from each of the following: the Department of Environmental Regulation, the Department of Transportation, the Game and Fresh Water Fish Commission, the Department of Community Affairs, the Division of Forestry of the Department of Agriculture and Consumer Services, the Division of Historical Resources of the Department of State, the Tampa Bay Regional Planning Council, the Southwest Florida Water Management District, the Southwest Florida Regional Planning

Council, Manatee County, Sarasota County, Charlotte County, the City of Sarasota, the City of North Port, agricultural interests, environmental organizations, and any others deemed advisable by the department.

(b) The coordinating council shall review and make recommendations on all proposals for amendments or modifications to this act and to the permanent management plan, as well as on other matters which may be brought before the council by the department, any local government, or any member of the council, and shall render its nonbinding advisory opinion to the Southwest Florida Water Management District, the department, and affected local governments.

(c) The council may adopt bylaws to provide for election of such officers as it deems necessary, removal of officers for just cause, meetings, quorum, procedures, and other such matters as its members may deem advisable in the conduct of its business. Such bylaws shall be approved by the department.

(d) Such professional staff as the coordinating council may require shall be provided by the department.

(7) PRESERVATION OF EXISTING GOVERNMENTAL AUTHORITY.—Nothing contained in this act shall operate to divest any agency, water management district, municipality, county, or special district of any authority or jurisdiction in existence on January 1, 1986.

(8) RULEMAKING AUTHORITY.—

(a) The department is authorized to adopt rules to regulate activities within the river area which have adverse impact on resource values as adopted by the coordinating council within the river area, subject to ratification by the executive board.

(b) The department shall coordinate all activities related to rule adoption and enforcement with the regulatory and management programs of other agencies in order to avoid to the maximum extent possible any conflicts or duplication arising therefrom.

(9) PERMITTING AUTHORITY.—

(a) No person or entity shall conduct any activity within the river area which will or may have an adverse impact on any resource value in the river area without first having received a permit from the department.

(b) A permit may be granted only after a finding by the department that the activity for which a permit has been requested will not have an adverse impact on resource values in the river area.

(c) The department may adopt an application fee schedule providing for payment of reasonable fees to defray the cost of processing applications.

(10) PERMITTED ACTIVITIES.—Nothing in this act shall be construed to prohibit or regulate any activity taking place outside the river area for which necessary permits and licenses are obtained as required by other provisions of federal, state, or local law.

(11) PROHIBITED ACTIVITY.—Airboats are prohibited from operating in the river area north of U.S. Highway 41 (State Road 45).

(12) ENFORCEMENT.—Officers of the department shall have full authority to enforce any rule adopted by the department under this act with the same police powers given them by law to enforce the rules of state parks and the rules pertaining to saltwater areas under the jurisdiction of the Florida Marine Patrol.

(13) PENALTIES.—Violation of this act or of any rule adopted under this act constitutes a misdemeanor of the second degree, punishable as provided in s. 775.082 or s. 775.083. Continuing violation after notice constitutes a separate violation for each day so continued.

History.—ss. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, ch. 85-363; s. 30, ch. 86-163.

APPENDIX G

MYAKKA RIVER TASK FORCE RECOMMENDATIONS

OBJECTIVE 1

To protect, enhance and maintain the unique and irreplaceable values, functions, diversity and benefits of the natural resources along the Myakka River.

ACTIONS

Action 1.1
Adopt a rule to establish standards for regulating activities in the river area.

Action 1.2
The Legislature should amend 258.501, Florida Statutes to : 1) establish the wild and scenic protection zone, 2) require local governments to amend their comprehensive plans as may be necessary to be in conformance with or more stringent that, [sic] this plan and management guidelines and criteria promulgated by DNR, 3) require local governments to adopt any necessary ordinances and regulations to carry out the purposes of this plan and DNR's guidelines and criteria, and 4) authorize DNR to carry out the management of the wild and scenic protection zone if it is determined, after an appropriate length of time, that local governments are unable to do so.

Action 1.3
DNR, DCA, and other appropriate agenccies [sic] should monitor and review Sarasota County's land use, zoning, and all pertinent regulatory activities to ensure that policies contained in APOXSEE are carried out consistently with the management plan guidelines and criteria.

Action 1.4
Determine the boundaries of in [sic] the river area by delineating the landward extent of wetlands vegetation as provided in Chapters 17-3 and 17-12, Florida Administrative Code.

Action 1.5
Conduct a study to determine the use of the wild and scenic protection zone by wildlife and to determine measures that may be necessary to better protect and manage wildlife in the river area and the wild and scenic protection zone.

Action 1.6
Acquire through willing-seller purchase, donation, or exchange headwater wetlands, tributaries, and land bordering the Myakka River.

Action 1.7
Establish a local land trust to facilitate willing-seller/donor land and easement acquisition of environmentally sensitive lands in the Myakka River watershed.

Action 1.8
Revise their habitat-based regulatory programs to maximize protection of wetlands and hammock vegetation along the Myakka River.

Action 1.9
Implement a prescribed burning and fuel reduction program involving landowners along the Myakka River.

Action 1.10
Implement an integrated program of exotic and nuisance species management for the river area and the wild and scenic protection zone.

Action 1.11
Implement a plan to locate, catalog, and protect listed plant and animal species and species of local concern within the river area and the wild and scenic protection zone.

Action 1.12
Recommend legislative amendments which would make it unlawful to harvest or destroy any endangered or threatened plant species within the river area and the wild and scenic protection zone.

Action 1.13
Compile an inventory of special ecological features along the Myakka River.

Action 1.14
Inventory and monitor changes to animal and plant communities in the river area and wild and scenic protection zone.

Action 1.15
Develop an inventory program to monitor and prioritize the important nesting, roosting, and breeding sites along the Myakka River corridor in order to protect these sites from any actions that may cause their discontinued use.

Action 1.16
Distribute warning signs around the two wading bird rookeries in the Myakka River near the Sarasota/Charlotte County line.

Action 1.17
Develop and implement a habitat and restoration in the river area and wild and scenic river protection zone.

Action 1.18
Develop guidelines for fence placement and educate landowners on how fences that border the Myakka River can be modified or newly constructed to facilitate easier crossing by wildlife.

OBJECTIVE 2

To protect and/or enhance the surface and ground water resource values of the Myakka River, including protection and enhancement of water quality and designated uses, and protection and restoration of optimal quantity and timing of freshwater discharge.

ACTIONS

Action 2.1
Strictly enforce regulations relating to water resources.

Action 2.2
Identify and seek funding sources to develop and institute programs for best management practices to control and reduce nonpoint source pollution within the Myakka River watershed.

Action 2.3
Revise Ordinance No. 81-22, Mining and Reclamation, to include language for the Myakka River watershed similar to that for the Manatee River watershed.

Action 2.4
Evaluate existing water quality monitoring programs to determine whether to continue and/or expand these programs to include:

a. Better coordinated and more comprehensive monitoring efforts,
b. Linkage to regulatory actions and programs,
c. Landfill and borrow pit monitoring, and
d. Monitoring of tributaries; for example, Howard Creek and Big Slough.

Action 2.5
Establish resource-based water quality and quantity standards for the Myakka River.

Action 2.6
Remove trash and debris within the river and along the river shoreline and sponsor a "Myakka River Cleanup Day" at least once per year.

Action 2.7
Conduct a hydrologic study that considers all existing and potential water control structures and diversions of river water.

Action 2.8
Petition the Environmental Regulatory Commission to amend Chapter 17-3, FAC, to designate the entire Myakka River as an Outstanding Florida Water.

Action 2.9
Seek an exemption from the exotic aquatic plant control program within Myakka River State Park to allow the limitation or prohibition of power boats on Upper Myakka Lake and Lower Myakka Lake.

Action 2.10
Investigate alternatives to the chemical control of aquatic weeds, including specifically a drawdown program for Upper Myakka Lake and Lower Myakka Lake, and effective and environmentally sound management and control practices for chemical, mechanical, biological, and/or physical weed control.

Action 2.11
Develop emergency action procedures to include timely monitoring response and remediation of spills of contaminants which could potentially affect the Myakka River.

Action 2.12
Maintain and coordinate monitoring programs for the consumptive use of ground water within the Myakka River watershed. Particular emphasis should be placed on the maintenance of wetland hydroperiods.

Action 2.13
Prohibit mining of resources in the river area. Establish recommended guidelines and design criteria for regulating mining discharges in the wild and scenic protection zone to ensure post mining runoff meets pre-mining runoff for water quality and quantity.

Action 2.14
Conduct a master watershed study to allow for comprehensive stormwater master planning.

OBJECTIVE 3

To preserve, protect and restore natural aquatic habitat necessary for the continued healthy existence of aquatic populations and communities within the Myakka River.

Action 3.1
Identify, prioritize and implement feasible aquatic habitat restoration projects upon completion of the hydrologic study.

Action 3.2
Continue monitoring programs and baseline studies with respect to major potential water withdrawals from the Myakka River.

Action 3.3
Post significant submerged aquatic vegetation beds in the lower Myakka River to reduce the incidences of prop cuts caused by boat traffic in these shallow and sensitive areas.

Action 3.4
Periodically remove derelict crab traps and fishing gear from the river to enhance aquatic resources.

Action 3.5
Implement a manatee management plan that incorporates appropriate findings and recommendations of the Nabor and Patton study (1989) and newly proposed boat speed limits.

OBJECTIVE 4

To coordinate with local, regional, state, and federal agencies in the use and regulation of land management practices that protect the quality of the Myakka River and its tributaries.

Action 4.1
Evaluate the function and composition of the Council as a management coordination body and implement any necessary modifications.

Action 4.2
Designate an officer who will be in charge of reviewing significant permits/development applications within the Myakka River watershed.

Action 4.3
Encourage consistent land use planning and regulations in the watershed between all local governments and regional, and state agencies.

Action 4.4
Monitor local codes and review and comment on proposed land development controls that regulate development within environmentally sensitive areas of the Myakka River watershed.

Action 4.5
Develop and implement land use design standards for development within the river area and wild and scenic protection zone.

OBJECTIVE 5

To minimize urban and suburban encroachment and resultant adverse impacts upon the river and allow appropriate land uses within the watershed.

Action 5.1
Continue to ensure through comprehensive plans, land development regulations and/or appropriate ordinances, that urban and suburban land uses are minimized within the river area and wild and scenic protection zone and the watershed.

Action 5.2
Regulate and discourage new facilities from being constructed over, through, or under the Myakka River.

Action 5.3
Require that land development review and approval consider sea-level rise, subsequent landward migration of wetlands, and resultant need for an upland buffer.

Action 5.4
Modify existing lighting to significantly reduce the spill of light into the Myakka River from the I-75/West River Road Interchange.

Action 5.5
Relocate the rest area located at the I-75/West River Road Interchange.

OBJECTIVE 6

To provide for the regulation, control, and distribution of public access to the Myakka River where necessary to protect and enhance the resource values of the river area.

Action 6.1
Limit uncontrolled public access to the Myakka River on the Ringling-MacArthur Reserve to the extent allowed by the rivers' carrying capacity, and include toilets, designated campfire areas, and refuse containers with a suitable vegetated buffer from the river area.

Action 6.2
Restrict additional public access on the Myakka River until a recreational carrying capacity is established and enforceable.

Action 6.3
Establish pedestrian-only nature trails on publicly-owned land in an area of the wild and scenic protection zone to promote nature study and research.

OBJECTIVE 7

To minimize the disturbances to natural resources of the Myakka River from river-related recreational uses.

Action 7.1
Conduct a comprehensive boat utilization study to quantify recreational carrying capacities by river segment and enforce recreational activity levels after carrying capacities as determined.

Action 7.2
Enact by rule a speed limits zone for the Myakka River from the Sarasota/Manatee to the Sarasota/Charlotte County line.

Action 7.3
Enact a nuisance noise ordinance, if warranted by the boat utilization study, to minimize noise impacts on the Myakka River.

Action 7.4
Prohibit airboats from operating in the wild and scenic portion of the Myakka River.

Action 7.5
Establish no-wake/idle speed zones in the vicinity of marinas, boat ramps, structures near navigable channels and in other locations where the river is too narrow to safely accommodate two-way traffic.

Action 7.6
Assign additional law enforcement personnel to enforce existing and adopted regulations on and adjacent to the Myakka River.

Action 7.7
Educate the public through a placement of signs program, at river access points, that briefly describes resource values and regulations.

OBJECTIVE 8

To protect archaeological/historical sites from adverse impacts associated with development, vandalism, and artifact collecting.

Action 8.1
Support a policy on the preservation of archaeological/historical sites on public lands.

Action 8.2
Develop management guidelines to facilitate the preservation or conservation of cultural resources, including development review of project impacts on cultural resources.

Action 8.3
Enforce existing laws and coordinate with state and local police authorities to protect archaeological/historical sites and educate law enforcement officials and the general public of these laws and regulations.

OBJECTIVE 9

To expand the knowledge and data base of the archaeological/historical resources in the Myakka River vicinity and in the watershed.

Action 9.1
Commission a cultural resource assessment survey of the watershed or the wild and scenic protection zone to acquire a greater knowledge and understanding of the watershed's archaeological/historical resources. The surveyors shall consult existing sources of information retained by DHR and Sarasota County Division of Historical Resources.

Action 9.2
Develop a sensitivity map that would locate areas of relatively high probability of cultural resource distribution.

Action 9.3
Designate a local museum in the Myakka River vicinity as an educational and curatorial facility to receive artifacts collected within the Myakka River watershed.

Action 9.4
Develop and monitor a public access site to an interpretive exhibit at one of the prehistoric Indian mounds/middens located near the river in the Myakka River State Park or Ringling-MacArthur Reserve.

Action 9.5
Sponsor an annual Myakka River Pioneer Festival at a restored homestead, farmstead or the Myakka School House with demonstration of pioneer crafts, music, storytelling, exhibits, and costumes.

DNR- Department of Natural Resources
DER- Department of Environmental Regulation
GFWFC- Game and Fresh Water Fish Commission
SWFWMD- South West Florida Water Management District
COE- U.S. Army Corps of Engineers
USGS- United States Geological Survey
DCA- Department of Community Affairs
SWFRPC- Southwest Florida Regional Planning Council
CFRPC- Central Florida Regional Planning Council
TBRPC- Tampa Bay Regional Planning Council
DHR- Division of Historical Records
Council- Myakka River Management Coordinating Council

APPENDIX H

SUWANNEE RIVER TASK FORCE RECOMMENDATIONS

Recommendation #1

The 100-year floodplains of the Suwannee, Santa Fe, Alapaha and Withlacoochee Rivers should be designated and considered as special planning areas in local government comprehensive plans and their implementing land development regulations.

Recommendation #2

Development within the special planning areas should be limited to public recreational uses, forestry, low intensity agricultural uses, low-density rural residential development, and limited commercial development (limited to existing urbanized areas within the special planning area or limited to water-dependent commercial development). New industrial, high-intensity/high-density agricultural and moderate to high-density residential uses should be prohibited. Existing industrial, high-intensity/high density agricultural and moderate to high-density residential uses should be considered non-conforming uses.

Recommendation #3

Local governments should work closely with the Department of Community Affairs technical assistance staff for guidance on designation of appropriate rural densities and resource-based non-residential development along the Suwannee River in their comprehensive plans. The Department of Community Affairs should provide its evaluations of the earlier comprehensive plans for counties in the Suwannee basin (Levy and Dixie counties) as guides for the remaining counties in the development of their plans for protecting the Suwannee River and its tributaries.

Recommendation #4

Contingent upon an adequate source of funding, the Suwannee River Water Management District and the two regional planning councils should create a GIS inventory of parcel ownership linked to county property appraisers' databases. The District and the regional planning councils, in cooperation with local, state and federal government agencies, should develop a procedure to ensure the timely update of the parcel ownership inventory (at least annually), including an update of permitting activity and enforcement actions.

Recommendation #5

The regional planning councils should advise local governments of the existence, number and configuration on non-conforming lots prior to completion of the local governments' comprehensive plans, with recommendations for treatment of such non-conforming lots. Each local government comprehensive plans should address the issue of non-conforming lots/parcels and provide for vacating plats of unsold/undeveloped subdivision lots or provide for specific terms of variances or grandfathering for lots for specific forms of development which occurs by a time certain (e.g., within one year).

Recommendation #6

Where ownership patterns allow it, platted unimproved subdivisions with undersized lots along the Suwannee River and its tributaries should be replatted to reflect acceptable lot sizes. If necessary, some sort of land authority should be created to purchase undersized lots and replat them for resale.

Recommendation #7

Incentives should be encouraged to ensure that the substantial lands in the Suwannee basin devoted to forestry are not converted to more intensive land uses. The Division of Forestry should be the lead agency for this. Forestry interests should continue to use Best Management Practices and to manage their lands in a manner that is most compatible with preserving significant natural resources in the basin.

Recommendation #8

Development along the Suwannee River and its tributaries should occur outside the 100-year floodplain wherever possible and should be concentrated as far from any water bodies as practicable.

Recommendation #9

The thresholds for development of regional impact (DRIs) should be reduced by fifty percent for any project whose lands are located wholly or partially within the 100-year floodplain of the Suwannee River or its tributaries.

Recommendation #10

The Task Force recommends that assistance be provided for local governments for the purposes of enhancing their ability to plan for the future of the Suwannee basin and to ensure that land development regulations are enforced. Because the planning and enforcement requirements of most local governments in the basin would not justify hiring full-time personnel, this recommendation could possibly be accomplished by providing funding on a continuing basis to the regional planning councils and the Suwannee River Water Management District to hire additional personnel to assist local governments in planning, monitoring and enforcement. The Department of Environmental Regulation and the Department of Community Affairs should include budget requests for funds for the Suwannee River Water Management District and the regional planning councils, respectively, to implement this recommendation.

Recommendation #11

The Suwannee River Water Management District should develop a river bank stabilization erosion control design, operation and maintenance manual with particular emphasis on river bank stabilization erosion control methods that could be implemented by residential owners along the river system.

Recommendation #12

Local governments in the Suwannee River basin should amend their floodplain ordinances to be consistent with the newly amended Rule 40B-4, F.A.C., requiring buffers greater than 75 feet where development is more intense than a single-family residence. The North Central Florida Comprehensive Regional Policy Plan should also be amended to reflect this variable buffer.

Recommendation #13

The North Central Florida Regional Planning Council and the Suwannee River Water Management District, in cooperation with the Florida Game and Fresh Water Fish Commission, should identify areas where additional setbacks should be implemented to ensure adequate habitat for wildlife dependent on the Suwannee River, its tributaries, springs, spring runs and associated wetlands. Local governments should use the results of this study in their development of comprehensive plans to identify areas along the Suwannee River and its tributaries that should be maintained as conservation areas for the protection of riparian wildlife habitat. The identification of areas where additional setbacks are necessary should be completed by June, 1990, to ensure sufficient time for local governments to consider the results in development of their comprehensive plans.

Recommendation #14

Wherever possible, undisturbed setbacks from the river should be adequate to maintain the aesthetic quality of the wilderness experience for those people using the river or its tributaries for recreational purposes.

Recommendation #15

Local governments and the Suwannee River Water Management District should ensure that all development within the 100-year floodplains complies with existing buffer requirements and with the minimum standards and requirements of the FEMA model ordinance provisions or the applicable county or city floodplain ordinances adopted pursuant thereto.

Recommendation #16

Where safety or erosion concerns warrant, the counties, DNR and GFC should cooperate to establish and enforce boating restricted areas. There does not appear to be a need for a riverwide recommendation on this issue. Boating problems should be addressed on a case-by-case basis with closer coordination among the responsible agencies.

Recommendation #17

The Task Force recommends that the Department of Natural Resources designate appropriate parts of the Suwannee River as slow speed zones to protect the West Indian manatee.

Recommendation # 18

The Task Force recommends that all spring runs that enter the Suwannee River or its major tributaries be closed to motorboats and that the Department of Natural Resources and the Florida Game and Fresh Fish Commission conduct a study to determine which spring runs, if any, should be reopened to motorboat traffic. (Commissioner Stephenson, Dixie County, requested that his objection to this recommendation be noted with an explanation that some springs do not have access by land. His concern is that cutting off access by motorboat will cut off all access to the springs.)

Recommendation #19

The Task Force recommends that signage regarding regulation of boating restrictions be the responsibility of the State, not local governments.

Recommendation #20

Given the broader interests of the CARL program, the recent acquisitions by government agencies, and the recent developments along the Suwannee River, the Task Force recommends that CARL staff reanalyze this basin to determine if land acquisition projects and programs currently in place are adequate for the long-term protection and conservation of this important river system. This could be accomplished through the CARL program, as was done for the Apalachicola River and Bay and is being attempted for the Wekiva River system, and should be coordinated with the District's Save Our Rivers program.

Recommendation #21

The Task Force recommends that the Department of Natural Resources conduct a study to determine how a local government's loss of ad valorem tax revenues through land acquisition can be offset by payment in lieu of taxes.

Recommendation #22

Given the limited funding available for the number of CARL and Save Our Rivers projects statewide, the Task Force recommends that state, regional and local government agencies establish joint participation in land acquisition programs and encourages the development of alternative funding sources for land acquisition and management in the Suwannee basin. Existing sources of funding for land acquisition need to be augmented to the greatest extent practicable.

Recommendation #23

The Suwannee River Water Management District should vigorously pursue implementation of its Surface Water Improvement and Management Plans for the Suwannee River basin. Funding for the implementation of the plans should be guaranteed on a continuing basis to ensure that the SWIM duties are carried out effectively.

Recommendation #24

The Department of Environmental Regulation should move forward promptly to collect sufficient data to evaluate the impact of Jumping Gully Creek upon the Withlacoochee River in accordance with the action taken by the Environmental Regulation Commission at its February 16, 1989 meeting. Upon completion of this study, the Environmental Regulation Commission should move promptly to take any necessary steps relating to the regulatory classification of Jumping Gully Creek to assure protection of the water quality of the

Withlacoochee River. Following action by the Environmental Regulation Commission, the Department of Environmental Regulation should move as expeditiously as possible in the permitting process to take all necessary steps to assure the continued protection of the water quality in the Withlacoochee River. The Task Force recommends that Jumping Gully Creek not be classified as a Class V waterbody.

Recommendation #25

The Task Force recommends that significant degradation of the water quality for the Suwannee River and its OFW tributaries be defined as any unnatural variation from ambient water quality; that FDER use the existing studies performed by State and federal agencies as defining ambient water quality; and that FDER perform studies to provide information not presently available. In summary, there is to be no further degradation of water quality in the Suwannee River and its OFW tributaries.

Recommendation #26

The source of the high levels of mercury in fish from the Suwannee River should be identified and measures taken to stop its bio-accumulation in the river's biota.

Recommendation #27

Nekoosa Packaging Company and Occidental Chemical Corporation have both made strides in reducing their impacts on surface waters in the Suwannee basin. All industrial discharges along the Suwannee River and its tributaries should share their long-range plans at appropriate time frames for further reduction of their impacts with local governments as a model for dealing with water quality in their comprehensive plans.

Recommendation #28

The Florida Department of Environmental Regulation with the cooperation of the Suwannee River Water Management District should develop and implement (by rule) a permitting system for high intensity/high density agricultural operations based on best management practices or other criteria specific to the agricultural industries (e.g., specific criteria for permitting dairies) and specific to the Suwannee River Basin within one year. The specific criteria or best management standards should ensure that such operations will be in full compliance with state water quality standards and other criteria established as part of a SWIM plan. Until that time, the FDER's current policy of review of such agricultural operations under a test of "reasonable assurance of no adverse impact" should continue. The permitting program should provide for upgrade and permitting of existing high intensity/high density agricultural operations within three years of rule implementation.

Recommendation #29

Occidental Chemical Corporation should continue its land reclamation in a manner that provides sufficient wetlands and vegetative cover necessary for cleansing water runoff prior to entering the Suwannee River or its tributaries and should continue to protect existing wetlands. Restoration of wetlands and hydrology should approximate the type, nature and function of pre-mining conditions.

Recommendation #30

Areas of high residential density within the 100-year floodplain should be encouraged to plan, develop and implement a stormwater management system through the development of "Stormwater Utilities", with the intention of providing existing and proposed development with sound stormwater/surface water management in accordance with applicable rules of the Department of Environmental Regulation and the Suwannee River Water Management District.

Recommendation #31

The Task Force endorses the changes proposed for Rule 10D-6, Florida Statutes, that would require repair permits for any modifications to septic tank systems, prohibit septic tanks in hydric soils or where the high water table is at ground level, and prohibit mounding in floodways.

Recommendation #32

The Florida Department of Health and Rehabilitative Services should phase out the vested rights provisions for permitting of pre-1972 undersized plats.

Recommendation #33

The Task Force recommends that the Florida Department of Health and Rehabilitative Services and local government health departments assess whether septic tanks along the Suwannee River and its tributaries are operating as permitted, or whether enforcement action need to be taken to ensure that septic tanks are functioning properly.

Recommendation #34

The State of Florida should contract with the Suwannee River Water Management District and the North Central Florida Regional Planning Council to identify the numbers and locations of lots which do not meet the minimum requirements of Rule 10D-6, Florida Administrative Code.

Recommendation #35

Urban, High and Moderate residential density areas and all commercial development within the 100-year floodplain should be served with central wastewater collection, treatment and disposal systems. Two areas in particular, the Lower Suwannee-Fanning Springs/Old Town to Suwannee area (Old Town and Fanning Springs between the Suwannee River and S.R. 349 in Dixie County and Fanning Springs south to Manatee Springs State Park and Fowler's Bluff in Levy County) and the Three Rivers Area (Santa Fe and Ichetucknee confluence area, including the town of Fort White, the area adjacent to and south of C.R. 238, the area east of C.R. 137, Ichetucknee Springs State Park, Three Rivers Estates and other subdivided areas) should be served by central sewage systems and public water supply system. All existing septic tanks should be abandoned in those areas. A feasibility study of regional wastewater utilities and public water supply systems for these areas should be funded and completed by the Florida Department of Environmental Regulation within one year.

Recommendation #36

On-site sewage disposal systems, private wells and central wastewater facilities should be prohibited within the 10-year floodplain and should otherwise be in compliance with applicable rules and regulations. All residential lots outside the 10-year floodplain proposing to use septic tanks should have at least 10,000 square feet of unobstructed area containing moderately limited or better soils to a minimum depth of 60 inches.

Recommendation #37

The Task Force supports and endorses the concept of Development Review Committees outlined in the 1988-89 SWIM plans. These committees should be a primary instrument for implementing Task Force recommendations and SWIM programs during the local development review process. Such committees, one for each county or in reasonable aggregations as situations warrant, should meet frequently with local officials to review development proposals. Support should be permanently dedicated to the Suwannee River Water Management District, the North Central Florida and Withlacoochee Planning Councils and the Department of Community Affairs for staff and resources to assist and participate in the review committees.

Recommendation #38

Governor Bob Martinez should contact Governor Joe Frank Harris of Georgia to initiate an interstate effort for long-term protection of the Suwannee River at all levels of government. Interstate cooperation should eventually result in coordinated efforts by Florida's state and regional agencies with Georgia's Department of Natural Resources and regional planning agencies.

Recommendation #39

The Secretary of the Department of Environmental Regulation, in coordination with the Governor's office, should request the U.S. Fish and Wildlife Service, managers of the Okefenokee Swamp National Wildlife Refuge, to develop and implement a management scheme for the Suwannee River discharge control structure at the southwestern boundary of the National Wildlife Refuge. The management scheme should provide specifically for return of pre-impoundment hydrology, frequency distribution and periodicity of discharges to the Suwannee River and provision for baseflow augmentation of Suwannee River discharges.

Recommendation #40

The Task Force recommends that the Department of Natural Resources conduct a public education program in the Suwannee basin on the state-administered Wild and Scenic River program.

Recommendation #41

The Florida Department of Natural Resources, Division of Recreation and Parks, should prepare a regional recreational development and management plan for the publicly owned lands within the study area. The plan should include one or more elements identifying the economic benefits of recreational use and development within the study area. The plan should be prepared in close coordination with the ownership agencies and should recognize individual limitations as to recreational use of lands with sensitive environmental resources.

Recommendation #42

An assessment should be made of the spring resources of the Suwannee basin to determine what measures are needed to protect the spring runs, springs, and their associated uplands. Protection options might include land acquisition, conservation easements, local spring protection ordinances, and restriction of access.

Recommendation #43

The Task Force endorses in principle the Department of Natural Resources' Management Concept for the Suwannee River and emphasizes the need for interagency coordination in developing the plan.

Recommendation #44

The Game and Fresh Water Fish Commission should assess wildlife habitat needs in the Suwannee basin to determine which areas in the basin need to be protected for conservation purposes. This assessment should be used as a basis for determining priority upland areas to be targeted for land acquisition by the Conservation and Recreation Lands (CARL) and Save Our Rivers (SOR) programs and for designation of significant natural areas in local and regional comprehensive plans for special consideration in reviews of large-scale developments such as developments of regional impact (DRIs), subdivisions or Planned Unit Developments.

ECONLOCKHATCHEE RIVER BASIN NATURAL RESOURCES DEVELOPMENT AND PROTECTION PLAN

VOLUME III
CRITICAL AREAS MANAGEMENT AND PROTECTION PLAN

Final Report to
St. Johns River Water Management District

by

Mark T. Brown and Charles S. Luthin
Center for Wetlands
University of Florida

John Tucker and Richard Hamann
Center for Governmental Responsibility
University of Florida

Joseph Schaefer
Urban Wildlife Program
Department of Wildlife and Range Sciences
Institute of Food and Agricultural Sciences
University of Florida

Lucy Wayne and Martin Dickinson
SouthArc Inc.
Gainesville, Florida

October 1990

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ACKNOWLEDGMENTS

We are grateful to Tom Ziegler and the staff of the St. Johns River Water Management District in Palatka, including John Hendrickson, Hal Wilkening, Lataine Donelin, and Librarian Judith Hunter, for unfailing attention to and friendly assistance on the project. We are particularly indebted to Colleen Logan (Seminole County Planning Department) and Sherry Hooper (Orange County Planning Department) for their special help in providing useful resource information for the Econlockhatchee River Basin Natural Resources Development and Protection Plan project.

We acknowledge the following individuals for sharing information and materials for preparation of this report:

Wes Biggs (Florida Audubon Society, Maitland)
Ken Bosserman (Friends of the Econ, Winter Park)
Jim Bradner (Department Environmental Regulation, Orlando)
Greg Brock (Florida Department of Natural Resources, Tallahassee)
Jim Crall (Orlando Utilities Commisision, Orlando)
Fred Cross (Florida Game and Fresh Water Fish Commission, Melbourne)
Jay Davoll (Florida Department of Transportation, Winter Park)
Michael Dennis (Breedlove, Dennis and Associates, Orlando)
Jim Farr (Department of Community Affairs, Tallahassee)
Richard Fowler (Florida Department of Transportation, Deland)
Chris Frye (Osceola County Planning Department)
Albert Gregory (Florida Department of Natural Resources, Tallahassee)
Michael Gilbrook and other staff, (East Central Florida Regional Planning Council, Winter Park)
Ellen Hemmert (East Central Florida Regional Planning Council, Winter Park)
Jim Hulbert (Florida Department of Environmental Regulation, Orlando)
Linda Jennings (Orange County Environmental Protection Department, Orlando)
Herb Kale (Florida Audubon Society, Maitland)
Dainne Kramer (Oviedo Planning Department)
David Kriz (USDA Soil Conservation Service, Orange County)
Roland Magyar (Orlando Planning and Development Department)
Bill Masi (Orange County Engineering Department, Orlando
Donald McIntosh (Donald W. McIntosh Associates, Inc., Orlando)
Rick Smith (Office of the Governor, Tallahassee)
Jack Stout (University of Central Florida, Orlando)
Henry Whittier (University of Central Florida, Orlando)

INTRODUCTION

The Critical Areas Management and Protection (CAMP) plan is the third and final volume of a three-part set of planning documents entitled "Econlockhatchee River Basin Natural Resources Development and Protection Plan." This volume proposes a specific overall management plan for the basin based on the inventory of resources and cognizant of the existing regulatory framework discussed in the previous volumes.

Volume I contains a resource inventory of basin covering, water resources, wetland and terrestrial ecosystems, wildlife, and historical resources.

Volume II surveys the regulatory framework and economic forces of the basin.

Statement of the Problem

The Econlockhatchee River Basin (Econ River Basin) of central Florida is under substantial development pressure. Because of its special characteristics, it takes considerable effort to manage its development in order to protect its resources. The overall basin is composed of two subbasins: (1) the eastern portion drained by the Big Econlockhatchee River, and (2) the western portion drained by the Little Econlockhatchee River. The Big Econ Basin is relatively undeveloped and the water quality has been relatively good. Major portions of the Little Econ Basin are highly urbanized and experienced serious water quality problems in the past. The Little Econ Basin still shows signs of poor water quality due primarily to nonpoint source urban runoff. The source of concern lies in the Little Econ Basin's close proximity to the rapidly expanding Orlando Metropolitan area.

As development spreads across the landscape toward the Econ River, issues of concern include maintaining and/or improving water quality and quantity as well as protecting wildlife species from extinction within the basin. Every time the ground, understory, or canopy layers in a natural vegetation community are altered, food and cover requirements for certain wildlife are removed. When an essential habitat component diminishes to a level that is insufficient for a species to survive, that species can no longer live there. In other words, it becomes extinct in that area. Of the state's 111 species which are endangered, threatened, or of special concern, 39 are found in various habitats within the Econ Basin. Seven of these occur only in Florida. Many of the other 238 species are extinct in several townships within the basin. Unless something is done to reverse present trends, these unique components of the basin's natural heritage will be gone forever.

The St. Johns River Water Management District funded this study to identify the extent of these problems and to achieve some measure of control over them through management and regulation. The study has been divided into two phases: (1) a rapid survey of the resources and potential problems

and development of a Critical Areas Management and Protection plan (CAMP plan), and (2) an extended and more detailed analysis of problems and solutions culminating in a Comprehensive Basin Management Plan.

The ultimate objective of the first phase is to develop the CAMP plan. The goals of the plan, implemented through management and regulatory initiatives are as follows:

1) Improve water quality in the Little Econ River.
2) Minimize the decline in water quality and quantity in the entire basin.
3) Protect wetlands and other significant ecological communities of the basin.
4) Maintain viable land populations of wildlife species.
5) Protect cultural and historical resources of the basin.

A regulatory framework already exists in the Econ Basin. To some degree, federal, state, and regional laws and rules manage growth and offer protection to its resources. There are no less than five municipalities and three counties that each have plans, laws, and development regulations affecting development within the basin. However, the regulatory framework is neither well coordinated nor comprehensive and does not treat the river as one system. Of critical importance, the existing regulatory framework does not seem to recognize the linkages between the "parts" (i.e., linkages between uplands and wetlands, habitat value and maintenance of viable wildlife populations, or lowered groundwater levels and wetlands protection).

This study doesn't intend to diminish the existing framework but, instead, to identify where critical gaps exist and suggest modifications and additions that may add a greater degree of protection. Most importantly, it is not the aim of this study to unduly hinder appropriate development, but only to help guide it to ensure compatibility between economic uses and ecologic functions and values.

Identification of Critical Areas

Critical areas are those areas within the basin that are worthy of special attention because of their location, ecological function, or sensitive nature are worthy of special attention. In some instances, critical areas are geographic portions of the basin that are developed and, as a result, require attention. Some contain rare ecological communities or particularly valuable ecosystems that require protection. Others are potential wildlife corridors or pivotal parcels and should be purchased. Still others provide essential habitat for maintenance of viable populations of wildlife.

The following paragraphs describe critical areas, starting with the more general and ending with specific geographic locales. In essence, the list is an ordered ranking by regulatory intensity. The larger the area, the more generalized the regulatory and management suggestions. For each critical area, a rationale is given for its inclusion. Critical areas are shown on Map 1.

Area 1. Urbanized portions of the Little Econ upstream of University Blvd. Much of this portion of the basin has been developed for a number of years and does not conform to current stormwater management rules. In addition, much of the river channel has been channelized. These two factors form the basis for management suggestions for this critical area and most often cited for the poor water quality associated with the Little Econ and the Lower Econ River.

Area 2. Headwaters of the Big Econ River south of the Beeline Highway. The Big Econ flows north from an extensive headwaters landscape dominated by cypress and marsh wetlands. Water quality and dry season flow rates are favorably influenced by the present condition of this area. Although management of the lower reaches of the river will ensure its health, management of the headwaters is also critical.

Area 3. Xeric scrub communities of the Big Econ Basin. Xeric communities in a flatwoods-dominated landscape are a rarity. Occupying relic dunes, mostly along the "ridge" that separates the Little and Big Econ basins, xeric communities are the habitat of numerous threatened and endangered wildlife and plant species. Unfortunately for these threatened and endangered species, xeric communities offer excellent development potential because of their landscape position and generally well-drained soils. As a result, they are disappearing throughout the eastern portions of Orange, Osceola, and Seminole counties.

Area 4. River corridor of the Big Econ and the portion of Little Econ north of University Blvd. The corridor of land that is delimited by the 100-year floodplain averages about 2500 feet wide for most of the Big Econ River, and approximately 1200 feet wide for the Little Econ River north of University Blvd. Included within this area is a mosaic of wetlands and uplands that is critically interconnected and that provides an important wildlife habitat. Slightly developed and with few intrusions, this river corridor contains the majority of historical Indian sites within the basin.

The riverine corridor of floodplain wetlands and adjacent uplands forms an impressive 38-mile wildlife corridor linking the headwaters with other dispersed wildlife habitat of the basin. Essential to wildlife, a corridor allows free movement of wildlife, provides for the spatial needs for maintenance of viable populations of wildlife, and ensures a scenic, wild buffer between developed lands and the river.

Area 5. Floodplain wetlands of the Big Econ and Little Econ. Floodplain wetlands are important wildlife habitat and ensure good water quality in the rivers with which they are associated. The floodplain wetlands of the Big Econ are relatively intact communities, although there is evidence of earlier logging. The Little Econ has relatively intact floodplain wetlands in its unchannelized portions.

Area 6. Lower Reach of the Econ River adjacent to the St. Johns River. Probably the most diverse mosaic of ecological communities in the basin is located in the lower reaches of the basin where the Econ joins the St. Johns River. Presently proposed for CARL acquisition, the lands surrounding the lower Econ River are host to numerous historical sites and relatively intact mixed hardwood swamps and upland hammocks.

Area 7. Potential wildlands corridors connecting the Big Econ with Seminole Ranch, Tosahatchee Preserve, and Lake Mary Jane Wetlands and corridor connecting Big and Little Econ Rivers. Because the recommended preservation/conservation area along the Big Econ is relatively narrow and will somewhat restrict wildlife movements compared to natural landscapes, several linkages between the Econ River and larger habitats to the east should be established. These wildlife corridors will allow alternate dispersal routes and a less restricted exchange of genetic material from other populations. Four corridors have been delineated that would add an important level of integration to the wildlands network and help ensure adequate population interaction and movement.

One corridor would connect the Big and Little Econ rivers; the three corridors would connect the Big Econ with three natural areas outside the basin: Tosahatchee State Preserve, Seminole Ranch, and Lake Mary Jane wetlands. This would form a regionwide network of wildlands (see Map 1).

MANAGEMENT AND DEVELOPMENT GUIDELINES

The system of critical areas (shown in Map 1) are crucial to management of the basin's natural resources. Extensive areas like Area 1 (urbanized portions of the Little Econ) and Area 2 (headwaters of the Big Econ) require broader scale management and development control. Smaller, specific areas require more definitive management.

This volume suggests guidelines for management and future development. Some are appropriate as planning policies and others may be useful as principles for site planning and design.

Guidelines Within Critical Areas

Each critical area has unique sensitivities to development as well as regulatory and management needs that will enhance its current condition. Compatible activities are those that enhance or do not disrupt ecological functions and values. The following paragraphs discuss what development activities are compatible and suggest regulatory initiatives for each critical area. In addition, this volume provides management and development guidelines that may further protect and enhance resource values.

Area 1. Urbanized portions of the Little Econ upstream of University Blvd. Providing better stormwater management will become increasingly important within area 1. This area is densely developed. For the most part, stormwaters are not adequately handled since much of the area was developed prior to current Water Management District stormwater regulatory authority. In addition to causing water quality problems, dense development of the area has eliminated most natural wildlife food and cover. Requiring all development within the basin to retrofit to current standards may be an impossible task given the level of development that has already occurred.

The following are management and development guidelines for the urbanized portions of the Little Econ River:

1) Prevent further channelization and dechannelize and re-establish old floodplain wetlands wherever practicable.
2) Purchase adjacent uplands for conversion into regional treatment systems which incorporate created wetlands to store and treat stormwaters within each subbasin.
3) Increase assimilative capacity of ditches and channelized portions of the Little Econ by growing and regularly harvesting aquatic and emergent vegetation, and harvesting on a regular basis.
4) Establish and revegetate native vegetation along channels where possible.

Area 2. Headwaters of the Big Econ River south of the Beeline Highway. Area 2 is greater than 50% wetlands and is critical for the "health" of the Big Econ. Development of its uplands will be extremely difficult without significant augmentation of natural drainage. This will cause a loss of storage capacity, increased wet season river flows, and decreased dry season base flows. While relatively undeveloped (that is, free of urbanization), much of the natural landscape of area 2 has been altered due to agricultural and silvicultural practices.

The following are management and development guidelines for area 2.

1) Require management of stormwaters from any proposed developments so that pre-development and post-development discharges are equivalent in quantity, rate, quality, timing, and duration.
2) Restrict (including harvesting) silvicultural operations in wetlands.
3) Require wildlife buffers of at least 550 feet from the edge of open water, including 50 feet of uplands for all isolated wetlands greater than or equal to 5 acres in size.
4) Purchase as much of the headwaters south of the Beeline Highway as possible, but especially the Econlockhatchee River Swamp with adjacent uplands and the area known as Bee Tree Swamp with adjacent uplands.
5) Prohibit further highway and utility corridor construction that crosses the headwaters basin and increases fragmentation.

Area 3. Xeric scrub communities of the Big Econ Basin. Most of the scrub is located within desirable locations for development and, as a result, they are endangered communities within the basin. Management and development guidelines for scrub communities are as follows:

1. Prohibit development activities within remaining scrub communities unless it does not alter essential habitat components.
2. Establish linkages with other habitat types, when setting aside scrub habitats, so they do not become isolated islands in developed landscapes.
3. Provide development credits or wetland mitigation credits when scrub communities are left intact and connected to other habitat systems.

Area 4. River corridor of the Big Econ and the portion of Little Econ north of University Blvd. A mosaic of wetlands and uplands, which lie within the 100-year floodplain, is included with area 4. Habitats within this mosaic are critically interconnected and important for wetland and upland wildlife. Wildlife access and movement along the length of the basin is greatly facilitated by the contiguous canopied corridor.

A continuous corridor with few road crossings, cleared utility easements, or developed patches is essential. Loss of vegetated cover reduces wildlife habitat values and corridor functions. Development within the corridor alters surface- and groundwater hydrology and decreases surface-water storage.

Continued fragmentation of the basin can be offset by preservation of a continuous riverine corridor that can connect fragmented and otherwise isolated habitats.

Management and development guidelines for the river corridor are as follows:

1) Establish a conservation zone along the main stem of the Big Econ and Little Econ north of University Boulevard that corresponds to the 100-year floodplain as delimited on USGS FIRM Maps (Map 1). Such a conservation zone should be described with (2), (3), (6), (7), and (12) characteristics.
2) Limit development activities within the conservation zone to activities that do not permanently alter vegetation except for those noted below.
3) Prohibit agriculture within the conservation zone.
4) Restrict silviculture to a minimum 100-year rotation (1% per year) except for using small cuts, or selective harvesting. In addition, approximately X% of land area should be preserved in old growth timber.
5) Preserve historical sites and protect them from further degradation.
6) Control passive recreation by locating nature trails along the preservation zone edge or landward edge of the area and transect the middle of the conservation zone only once per mile. Further, pavilions, nature centers, parking lots or other structures should be eliminated.
7) Recreational and nature trails should be unsurfaced, no wider than 4 feet, and prohibit motorized vehicular access except for maintenance.
8) Minimize utility and road crossings. These present major obstacles to wildlife movements and should be strictly minimized with provision of adequate wildlife underpasses wherever allowed. No more than two more should be allowed along the entire length of the Big Econ. Prohibit further highway and utility corridor construction than increase habitat fragmentation.
9) Control groundwater levels within the conservation zone to ensure no lowering of groundwater levels within the floodplain wetlands preservation zone.
10) Encourage revegetation of all cleared and previously altered lands should be allowed to revegetate with native ecological communities in the conservation zone.
11) Prohibit free-ranging domestic in the conservation zone.
12) Develop and implement a prescribed burning plan throughout the conservation zone where applicable.

Area 5. Floodplain wetlands of the Big Econ and Little Econ. The floodplain wetlands associated with the river are essential for water quality, flood storage, and wildlife. The following are management and development guidelines for floodplain wetlands.

1) Establish a basinwide preservation zone along the main stems and tributaries of the Big Econ and Little Econ rivers that is the greater of either 550 feet landward of the water/wetland edge, or 50 feet landward of the landward extent of the floodplain wetland (see Figure 1 and Map 1).
2) Prohibit all development activities except for nature trails, boardwalks, dock, and other construction as provided for below in the preservation zone.
3) Prohibit silviculture and agriculture within the preservation zone.

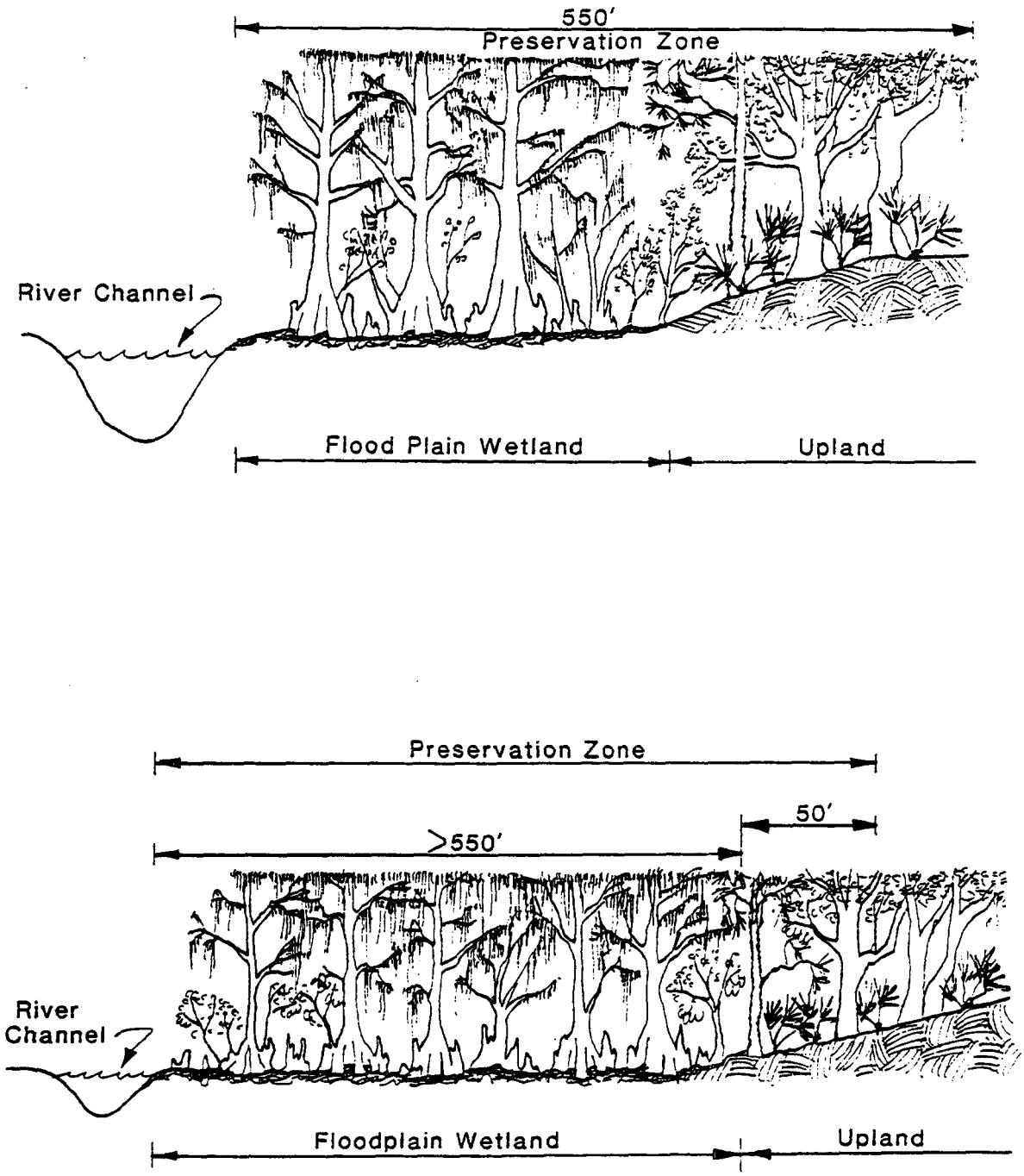

Figure 1. Diagram illustrating the width of the Preservation Zone for the river floodplain wetlands of two different widths; for those less than 550 feet (top diagram) and for those greater than 550 feet (bottom diagram). In the top diagram, where the wetland is less than 550-feet wide measured from the waterward edge of the wetland to its upland edge, the preservation zone is 550 feet. Where the wetland is greater than 550-feet wide, the preservation zone is the width of the wetland plus 50 feet of upland.

4) Control passive recreation by locating nature trails only close to the waterward or landward perimeters of the preservation zone and cross the middle of the preservation zone no morethan once per mile. Further, pavilions, nature centers, parking lots or other construction should be prohibited.

5) Limit boat ramps and river access points to no more than one per mile of river to preserve the connectivity of the system.

6) Minimize utility and road crossings and provide adequate wildlife underpasses wherever crossings are allowed. No more than two more should be allowed along the entire length of the Big Econ. Prohibit further highway and utility corridor crossings that increase habitat fragmentation.

7) Prohibit alteration of the hydrologic regime within the floodplain wetlands preservation zone.

8) Allow all cleared and previously altered lands to revegetate with native ecological communities.

9) Prohibit free-ranging domestic animals.

10) Develop and implement a prescribed burning plan where applicable.

Area 6. Lower Reach of the Econ River adjacent to the St. Johns River. Area 6 contains numerous historical sites, an extensive mosaic of ecological communities and important wildlife habitat. Because of its pivotal location, linking the St. Johns River and the Econ River systems, and because of its landscape diversity, it is an important resource for wildlife.

Management and development guidelines for the lower Econ River area as follows:

1) Proceed with acquisition under the CARL program.

2) Design development of public lands for recreational purposes outside of the conservation area to minimize fragmentation of important habitats and mosaics of habitats.

3) Leave historical sites on public lands intact and protect from further degradation.

Area 7. Potential wildlands corridors connecting the Big Econ Conservation Zone with other wildlands. Area 7 consists of wildlife corridors which would connect the basin to large natural areas to the east and west. Areas one mile wide have been delimited on the map. It is suggested that efforts for acquisition of parcels within these broad corridors be increased as a means of establishing contiguous corridors as wide as possible, from the Econ to the St. Johns River at several locations. The locations chosen are tributaries to the Econ that connect with relatively undeveloped lands. Management and development guidelines for these potential wildland corridors are as follows:

1) Establish a program to evaluate, select and purchase lands; establish easements, or transfer development rights to adjacent parcels.

2) Institute an overlay zoning category called "wildlands corridor" and develop performance criteria and incentives for uses of lands that are consistent with wildlife corridor functions and for the preservation of natural vegetative cover.

Table 1 gives the area within the conservation zone, preservation zone and floodplain Wetlands of the Big and Little Econ rivers. Since the preservation zone extends along the tributaries of the river, its area is greater than the area within the conservation zone.

Table 1. Area of Floodplain and Wetlands and Preservation and Conservation Zones.

Seminole County	31354		17.9%
Wetlands*	4396	14.0%	2.5%
Preservation Zone@	2201	7.0%	1.3%
Conservation Zone#	4667	14.9%	2.7%
Orange County	127315		72.8%
Wetlands*	20222	15.9%	11.6%
Preservation Zone@	8712	6.8%	5.0%
Conservation Zone#	5867	4.6%	3.4%
Osceola County	16203		9.3%
Wetlands*	1466		0.8%
Preservation Zone@	3255	20.1%	1.9%
Conservation Zone #	2000	12.3%	1.1%

* Wetlands not within the preservation or conservation zones.

@ Preservation zone is defined as a zone along the main stems and tributaries of the Big Econ and Little Econ rivers that is 550 feet landward of te waterward edge of the wetland, or 75 feet landward of the landward edge of the floodplain wetland, whichever is greater.

Conservation zone is defined as a zone along both sides of the main stem of the Big Econ and the Little Econ north of the University Blvd. measuring 1100 feet from the landward edge of the river channel toward the upland.

Guidelines Outside Critical Areas

Management and regulation of activities within critical areas alone is insufficient to ensure maintenance of their values, activities at sites outside of critical areas must also be managed. Some activities, because of their intensity or ubiquity, can impact a critical area even if they are distant from the critical area. In the following discussion, several activities are discussed with regard to their potential impacts on critical areas of the basin.

Maintaining Habitat Values of Critical Areas

There are several management and development guidelines for sites outside of critical areas that will greatly facilitate the ability of the critical areas system to maintain viable populations of wildlife. Major east-west highways such as Routes 420, 50, and 528 have divided the basin into four large habitat blocks. These roads are serious obstacles to north-south movements of animals along the Econ River. Their effectiveness as barriers increases as urban sprawl travels down these infrastructures. Highways also are responsible for significant mortality rates of many species. Safe travel is necessary to maintain high levels of variation in the gene pools and to replace animals that die from various causes.

Loud and sudden noises interfere with wildlife communications, and disturb feeding and nesting wildlife.

Free-ranging cats and dogs exert unnaturally high predation pressures on ground-feeding and nesting species in developed areas and adjacent critical areas. Many of the wildlife benefits achieved through preservation and conservation zones will be negated by free-ranging cats and dogs if not controlled.

Uncontrolled burning in adjacent areas threatens a prescribed burn plan for critical areas should fires escape. While natural fires play a large role in maintaining plant species composition in flatwoods and other upland vegetation communities wild fires can be disastrous to ecological communities and wildlife.

Recommendations:

1) Design and construct wildlife underpasses on existing cross-basin roads similar to those implemented along Alligator Alley. These underpasses should be wide enough to substantially reduce disturbances from encroaching development along the highways.
2) Prohibit loud and sudden noises in areas adjacent to identified critical areas.
3) Develop educational programs and additional incentives that will encourage pet owners to keep their cats and dogs confined to their property.
4) Develop a prescribed burning program in areas where applicable adjacent to critical areas to protect against wild fires.

Managing Developed Areas for Wildlife

Current development practices are often not sensitive to wildlife requirements. Solutions to several problems associated with habitat loss and degradation could be easily accommodated within developed lands.

Only 8 of the 39 listed (endangered, threatened, and special concern) species that are assumed to occur in the Econ Basin have been documented through the development review process. Consequently, development is probably destroying critical habitat for unnoticed, listed species.

Landscaping practices that do not effectively address wildlife needs create artificial environments with very little, if any, habitat values.

The location, arrangement, and use of wildlife corridors and conservation areas within developments determine how valuable they are to wildlife. Consequently, the areas set aside for conservation are not always providing the greatest potential benefits for wildlife that the property has to offer.

Many wetland-dependent wildlife will not be able to survive in areas where access to upland areas is not available. They will be deprived of critical nesting and feeding resources provided by these habitats.

Stormwater control impoundments with steep sides, and no emergent or shoreline vegetation are sterile environments for wildlife.

Recommendations:

1) Implement the use of the Wildlife Methodology Guidelines published by the Florida Game and Fresh Water Fish Commission for all proposed development sites.
2) Landscaping standards should be developed that include the use of native plant species and restrictions on the removal of understory vegetation so that some wildlife requirements can be provided and the landscaped areas will blend into nearby natural areas.
3) Arrange wildlife corridors and conservation areas so they connect with each other and with larger natural systems as much as possible. Construct road underpasses that allow movement of wildlife. One large conservation area usually provides more benefits to wildlife than many smaller ones. Whenever possible, conservation areas of adjacent developments should be combined into large connected areas. Recreational facilities should be provided in areas other than conservation areas.
4) Provide buffers of at least 550 feet from the center of the wetland including 50 feet of uplands for all wetlands equal to or greater than 5 acres. Locate upland conservation areas so they will connect as many wetlands as possible. Standards should be developed for protecting smaller permanent and ephemeral wetlands.
5) Develop standards for stormwater ponds that include the use of native emergent vegetation, littoral zones, and native vegetation along the shore so that these ponds will provide aquatic and wetland wildlife habitat values.

Drainage. Drainage of lands, especially in the flat, poorly drained topography that is characteristic of much of the Econ Basin, affects areas a great distance from the drainage site. In a recent study, Brown, Schaefer, and Brandt (1989) calculated that in very flat topography, water levels in wetlands more than 700 feet from a groundwater drawdown structure can be lowered--even when the drawdown at the structure is only 3 feet. Greater drawdowns require much greater distances to buffer their effects.

Recommendations:

1) Establish a maximum drawdown of feet below the average, wet season, water-table elevation throughout the Big Econ, and undeveloped portions of the Little Econ Basin to minimize overdrainage, loss of existing storage and losses of wetland and terrestrial vegetation.
2) Require permits for construction of any significant additional drainage ditches by public agencies or private organizations regardless of outfall cross-sectional area. Require in the permit conditions that the net effect of the drainage structure will not lower surrounding groundwater elevations more than three feet from the average wet season elevations.
3) Construct weirs and internal dams (where practical) in existing drainage ditches that criss-cross the basin to raise water levels and therefore slow dewatering of the landscape. Re-establish groundwater levels no lower than three feet below pre-development, average, wet-season groundwater levels.
4) Require setbacks or buffers to be located between stormwater management structures and significant wetlands to ensure no significant alteration of the hydrologic regime at the wetland edge.

Channelization. Channelization of drainage features is extremely destructive to resource values. Waters move more quickly; therefore, there is less time for assimilation of wastes and pollutants. While the channelized drainageway can accommodate more water in a shorter period of time, the water carries increased nutrient and pollutant loads to downstream locations. Often channelization also lowers water table elevations in surrounding lands.

Recommendations:

1) Prohibit further channelization of rivers and tributaries.
2) Begin a program to restore channelized streams and tributaries. Where this is not possible, establish wetland detention basins as a means of improving water quality prior to release to the river.

Stormwater management. Impervious surfaces ultimately increase runoff and nonpoint sources of pollution. Combined with declines in storage in wetlands and soils, increases in impervious surface can shift the river's hydrology to higher, wet-season, peak runoff and lower, dry-season base flow.

Under existing stormwater regulations, stormwater systems are required to reduce by 80% the pollutant load (nutrient load) of stormwaters exiting a developed site. While the intent is to reduce the potential pollutant load leaving any single site, the regulation does not address the cumulative effects of numerous developments all discharging 20% of their pollutant load to the river.

The quality, quantity, rate, and timing of runoff from lands is important to the long-term environmental quality of the Econ River. Changes in impervious surfaces and storage characteristics of lands as they are developed can alter runoff characteristics. Stormwater rules in the basin should regulate effects on runoff quantity and timing as well as quality to ensure runoff patterns; thus, river hydrology is not negatively affected by development.

Recommendations:

1) Require more stringent stormwater management in the Big Econ Basin, and require that pre- and post-development runoff should be similar in quality, quantity, rate, and timing.
2) Change stormwater regulations to address cumulative impacts of full development of the basin. One way to address full development may be to do a nonpoint source waste load allocation of the basin and assign waste load discharges on a per acre basis.
3) Bring retro-fit existing, non-conforming stormwater management systems into conformance with stormwater regulations in the Big Econ Basin.

Wetland stormwater management systems. Detention systems are often designed as wet systems in areas with high-water tables such as the Econ Basin. Frequently they are designed as lakes with mostly open water and some wetland vegetation around the edges. These systems, by their location and the stormwater loads they receive, are relatively nutrient rich and require special management to maintain their open water character. In addition, the stormwater treatment ability of a lake versus a wetland is poor.

Recommendations:

1) Modify existing stormwater regulations and policies to encourage construction of wetlands within wet detention systems. The more self-maintaining the community is the better it will be able to treat stormwaters on a long-term basis. Forested systems are easiest to maintain over the long run, but hardest to establish. Marshes are easy to establish, but often require maintenance.
2) Encourage the construction of surface-water conveyance systems as forested or herbaceous wetland swales (or sloughs).
3) Develop performance criteria for the design and construction of all wetlands that emphasizes site analysis, engineering of hydroperiods, use of proper planting stock, etc.

Manage waters according to their nutrient status. The stormwater leaving a developed site generally has a higher nutrient load than waters running off an undeveloped site. A water body having a high nutrient load is characteristic of eutrophic conditions (i.e., its nutrient status is tyically eutrophic or rich in dissolved nutrients).

The nutrient status of a water body that receives only rainfall, or very limited runoff from terrestrial sources is termed oligotrophic (i.e., nutrient poor). The ecological conditions of each of these two types of lakes are quite different. The nutrient-rich environment is very productive and grows much vegetation, while the nutrient-poor environment is less productive and grows less robust vegetation.

Often the aesthetic qualities of oligotrophic conditions are considered desirable, while those of eutrophic conditions are considered undesirable. As a result, the vegetation that is associated with eutrophic conditions is often considered a nuisance or undesirable, and efforts are made to rid eutrophic waters and wetlands of their natural vegetative cover in favor of species or characteristics of oligotrophic conditions.

Management according to nutrient status suggests that programs to eliminate native vegetation from eutrophic waters should be discontinued; rather, native aquatic vegetation should be encouraged in order to benefit water quality in downstream locations.

Recommendations:

1) Manage surface waters when they are nutrient rich to allow native vegetative cover and, thus, water quality improvement and nutrient removal and when they are nutrient poor, manage as open water bodies. Discontinue aquatic weed spray programs in man-made drainage channels and allow vegetation to filter waters unless navigation is impaired or flood potential is significantly increased.

2) Suspend programs that require removal of native wetland vegetation species over long periods of time in created and restored wetlands or drainage swales because these species are considered undesirable. Instead, encourage greater planting densities higher diversity of planted species, creation of forested wetlands, and control of vegetation in construction phases.

Construction setback for isolated wetlands. When clearing activities occur immediately adjacent to wetland communities, there is often potential for erosion from upland portions of the site to deposit sediments within the wetland. In addition, the operation of heavy equipment in close proximity to the wetland boundary can often result in impacts to the peripheral areas of the wetland.

Recommendations:

1) To minimize impacts of heavy equipment and sedimentation in wetlands, provide a 75-foot construction setback for isolated wetlands.

REGULATORY INITIATIVES

The regulatory framework that guides development within the basin, for the most part, is capable of controlling development and protecting much of the basin's resources. However, several critical gaps have been identified that, if filled, would ensure future maintenance of resource quality and quantity.

MSSW Permitting

Modification of MSSW permitting criteria could provide substantial additional protection for the Econ Basin. Current MSSW criteria allow groundwater drawdown and do not require compensating storage for systems which cause a reduction in storage capacity between the 10- and 100-year floodplain. In addition, the criteria do not ensure that runoff characteristics (volume) or peak Q for specific storms (see #3 below) are similar for pre- and post-development conditions equals pre-development runoff.

The overall storage capacity of the entire basin could be preserved and enhanced if MSSW criteria were modified to:

1) limit the lowering of average wet season water tables to no more than three feet at any location;
2) prevent any significant alterations of existing hydrologic regime in preservation or conservation zones and significant wetlands, as defined by the East Central Florida Regional Planning Council (wetlands of five acres or greater);
3) maintain pre-development runoff characteristics by requiring drainage from a site after development to have approximately the same rate of flow, volume, timing, and quality as runoff that would have occurred following the same rainfall under pre-development conditions; and
4) restore pre-development drainage characteristics whenever possible.

Chapter 373, Florida Statutes, grants the St. Johns River Water Management District (District) broad rule-making authority to protect water resources of the district. Groundwater levels, drainage characteristics, and wetlands are clearly water resources of the district. Accordingly, the district could probably adopt more stringent MSSW permitting criteria for the Econ Basin without an additional grant of legislative authority.

Furthermore, MSSW threshold levels should be lowered for the Econ Basin. The District rules state that the "Governing Board [of the District] may designate specific geographic areas ... with threshold volumes and areas different from those ... [adopted for the entire regulatory area of the

District]."[1] Chapter 373 appears to provide ample regulatory authority for this rule, and, accordingly, for the adoption of basin specific thresholds and regulations. However, additional legislation specifically addressing the Econ Basin would be helpful.

Stormwater Permitting

District staff indicate that stormwater runoff continues to be a source of pollution in the Econ Basin. Existing district and local government regulations could be strengthened by

1) requiring the use of forested wetland detention systems rather than open water systems;
2) developing a more specific and measurable nutrient standard;
3) providing for consideration of the short-term, long-term, and cumulative effects of the construction of stormwater treatment systems on aquatic and wetland dependent wildlife and their habitat; and
4) developing specific design and performance criteria for treatment systems which will function properly considering the specific hydrology and geology of the Econ Basin.

The authority for the district to develop basin specific stormwater criteria for the Econ Basin can be implied from Chapters 373 and 403, Florida Statutes, although additional legislative authority would be helpful.[2] Local government authority to adopt stormwater regulations is derived from home rule powers and the Local Government Comprehensive Planning and Land Development Regulation Act.

In addition, the district should consider requiring retro-fitting of existing stormwater discharge facilities which do not comply with current regulations. The district should also consider requiring permits for discharges from agricultural and silvicultural lands. Both of these initiatives would be controversial and would require additional research to determine their feasibility.

Preservation and Conservation Zones

Lands adjacent to the Econ River are particularly critical for the preservation of water quality, water quantity, and wildlife. Although local governments and state agencies currently regulate activities within the Econ Basin, there is no comprehensive management scheme which provides adequate protection for the entire river system. Creation of the preservation and conservation zones as described in the Management and Development Guidelines could protect these resource values and enhance recreational and aesthetic opportunities.

Several alternatives exist for establishing and managing the preservation and conservation zones. Authority for the district to regulate riparian areas which provide habitat for aquatic and wetland dependent species can be implied from Chapter 373. Accordingly, the district could create rules specific

[1] Fla. Admin. Code § 40C-4.041(3)(a) (August 1989).

[2] Fla. Stat. §§ 373.044, 373.113, 373.171, 403.812, 403.814.

to the Econ Basin which establish the preservation zone and strengthen criteria under existing permitting programs. However, the district declined to adopt similar regulations in the Wekiva Basin without an additional grant of legislative authority. Therefore, specific legislation directing the district to establish the conservation zone and to adopt additional criteria would probably be necessary.[3]

Without an additional grant of legislative authority, the district would probably not have authority to establish the conservation zone. Although uplands and non-aquatic or wetland dependent species of wildlife within the 100-year floodplain are arguably related to the water resources of the district, the connection is tenuous. The legislature could probably grant the district authority to create and regulate the conservation zone, including uplands.

Local governments within the Econ Basin have the authority to adopt regulations to implement the preservation and conservation zones. Local governments currently provide significant protection to certain areas within the Econ system, such as wetlands, but do not adequately protect other areas, such as upland wildlife habitat and corridors. Draft comprehensive plan conservation elements for local governments within the basin contain language which could provide additional protection for the basin. However, draft conservation elements are not due for adoption until late 1990 or 1991, and corresponding land development regulations are not due until a year later.[4] At the current rate of development, many of the resource values of the Econ Basin could be lost before regulations were in place.

The legislature could direct the local governments to modify their comprehensive plans and to adopt regulations to create and regulate the preservation and conservation zones. Such legislation should create an accelerated schedule to ensure regulations are adopted as soon as possible.[5] In addition, the legislation should provide sufficient specific criteria so that local governments within the basin establish and regulate the preservation and conservation zones in a consistent manner.[6]

A third alternative involves expanding the district's authority and directing local governments to adopt specific regulations. This is the approach used in the Wekiva Basin, and it appears to be the most practical and effective method of creating and regulating the preservation and conservation zones. The

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[3]The legislature recently granted similar authority to the district to create protection zones and strengthen permitting criteria within the Wekiva Basin.

[4]Draft Comprehensive plans must be submitted by the following dates: Osceola County, July 1, 1990; Orange County, December 1, 1990; Orlando, January 1, 1991; Seminole County and Oviedo, April 1, 1991. (Fla. Admin. Code § 9J-12.007(1),(6),(7),(10).

[5]The Wekiva River Protection Act (Fla. Stat. § 369 (Supp. 1988)), enacted in the spring of 1988, required local governments to complete and submit their plans by April 1, 1989. However, at the time of this writing, one local government has still not submitted acceptable comprehensive plans and regulations.

[6]The Wekiva River Protection Act relies on the comprehensive planning review process to ensure that local government comprehensive plan amendments and regulations are consistent with the intent of the Act. Currently, two local governments with jurisdiction over the Wekiva Basin have adopted building setbacks and vegetative buffers of 200 feet landward of the river and 500 feet landward from the landward edge of wetlands. A more consistent result might have been achieved if the legislature had designated a minimum buffer width.

approach ensures that the basin is regulated from both a regional and a local perspective, and utilizes and enhances existing planning mechanisms and regulatory programs.

Regardless of which approach is taken, it appears that establishment and regulation of the preservation and conservation zones will require additional legislation. Such legislation should require rapid development and implementation of regulatory provisions. Furthermore, the legislation should provide sufficient specificity to ensure regulations are developed which result in consistent management of the Econ River system.

Outstanding Florida Waters

All surface waters in the Econ Basin are currently classified as Class III, which allows lowering of water quality below existing levels. A substantial additional degree of protection could be achieved by designating the Econ as an Outstanding Florida Water (OFW).[7] New direct discharges to the OFW, and new indirect discharges that "significantly degrade" water quality, would be prohibited unless they would not lower ambient water quality and are in the public interest. To the extent discharges are regulated, further lowering of water quality could be prevented.

Designation as an Outstanding Florida Water also increases the stringency of dredge and fill permitting. Dredge and fill projects within an OFW (or significantly degrading it) must be "clearly in the public interest," as opposed to the more lenient general standard of "not contrary to the public interest."[8] In addition, more protective dredge and fill standards could be adopted specifically for the OFW by the Florida Department of Environmental Regulation. The Wetlands Protection Act gives DER authority to adopt "stricter permitting and enforcement provisions within Outstanding Florida Waters...."[9]

Outstanding Florida Waters must be designated by the Environmental Regulatory Commission(ERC) after a lengthy administrative process. The ERC must find the candidate waters are "of exceptional recreational or ecological importance" and that "the environmental, social, and economic benefits of the action outweigh the environmental, social, and economic costs."[10] The legislature could probably also designate an OFW.

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[7]Fla. Stat. § 403.061(27)(a) (1987); Fla. Admin. Code §§ 17-3.041 (April 1989), 17-4.242 (September 1988) (Note: Rule 17-3.041 is being transferred to Rule 17-302).

[8]But see 1800 Atlantic Developers v. Department of Environmental Regulation, __ So. 2d __ (Nov.9, 1989), reversing Florida Keys Citizens Coalition V. 1800 Atlantic Developers, 8 FALR 5564 (Final Order) (Oct. 17, 1986).

[9]Fla. Stat. § 403.912(1) (1987). Such authority also extends to aquatic preserves, areas of critical state concern, and areas subject to chapter 380 resource management plans. Id. Special criteria have been adopted for the Florida Keys under this authority. (Fla. Admin. Code § 17-312.400 - 17-312.470 (July 1989).

[10]Fla. Admin. Code § 17-3.041(2) (April 1989).

Water Quality Based Effluent Limitations (WQBEL) Level II Process

According to district staff, one of the primary problems with regulating stormwater and other discharges to the Econ Basins on Class III water quality standards is that there is no specific nutrient standard. The standard currently reads: "In no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora or fauna."[11] One solution to this problem would be to conduct the necessary water quality studies and computer modeling to assess the assimilative capacity of the affected waterbodies and allocate increments of loading to point and nonpoint sources of pollutants. The rules of the Florida Department of Environmental Regulation (DER) provide for such a process for setting water quality based effluent limitations (WQBELs), conducted by DER or discharge permit applicants.[12]

Developments of Regional Impact (DRI or DRIs)

Developments which substantially affect the citizens of more than one county (DRIs) are reviewed by local, regional, and state agencies to determine regional impacts of the development. Proposed DRIs are reviewed for consistency with local comprehensive plans and regulations, regional policies, and state guidelines and standards.

The regional importance and uniqueness of the Econ Basin warrants lowering DRI thresholds. The potential is great for projects located near the continuous river system to cause adverse downstream affects in other counties. Lowering of DRI thresholds by 50% would ensure comprehensive review of a greater number of projects. The Legislature recently directed the Governor and the Cabinet to reduce DRI thresholds by 50% for significant portions of the Wekiva Basin.[13]

The Department of Community Affairs or the East Central Florida Regional Planning Council may petition the Governor and the Cabinet to decrease thresholds for DRI review.[14] The Governor and the Cabinet may decrease thresholds by up to 50%, subject to legislative approval.[15] Alternatively, the Legislature could direct the reduction of DRI thresholds by an appropriate percentage.

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[11]Fla. Admin. Code § 17-3.121(19) (May 1987).

[12]Fla. Admin. Code § 17-6.403 (April 1989).

[13]Fla. Stat. § 369.307(2) (Supp. 1988).

[14]Fla. Stat. § 380.06(3) (1987).

[15]Id. at §§ 380.06(3)(c),(e).

Interim Development Controls

Substantial changes in local government comprehensive plans and land development regulations, district regulations and other state agency regulations are necessary to fully implement the CAMP plan. The pace of development in the basin is very rapid. Several major Developments of Regional Impact (DRIs) have been approved within the last year and several others are under review near the confluence of the Big and Little Econ Rivers. The owners of most of the remaining large tracts in the upper Econ have recently announced plans to submit Applications for Development Approval (ADAs). Numerous developments below the DRI threshold are also being processed at various levels of planning and regulatory review. Only currently valid comprehensive plans, land development regulations and state agency regulations can be applied in the review process. There is a substantial likelihood that much of the basin could be committed to development that is inconsistent with the CAMP plan before the necessary regulatory changes are made to implement it. A moratorium on the issuance of development approvals pending the adoption of implementing ordinances and regulations should be considered.

Moratoria or "interim development controls" are generally considered to be valid, provided certain conditions are met.[16] First, the purpose must be valid. Allowing a local government to revise comprehensive plans or land development regulations is generally considered a valid purpose. Second, the local government must be acting in good faith to protect the effectiveness of its regulatory scheme and not merely to delay, and thus discourage development. The local government must be able to show that it is actively working to make the necessary revisions and expeditiously adopt them. Third, the local government must have been delegated the necessary authority and must follow the required procedures. In Florida, local governmental authority may be implied from home rule powers and the Local Government Comprehensive Planning and Land Development Regulation Act.[17] Finally, the ordinance cannot infringe upon such constitutional rights as due process, equal protection and the "taking" clause.

There are several options for implementing interim development controls. A moratorium on the issuance of all development approvals within the basin could be instituted. This would be controversial and, unless necessary, should probably be avoided. A more limited option would be to adopt relatively general interim development regulations based on the CAMP plan that would be applied on a case by case basis, pending the adoption of more detailed regulations. These might be similar to the Principles and Standards for Guiding Development that have been adopted for areas of critical state concern. Certain regulations could be applicable to all development approvals within the basin, while others would only apply to developments within preservation or conservation zones. Such standards could probably be drafted and adopted as quickly as a comprehensive moratorium.

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[16] See generally, T. Roberts, Interim Development Controls, Ch. 22, 3 ROHAN, ZONING AND LAND USE CONTROLS (July 1989); P. Gougelman & T. Taub, Moratoria and Interim Growth Management, Ch. 5, FLORIDA BAR, ENVIRONMENTAL AND LAND USE LAW SECTION, FLORIDA ENVIRONMENTAL AND LAND USE LAW, Vol. II (July 1989).

[17] Fla. Stat. § 163.3202 (1987).

Consideration should also be given to the adoption of interim regulations by the St. Johns River Water Management District, as well as local governments. The authority to adopt interim regulations could be implied from the general authority of the district to require MSSW permits.

Whether local governments or the district adopt interim controls, they are likely to be challenged in judicial and administrative proceedings. Legislation allowing interim regulations to be enforced pending the disposition of such challenges would be helpful.

ACQUISITION SUGGESTIONS

In addition to development guidelines and suggestions for the reform of some permitting, effective basinwide management should include a program of acquisition. Candidate lands are those that because of their location are pivotal parcels, ecologically, or represent relatively intact examples of associations of ecosystems. Two classes of acquisition suggestions are given in the following paragraphs. First, specific parcels of land are given and second, general suggestions that include the headwaters and wildlands corridors are outlined that connect regional wildlands resources. Within these corridors, lands should be purchased and easements sought so as to develop a continuous wild corridor connector.

Specific Acquisition Suggestions

Three specific parcels (see Map 1) are suggested for immediate acquisition because of their pivotal location. Immediate acquisition may be necessary to ensure they remain undeveloped.

Lower Econ CARL Application

These lands, located at the mouth of the Econ River, contain an impressive mosaic of uplands and wetlands and some of the most important historical resources of the basin. Their location adjacent to the St. Johns River enhances their values and increases the need for public ownership.

ICP Property North of and Adjacent to the Beeline Highway

Located in Twp. 23S - Rng. 32E, this property (totaling approximately 1300 acres) is in a pivotal location at the confluence of the Big Econ with two of its lessor tributaries (Green Branch and

Turkey Creek). Its location adjacent to the Beeline and between the Ranger Drainage District and DOC lands make it a likely candidate for acquisition.

Rybolt Property

Located in Twp.22S-Rng.32E, the Rybolt property is approximately 2100 acres of relatively intact flatwoods, scrub, and wetlands. The Econ River flows for approximately 1.5 miles through the western portions of the property.

General Acquisition Suggestions

Big Econlockhatchee River Headwaters

The St. Johns River Five-Year Acquisition Plan shows the headwaters area of the Big Econ River as lands that are being considered for purchase. The extent of wetlands within the areas south of the Beeline Highway and the significant storage that is accommodated there would suggest that it is appropriate for the district to consider purchase. This plan strongly supports that position. The headwaters are critical to the health and well-being of the entire Big Econ systems and should be preserved.

Without further, more detailed site reconnaissance, it is not possible to narrow down acquisitions further than to suggest the entire headwaters area south of the Beeline be considered. Unfortunately, a recent DRI proposal has been revealed that may prevent the acquisition process and potentially compromise the integrity of the river.

Wildlife Corridors

Four potential corridors are outlined on Map 1. Each is named by the major drainageway it subsumes as follows:

WC#1 = Lake Price/South Branch Creek Corridor
WC#2 = Long Branch Corridor
WC#3 = Little Creek/Second Creek Corridor
WC#4 = Green Branch/Crosby Island Marsh Corridor

WC#1: Lake Price/South Branch Creek Corridor

Located adjacent to the Rybolt property, this connector is designed to provide a corridor between the Big and Little Econ through a large headwaters swamp and northward along a creek named South Branch Creek. The creek has several large wetlands that drain into it from the east. Total length of the corridor from the Big Econ to the Little Econ is approximately 6 miles.

WC#2: Long Branch Corridor

Located south of Bithlo and east of the Big Econ River, The Long Branch Corridor follows Long Branch Creek to the intersection of Highway 50 and SR 520. This is a difficult transition point and will require imaginative planning to tie lands north and east of these roads to the creek. The corridor widens at this juncture to indicate that two potential routes eastward to Seminole Ranch are possible. The first is northeast under the Highway 50/SR 520 intersection into an extensive flatwoods area dominated by large forested wetlands, and then eastward to the Iron Bridge Created Wetland Complex. The second route remains south of Highway 50 crossing under just west of Christmas to occupy the drainageway of an unnamed creek that flows into Seminole Ranch. Total length of the corridor from the Big Econ to Seminole Ranch is about 8 miles.

WC#3: Little Creek/Second Creek Corridor

This corridor has its origins in the ICP property that was proposed for acquisition above. It occupies downstream portions of Little Creek but extends eastward along an unnamed eastern fork. The corridor parallels the Beeline Highway and connects with Second Creek about 3.5 miles to the east. The total length of the corridor from the Big Econ to Tosohatchee State Preserve is about 8 miles.

WC#4: Green Branch/Crosby Island Marsh Corridor

Like the previous corridor, this corridor has its origins in the ICP property proposed for acquisition.. The corridor extend southwest along the Green Branch drainage way and connects to an extensive wetlands/agricultural system known as Crosby Island Marsh. Serious attention should be given to acquisition of Crosby Island Marsh for restoration from pasture back to a marsh ecosystem for habitat values and as a means of protecting water quality in Lake Mary Jane.

The total length of the corridor including Crosby Island Marsh to connect with Lake Mary Jane is approximately 7 miles.

SUMMARY AND RECOMMENDATIONS FOR FURTHER RESEARCH

Summary

This CAMP plan seeks to identify the most pressing issues surrounding the Big and Little Econ Rivers and the ecological communities, historic resources, and wildlife species within their watershed. The CAMP plan is a short-term management and protection plan that is mostly general in its recommendations, but contain some specific recommendations based on the limited time and analysis of the data provided in this first phase of the program.

There are numerous areas where more detailed analyses can be done and recommendations made. To tailor a resource management and acquisition plan to the basin, much more field work by archaeologists, ecologists and wildlife experts is essential. To help develop additional regulations, adapt current regulations and address issues of consistency with other agencies and laws, additional analyses must be carried out. Finally, to provide a complete list of lands for acquisition that encompasses the most suitable parcels within the basin, detailed field reconnaissance is necessary.

Suggestions for an Integrated Management and Protection Plan

A management and protection plan that effectively preserves and enhances water quality and quantity of the basin should address the following issues:

1) Cumulative assimilative capacity of the Big Econ River
2) Restoration of floodplains of the Little Econ
3) Retro-fitting of older stormwater systems
4) Groundwater drawdowns throughout the basin

A management and protection plan that preserves biotic diversity, wetland functions and values, and health of rare and endangered ecosystems should address the following issues:

1) Issues of habitat
2) Fragmentation of landscapes
3) Desiccation resulting from lowered groundwater levels
4) Increased fire frequency

A management and protection plan that will effectively preserve the wildlife integrity of the Econ Basin should address the following issues:

1) Loss of habitat
2) Habitat fragmentation

3) Wildlife corridor misconceptions
4) Decrease in landscape diversity
5) Reduction in habitat quality
6) Impacts of adjacent land use
7) Impacts of public recreation

Until a plan is formalized, a moratorium on development in the basin would ensure that remaining critical habitat areas will not be lost.

Recommendations for Further Research

Water Resources

Probably the best way to determine the long-term effects of development within the Econ Basin on water quality and quantity is to develop the necessary water quality studies and computer modeling to assess the assimilative capacity of the river on a reach by reach basis. Nonpoint source discharges could then be permitted through a loading increment allocation for each acre of developed lands.

Wetland and Terrestrial Communities

Further analysis of land-cover data should be conducted to develop greater insight into the organization of the landscape mosaic of ecosystems. Additionally, detailed site reconnaissance should be carried out for selected portions of the basin, where warranted, through analysis of the GIS data base and aerial photographs.

Wildlife Surveys

The short time frame for this study did not allow a thorough assessment of the wildlife resources in the Econ Basin. The most accurate method of delineating sites within the basin which may require special protection would be through systematic species' surveys. The need for this is exemplified by the fact that only 8 of the 39 listed (endangered, threatened, and special concern) species that are assumed to occur in the basin have been documented. The cursory surveys that have been conducted to date would be unlikely to document species such as the bluetail mole skink, Bachman's sparrow and gopher frog. A systematic survey schedule for all classes of wildlife in different community types would take at least one year. Data obtained from these surveys would greatly enhance the assumptions upon which decisions determining the fate of the basin's wildlife resources will be based.

Historical Site Survey and Model

It is recommended that all future systematic surveys locating cultural resources include systematic subsurface testing. Methodologies for all surveys should be comparable in order to acquire data which can be readily utilized to develop a predictive model for the basin. It is recommended that these methodologies follow the guidelines promulgated by the FDHR (1988).

Data generated from existing and future surveys can be use in a future research efforts designed specifically to develop predictive locational models for the basin. Such a project would require additional archival research, acquisition of environmental information for the basin, subsurface sampling of all represented environmental zones in order to acquire basic data for development of the model, and field testing of the model in selected portions of the basin. The model should include a comprehensive cultural history of the basin as well as statistical analysis of the data and mapping of the levels of sensitivity present within the project area. The model should also provide guidance for its application and provisions for updating it as additional data is acquired.

Basinwide Natural Resource Development and Protection Plan

The process that has culminated in the preparation of this CAMP plan is only the first phase of needed research to adequately address the long-term needs of a rapidly developing watershed. The critical work has been done; gaps in the existing regulatory framework have been surveyed and suggestions made to overcome the perceived weaknesses, lands have been identified for acquisition, and a basinwide system of conservation and wildlands corridors suggested. However, as the result of the macroscopic approach taken, by necessity, this CAMP plan should not be the final say as to how the basin is managed. More detail is needed and the work presented here needs time to mature in a way that will allow a more complete and integrated basinwide plan for the future development and protection of the Econ's resources. The following are suggestions for Phase II research and planning that are necessary components for development of the Basinwide Natural Resources Development and Protection plan:

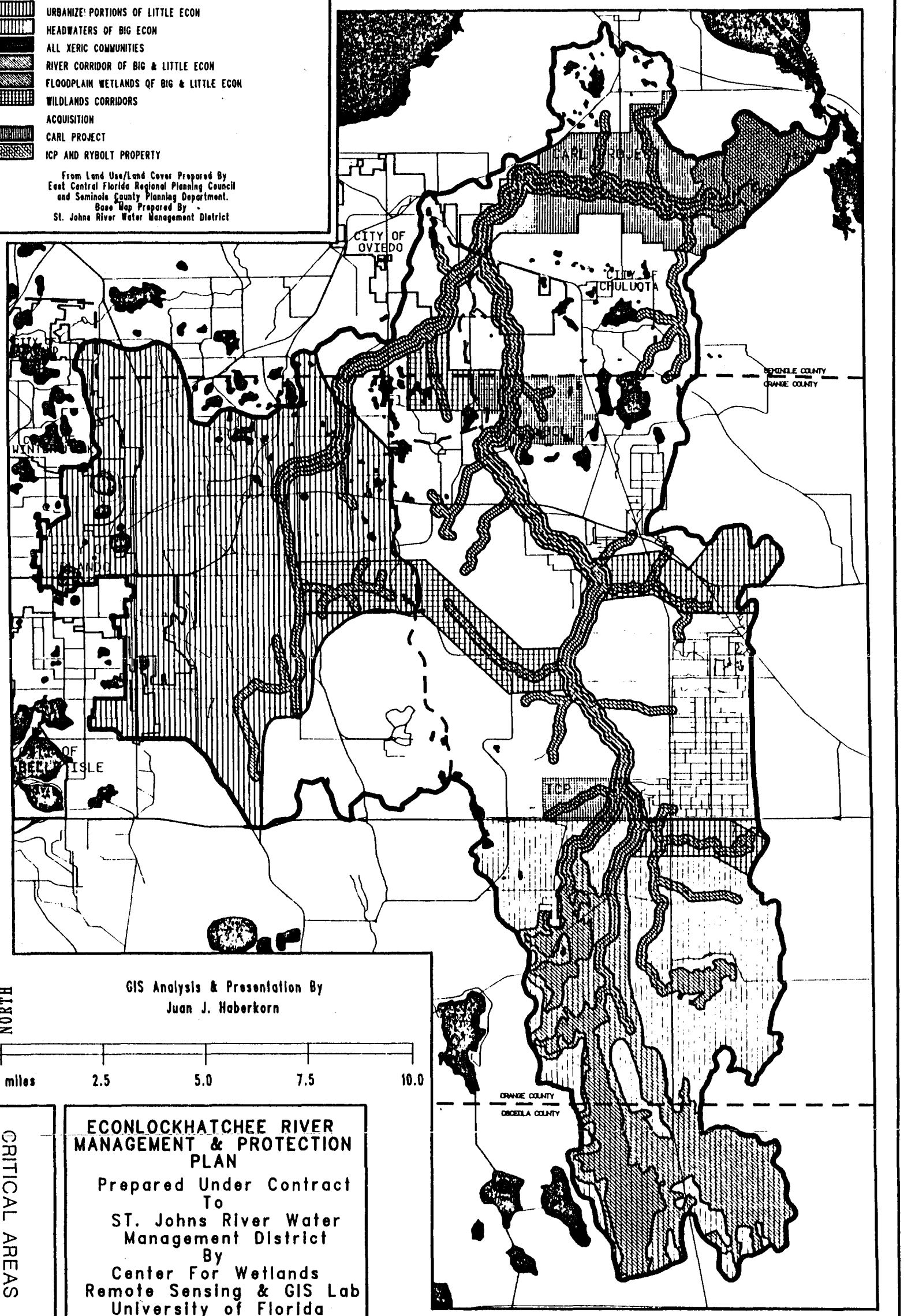
1) Systematic surveys of acquisition suggestions, wildlands corridors, conservation zone and Big Econ headwaters.
2) Detailed stormwater analysis of the Upper Little Econ watershed with particular emphasis on delineation of regional wetland detention basin location and size.
    a) Develop perspective for funding of operation and maintenance of the stormwater system.
    b) Develop overall plan for location and size of basins within the upper basin.
3) Develop potential local government regulations that reinforce the goals and objectives of the CAMP plan.

4) Quantitatively analyze the impacts of further development in the basin so that CAMP plan recommendations can be further tailored to the basin. Of concern are the following:
   a) Further urbanization impacts on surface water quality and quantity.
   b) Increases in wasterwater discharges.
   c) Increased discharges from the Stanton Energy Center.
5) Analyze and simulate the effectiveness of the CAMP plan suggestions and recommendations in meeting the overall goal of no net declines in the quality and quantity of natural and cultural resources of the basin.

MAP LEGEND:

- CRITICAL AREAS
- URBANIZED PORTIONS OF LITTLE ECON
- HEADWATERS OF BIG ECON
- ALL XERIC COMMUNITIES
- RIVER CORRIDOR OF BIG & LITTLE ECON
- FLOODPLAIN WETLANDS OF BIG & LITTLE ECON
- WILDLANDS CORRIDORS
- ACQUISITION
- CARL PROJECT
- ICP AND RYBOLT PROPERTY

From Land Use/Land Cover Prepared By
East Central Florida Regional Planning Council
and Seminole County Planning Department.
Base Map Prepared By -
St. Johns River Water Management District



GIS Analysis & Presentation By
Juan J. Haberkorn

CRITICAL AREAS
WITHIN ECON BASIN

ECONLOCKHATCHEE RIVER MANAGEMENT & PROTECTION PLAN

Prepared Under Contract
To
ST. Johns River Water
Management District
By
Center For Wetlands
Remote Sensing & GIS Lab
University of Florida
January 1990

MARK T. BROWN
CENTER FOR WETLANDS
UNIVERSITY OF FLORIDA

RICHARD HAMANN/JOHN TUCKER
CENTER FOR GOVERNMENTAL
RESPONSIBILITY
UNIVERSITY OF FLORIDA

JOSEPH SCHAEFER
URBAN WILDLIFE PROGRAM
DEPT. OF WILDLIFE & RANGE SCIENCES
IFAS, UNIVERSITY OF FLORIDA

LUCY WAYNE & MARTIN DICKINSON
SOUTHARC, INC.
P.O. BOX 1702
GAINESVILLE, FL. 32602